An Appraisal of Homoeopathic Quinquagenimillesimal Potencies of *Plumbum metallicum* and *Stannum metallicum* by means of Nuclear Magnetic Resonance Spectroscopy.

By

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I, Sean Michael Power, do declare that this dissertation is representative of my own work.

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Dedicated to my parents,

John and Avila

for their faith and support in this process.

Jai Guru Dev

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ABSTRACT

The purpose of this study was to investigate the Nuclear Magnetic Resonance spectra of samples of LM6; LM14 and LM22 homoeopathic quinquagenimillesimal (LM) potencies of tin (*Stannum metallicum*), lead (*Plumbum metallicum*) and two lactose based controls: one control which is prepared by the means of potentisation and one control prepared without the means of potentisation. It was hypothesised that in terms of the effect of different substances (*Stannum metallicum* and *Plumbum metallicum*, and the lactose controls) and of different dilutions (LM6, LM14, LM22) of these substances that significant differences exist between the chemical shift (δ) and relative integration values of the CH_3, CH_2, OH and H_2O signals of these homoeopathic substances. It was further hypothesised that the process of potentisation played an integral part in the development of distinct physicochemical identities in the respective potencies of the substances mentioned above. Thus it was hypothesised that significant differences exist between the control that was potentised and that which was not subjected to potentisation in terms of the chemical shift (δ) and relative integration values of the CH_3, CH_2, OH and H_2O signals of parallel potencies of these two controls.

The investigation was designed as a scientific experiment, whereby LM potencies of tin (*Stannum metallicum*), lead (*Plumbum metallicum*) and two lactose-based controls were prepared according to the directions of Hahnemann to the LM22 level. LM6, LM14 and LM22 liquid potencies (95% ethanol) of each group were prepared in ≈ 19.68ml volumes to be sent for analysis.

NMR-spectroscopy was conducted on fifteen samples (15) of each sample substance. The samples where conducted in coaxial sample tubes making use of deuterium oxide (D_2O) as an external lock and dioxane as a reference. The samples were drawn in a random order to avoid instrumental bias by the resident NMR-technician in the Department of Chemistry, University of Cape Town. The NMR spectrometer used was a Varian VXR-2000 operating at a frequency of

200.057 MHz. A pulse width of 6° was employed and the acquisition time was 3.721 seconds. The temperature was maintained at a constant value of 298.1 K (25.0°C).

The data was recorded and expressed in the form of NMR-spectra giving the chemical shift value and integration values of the peaks. The chemical shift and relative integration values of the CH_3, CH_2, OH and H_2O signals were subjected to a process of statistical analysis using two main steps. Firstly the MANOVA (multi-factorial analysis of variance) was applied to the two sets of data (chemical shift and relative integration) to test differences and interactions between the different factors involved in the data groups. In the case of the chemical shift values these factors where the substance, dilution and chemical shift value. The same factors with the exception of the chemical shift, which was replaced by the relative integration value, were examined for the second data group. Thereafter the individual t-test and Mann-Whitney analyses were applied depending on whether the data was found to be parametric or non-parametric. These tests were applied to intra-substance and parallel substance comparisons of the chemical shift and relative integration values. The level of significance was set at $\alpha = 0.05$ for both the MANOVA and the test comparisons.

Significant differences were noted in the MANOVA of the chemical shift values with the following interactions: substance ($F < 0.0001$), dilution ($F < 0.0001$), chemical shift ($F < 0.0001$), substance by dilution ($F < 0.0001$) and dilution by chemical peak ($F < 0.030$). Significant interactions were noted in terms of the analysis of the interactions of the relative integration values with the effect of the relative integration values ($F < 0.000$), the effect of substance and dilution ($F < 0.000$), dilution by relative integration ($F < 0.000$) and substance by dilution by relative integration ($F < 0.001$). In terms of the t-test and Mann-Whitney 139 tests of 240 conducted were found to be significant. These where spread evenly across all the comparisons substances vs. controls, substance vs. substance and intra-substance. This spread of significant comparisons was not reflected in the intra-substance comparisons of the second lactose control where there were

systematically less significant comparisons noted. No significant differences were noted between the lactose controls.

The investigation served to support the hypotheses that the effect of substance and the process of homoeopathic dilution found in the LM potency scale render ethanol samples that are distinct from each other in terms of their identities measured by NMR-spectroscopy. This conclusion is found in the theoretical absence of any molecules of the original substance. It does not conclusively support the hypothesis that the process of potentisation plays a role in the production of distinct physicochemical identities. It also serves to support the use of NMR spectroscopy as a tool in the ongoing inquiry into the nature of homoeopathic potencies.

Further investigation and inter-disciplinary collaboration is crucial in order to identify the true nature of homoeopathic potencies.

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TABLE OF ABBREVIATIONS

C.I.	-	Confidence Interval
CH	-	Centesimal Hahnemannienne
δ	-	Delta, representing the chemical shift
DH	-	Decimal after Hahnemann
LM	-	Quinquagenimillesimal potency
MANOVA	-	Multifactorial Analysis of Variance
S.G.	-	Specific gravity
SEM	-	Standard Error of the Mean
Std. Dev.	-	Standard Deviation

DEFINITIONS OF TERMS

Batch: a specified quantity of medicine which has uniform characteristics and quantity within defined limits, and is manufactured according to a single procedure of preparation in the same cycle of manufacture.

Chemical Shift: indicates the difference between the resonance frequency of the nucleus and a standard, relative to that standard. The quantity is given in ppm (parts per million) and given the symbol delta, δ.

Integration: the process of finding the integral of the area under the curve of the chemical shift. This refers to the relative intensity of the NMR peaks and is a function of the ratio of protons within individual molecular groups.

MANOVA: an analysis of variance used to analyse data relating to multiple effects.

Mean ($\bar{x}$): quotient of the sum of several quantities and their number; the average of their arithmetic mean. The most commonly used measure of central tendency.

NMR-spectroscopy: a tool of chemical analysis whereby the protons of a test substance are exposed to a magnetic field operating at a certain frequency. The interaction and resulting resonance of the protons as a spectrum of the resonant peaks.

Potency: A stage of altered remedial activity of a drug substance obtained by a measured process of deconcentration and the application of kinetic energy through succussion and/or trituration [*potentisation* (v)]

Quinqaugenimillesimal: The LM potency scale introduced by Hahnemann, whereby the deconcentration is achieved in two stages: initially being 1:100 and then 1:500 resulting in an effective deconcentration of 1:50 000 (5×10^{-4}).

Specific Gravity: the mass of a substance relative to its volume. It is defined as:

$$S.G. = \frac{Mass(g)}{Volume(ml)}$$

Spectrum: a graphical representation on an X-Y axis of a series of peaks of the resonant frequencies at which protons (usually ^{1}H and ^{13}C) absorb electromagnetic radiation. Ethanol and water mixes (as used in this study) have four peaks relating to the four hydrogen atoms found in solution. These are the CH_3, CH_2, OH peaks of ethanol (CH_3CH_2OH) and the H_2O peak of water.

Standard Deviation: If the population SS (sum of squared deviations from the mean) is divided by the number of measurements in the population it provides an average (or mean) squared deviation from the mean. This quantity is usually referred to as the variance. The square root of the variance is known as the standard deviation.

Succussion: the specific homoeopharmaceutical method of vigorously shaking up the liquid dilution of a homoeopathic medicine in a vial or bottle, whereby each stroke ends with a jolt, usually by means of pounding the hand holding the vial or bottle against a leather bound book or against the other hand.

Trituration: the act of prolonged grinding with a pestle in a mortar of a base crude homoeopathic substance usually with lactose monohydrate to reduce it to a fine powder that is soluble in water.

T-Tests: this is a test statistic of the ratio of explained to unexplained variation. The measure of explained variation is the difference in the mean values $\bar{X}$ treatment – $\bar{X}$ control. The unexplained variation is that contained within the samples represented by differences between replicates. T-tests may be either paired or unpaired.

CHAPTER ONE: INTRODUCTION

The development of homoeopathic pharmacy has undergone many changes both during Samuel Hahnemann's lifetime and subsequent to that. Even today with the publication of numerous pharmacopoeias that have attempted to achieve a modicum of standardisation of the homoeopharmaceutical process many factors remain totally unquantified. This has led to a situation where homoeopathic manufacturers can choose a standard that has historical significance (e.g. after Hahnemann) or develop new methods of manufacture that perhaps might be more expedient than they are efficacious.

This less than desirable situation has arisen because of the lack of a coherent and accepted theoretical model for the phenomenon of homoeopathic potency and the physicochemical identity of remedies. In addition, there is little understanding of how remedies actually achieve the observed clinical effect in the organism. (Bellavite and Signorini, 1995: 244).

Attempts to measure the identity of homoeopathic remedies is plagued by the problem of an absence of original base solute in dilutions that exceed 12C, 24D and LM4 in their level of dilution. Lessell (1994: 37) has pointed out that investigations into the physical nature of homoeopathic potencies have made use of electrical conductivity, relative permittivity (dielectric constant), and surface tension, Raman laser spectroscopes, UV (ultraviolet) spectroscopes, light polarizers and Nuclear Magnetic Resonance spectroscopy. Bol (1997) in a summary of the research presented into NMR studies of homoeopathic remedies points out that the technique serves as a valuable tool for investigation of potencies. Many of the studies presented using NMR are tentatively conclusive, but insufficient data still exists for a clear interpretation of the observed effect.

Into these considerations comes the LM potency scale introduced by Hahnemann towards the end of his lifetime, of which he describes it as "my new altered but perfected method"

(Hahnemann, 1995: 271). However, the method has never achieved widespread clinical popularity (Schore, 1990). In terms of the investigation of the identity of homoeopathic potency, the LM scale has only been investigated on one previous occasion by Ross (1997). The study revealed that significant statistical differences existed between the different chemical shift values of an LM10 potency of Sulphur and a lactose control. This finding was seemingly anomalous and required further investigation since no significant differences were noted in the lower (LM 2, 6) potency scales that were also investigated. These findings thus became the departure point for this investigation.

1.1 THE AIM OF THE STUDY

The purpose of this study was to investigate the Nuclear Magnetic Resonance spectra of samples of LM6; LM14 and LM22 homoeopathic quinquagenimillesimal (LM) potencies of tin (*Stannum metallicum*), lead (*Plumbum metallicum*) and two lactose based controls: one control which is prepared by the means of potentisation and one control prepared without the means of potentisation.

1.2 STATEMENT OF THE OBJECTIVES

1.2.1 First Objective

The first objective was to analyse and compare the NMR-spectra of LM6, LM14 and LM22 potencies of tin (*Stannum metallicum*), lead (*Plumbum metallicum*), a lactose control prepared with potentisation, and a lactose control prepared without potentisation in terms of the chemical shift and relative integration values of the CH_3 signal.

1.2.2 Second Objective

The second objective is to analyse and compare the NMR-spectra of LM6, LM14 and LM22 potencies of tin (*Stannum metallicum*), lead (*Plumbum metallicum*), a lactose control

prepared with potentisation, and a lactose control prepared without potentisation in terms of the chemical shift and relative integration values of the CH_2 signal.

1.2.3 Third Objective

The third objective was to analyse and compare the NMR-spectra of LM6, LM14 and LM22 potencies of tin (*Stannum metallicum*), lead (*Plumbum metallicum*) a lactose control prepared with potentisation, and a lactose control prepared without potentisation in terms of the chemical shift and relative integration values of the OH signal.

1.2.4 Fourth Objective

The fourth objective is to analyse and compare the NMR-spectra of LM6, LM14 and LM22 potencies of tin (*Stannum metallicum*), lead (*Plumbum metallicum*), a lactose control prepared with potentisation, and a lactose control prepared without potentisation in terms of the chemical shift and relative integration values of the H_2O signal.

1.3 HYPOTHESES

Thus the objectives of the study hoped to prove the following hypotheses:

1.3.1 First Hypothesis

It was hypothesised that in terms of the effect of different substances (*Stannum metallicum* and *Plumbum metallicum*, and the lactose controls) significant differences exist between the chemical shift (δ) and relative integration values of the CH_3, CH_2, OH and H_2O signals of respective LM6, LM14 and LM22 potencies of these substances. That is that the effect of different substances would yield significantly different NMR spectra.

1.3.2 Second Hypothesis

It was hypothesised that in terms of the effect of dilution (LM6, LM14, LM22) of each of the different substances (*Stannum metallicum, Plumbum metallicum* and the lactose control)

significant differences exist between the chemical shift (δ) and relative integration values of the CH_3, CH_2, OH and H_2O signals.

1.3.3 Third Hypothesis

It was hypothesised that the process of potentisation played an integral part in the development of distinct physicochemical identities in the respective potencies of the substances mentioned above. Thus it was hypothesised that significant differences exist between the control that was potentised and that which was not subjected to potentisation in terms of the chemical shift (δ) and relative integration values of the CH_3, CH_2, OH and H_2O signals of parallel potencies of these two controls.

CHAPTER TWO: THE REVIEW OF THE RELATED LITERATURE

2.1 THE INTRODUCTION

The scientific establishment repeatedly holds that the clinical effects observed with homoeopathic treatment are due to expectation, suggestion, psychotherapy and other factors or at worst to an exaggerated placebo response. Fisher (1998: xi), points out that a recently conducted metanalysis of clinical trials by Linde et. al. (1998: 246) provides conclusive and unequivocal evidence that the effects of homoeopathy cannot be attributed solely to the placebo response. If one considers that many homoeopathic remedies are prepared to a point of ultra dilution such that it can be demonstrated that mathematically no molecules of the original substance remain in the medicine, how then can the biological informational content of the base substance be retained and how is this information communicated to the organism?

Bellavite and Signorini (1995: 244) have pointed out that in order to begin to understand the nature of homoeopathic potencies it is necessary to go beyond the conventional constructs of chemistry and biochemistry and consider a *biophysical paradigm* as a means of arriving at cogent theories and proof of the validity of homoeopathic potencies.

The aim of this investigation was to attempt to address part of the first issue of this *biophysical paradigm*, namely what is the nature of homoeopathic potency? A brief review of the literature describing research into this area is given.

2.2 FEATURES RELATING TO THE PHYSICOCHEMICAL PROPERTIES OF HOMOEOPATHIC POTENCIES.

The discovery of the phenomenon of homoeopathic potency has been ascribed to Samuel Hahnemann, who in an attempt to reduce the material toxicity of drug substances

experimented with reducing the quantity of dose by subjecting the substance to a process of serial dilution. In addition he held that the application of kinetic energy through the process of succussion and/or trituration (also referred to as dynamization) was necessary in the compounding process. This, in his opinion reduced the toxicity of the substance and simultaneously increased its therapeutic efficacy (Hahnemann, 1995: 269). Bellavite and Signorini (1995: 244) advance the deduction, based on a consideration of experimental evidence that this dilution-dynamization phase is critical to the nature of the homoeopathic potency.

Hahnemann initially prepared his remedies according to a deconcentration scale of 1 part of the original drug substance to 99 parts of solvent (Bärthel, 1991). This means that each stage of preparation resulted in a decrease in the concentration of the base substance of 10^{-2}. These potencies were called centesimal potencies (being made in a constant ratio of 1 part in a 100) and designated as CH. Thus when a centesimal potency has been prepared to the point of a 12CH, the effective deconcentration of the substance is 10^{-24}. Thus, considering that Avogadro's number is in the region of 6.023×10^{23} elementary particles per mol of substance, it can be argued that beyond this point of dilution that none of the original base substance can exist in the homoeopathic dilution. In a similar vein if one continues on the decimal scale (designated as DH), which was developed after the centesimal scale this limit is passed at the point of the 24DH.

In discussing the nature of homoeopathic dilutions, Lessell (1994: 1-3) points out that the field of posology (science of dosage) in homoeopathy is in a state of disarray. Accompanying this is an inability to supply a cohesive theory of the mechanism of potentisation. This failure is compounded by an inability to define the physicochemical nature of homoeopathic remedies. Further, the question is posed of how effective standardisation of pharmaceutical methods in homoeopathy is to be achieved considering the undefined nature of potencies and the multitude of factors that are thought to interfere with the integrity of the medicines.

2.3 THE EVOLUTION OF HAHNEMANN'S LM POTENCIES.

The development of homoeopathic pharmacy by Hahnemann evolved through a constant process of experimentation and evolution between 1801 and 1842 in an attempt to find the most efficacious method of drug delivery. To this end the Q (LM) potency scale was introduced towards the end of his lifetime (circa 1841). It was stated that this scale offered the "most harmless way to rapid, gentle and permanent restoration of health" (Bärthel. 1991). However, Gaier (1991: 601) asserts that the publication of the 6th edition of the Organon, containing the details of the LM potency scale in Aphorism 270, 78 years after Hahnemann's death, resulted in the potency scale not achieving the prominence it deserves. Schore (1990) states that few in-depth articles have been produced on the fifty millesimal (LM) potencies and this paucity of work does not lend itself to an objective appraisal of their relative merit or the confident clinical employment. Bärthel (1991) argues that the failure of present-day practitioners to reproduce the results of Hahnemann with the Q potencies is due to the proper manufacturing instructions not being followed. Schmidt (1971) is of the opinion that if precise results are to be obtained with the Q dynamizations it is imperative that Hahnemann's instructions be followed to the letter.

The LM potencies include three distinctive features that Hahnemann incorporated:

- The base substance (no matter what its identity is) undergoes a process of trituration with lactose in a mortar and pestle to reach in the 3CH. This issue of trituration saw its introduction into Hahnemann's seminal homoeopharmacy circa 1824 and thereafter became the only means employed by Hahnemann to produce the first potency stages of remedies (Bärthel, 1991).
- The dilution factor at each stage after the LM mother tincture is in an effective dilution ratio of 1:50 000 (5×10^{-4}) (Gaier, 1991: 450). This is in distinction to the earlier centesimal and decimal dilutions that are 1:100 and 1:10 respectively.

- After the production of the LM mother tincture, the ongoing process is one of taking the preceding ethanol based solution on to lactose granules and then one of these granules is taken back into ethanol and so forth (please refer to Appendix A for a detailed description of the method of manufacture).

Thus the process of production of an LM potency is distinct to the other potency scales and hence it is evident that investigation into the physicochemical properties of this scale is necessary.

2.4 THEORETICAL MODELS OF THE NATURE OF HOMOEOPATHIC POTENCIES.

Gaier (1991: 435 – 441) asserts that the experimental evidence indicates the existence of a "physicochemical force field" in the potencies. This so-called "force-field" is said to be responsible for carrying forward information of the medicine into stages of ultra molecular dynamization. This point emphasises the view mentioned earlier of Bellavite and Signorini (1995: 244 - 245) that the understanding of the nature of homoeopathic potency will arise from an adoption of a *biophysical paradigm* to explain the action of these ultra molecular dilutions and give credence to the notorious "memory of water".

Del Giudice and Preparata (cited by Bellavite and Signorini, 1995: 249 - 252) and a group of physicists from the Milan Institute of Nuclear Physics have proposed a theory of dense matter and in particular water in the liquid state that they have termed "Superradiance". In this theory, it is proposed that water in the liquid state interacts via the hydrogen bonding between molecules and in addition they propose that the presence of an electromagnetic radiation field (a type of long range messenger) that serves to bring order to the vibratory motion of the molecules. The need for this theory arose when one considers the pace at which water vapour liquefies. This gas-liquid phase transition occurs at a rate of 10^{23} molecules/litre, and is too swift and massive, considering the thermal energy of the molecules (100°C), for this to be explained solely due the electrostatic forces of the hydrogen bonds

alone. Thus the theory goes on to propose that when a large number of molecules, beyond a certain critical density, interact by means of an electromagnetic field, that these molecules begin to move coherently and begin to be kept in phase by the field itself. Thus, it is proposed that large number of water molecule will move in unison together over time and in a certain space. This coherent phase of the water, which is distinct from the fluid (gas-like phase), is maintained and is stable and has an entropy close to zero. Consequently, other molecules find it hard to enter this 'coherent phase'. However, upon succussion and the resulting turbulence of the solvent, a situation is created where these coherent domains temporarily relax and interaction of the solute molecules with the coherent domains occurs. This interaction allows for the coherent electromagnetic vibration to be modulated taking on the 'signature' of the solute molecule. It is thus supposed that these modulated coherent domains are able to interact with other biological systems.

Bellavite and Signorini (1995: 257 – 260) cite Anagnostatos et. al. (1991) and Smith (1998) relating to a model of the "memory of water" in which it is held that the basis of the informational content in the solvent is achieved through the formation of aggregates or *clathrates* (which is a word arising from the Latin word 'clathrus' meaning lattice or grating). These clathrates are hollow grid-like arrangements around an interior niche or cavity and the water molecules assume pentagonal or hexagonal forms due to their hydrogen bonding. Other types of bonding like dipole interactions between hydrogen and hydroxyl ions might also contribute to the clathrates' formation. During the process of succussion it is supposed that it is possible for the interior solute molecules to be expelled from the clathrates. These newly formed "empty" clathrates would then become the nuclei for new clathrates and thus the original pattern of the initial base solute would be maintained with increasing dilution and succussion stages. What is interesting about this model is that it does not provide for the water to be able to emit radiation or a magnetic field. However is suggested that the clathrates act as *mirrors of coherence.* That is, the interaction with a biological system would occur as a result of a resonance between a coherence pattern of the solution and a frequency

pattern of the organism. In this way the pattern in the solvent does not become exhausted or dissipated.

The notion of clathrates in water is supported by Antonchenko and Ilyin (1992) who maintain that substances dissolved in water create hydration shells in the region of dissolved substances. There arise as specific hydration shells for each particle of the dissolved substance and with its own hydration shell structure specific to that substance. In this, not all the hydration shells are complete, but rather become the basis for larger clusters. They go on to propose that there exist water structures that coincide in their topology and structure with biopolymers. These create hydration forms that are stabilised as static structures. Upon these structures, long one-dimensional water molecule chains exist and these realise a type of proton transfer mechanism. The transfer mechanism is supposed to occur via the movement of areas of compression and rarefaction of the proton density within the water system. This "soliton" mechanism of proton transfer stabilises dissipative structures that occur in hydration shells and similar microclusters. This property allows for the conservation of substance specific characteristics in the water. The process of succussion causes the formation of cavitation microbubbles in the liquid. The resulting collapse of these bubbles creates a dissociation of the water molecules and a release of the protons necessary for the stabilisation of the dissipative structures.

Resch and Guttman (1991) point out that the relationship between molecular properties/molecular structure and that of macroscopic properties is uncertain. These macroscopic properties of a substance such as vapour pressure, strength, viscosity, temperature, colour, and melting point are not adequately accounted for by the molecular properties. In addition, even knowledge of the spatial arrangement of the constituents of a crystal is not enough to reach conclusions about its macroscopic properties. One cannot attempt to understand all the properties of a substance from an exclusively molecular

perspective. This faith in the molecular concept is why a potentised remedy is considered to be no different to the pure solvent.

Resch and Guttman (1991) propose a system whereby there exists a hierarchic stratification in the system organisation of a liquid. It is proposed within this system that there exist the presence of hydrophobic molecules, such as dissolved gas molecules. These are said to have a decisive influence on the oscillating pattern of the whole liquid. The gas molecules are said to have the ability to take over structural information from the solution and to preserve it dynamically within their oscillating behaviour, in harmony with the solution. Subordinated to this level in the liquid exists the level of the hydrophilic solutes and the surrounding water molecules. The liquid influences these hydrophilic solutes and in turn by virtue of their ability to form "hydration shells" these solutes influence the solution. The whole solution structure and its oscillation pattern maintained by the gas molecules are modified and the information pertaining to the dissolved solutes is spread throughout the solution. In the process of dilution the relatively small concentration of solute comes into contact with the pure solvent and the more highly organised solute with its better-developed static structural aspects interfaces with the more dynamically organised pure solvent. This interfacing allows for the integration of the structural information from the dissolved solute to be integrated into the more diluted solution. With subsequent dilutions the ratio of starting solute is decreased but the informational content is retained. In addition the solubility of the gases is increased allowing for an alteration of the ratio of hydrophobic to hydrophilic molecules. Thus the number of molecules in the higher hierarchic levels are increased which serves to preserve the static aspects of order in the solution and hence preserve the informational content of the starting solute. They go on to conclude that the system organisation of the new solution is improved by shaking, which has the effect of maintaining the integral configuration and functionality of the new solution. This theory of the organisation of liquids has special significance to this study for 4 main reasons:

- Considering that LM potencies undergo a process of dilution from solid lactose to ethanol and back again (as described above in 2.3) does this process which is a later addition to Hahnemann's pharmacy serve to reinforce the informational transfer at each successive stage of dilution? Is this achieved because, as according to Resch and Guttman (1991), the static aspects of order are better preserved within lactose and thus when the lactose solute interfaces in the dissolution process with the solvent, the information is transmitted more coherently?
- What influence does the atmospheric pressure have on the maintenance of the potency information? If according to Resch and Guttman the presence of dissolved gas molecules in the solution are the key factors in the preservation of a modified oscillatory signal of the solute, then the factor of atmospheric pressure needs to be investigated for control in later experiments.
- What is the threshold for effective dilution ratios? According to the theory summarized above, there must exist a threshold above which the addition of too much solute will prevent the transmission of the informational content of that solute to the solvent. This is because the solvent will not be able to adequately "take up" the information for transmission to subsequent dilutions. This has relevance to the LM scale because the effective dilution ratio is one of 5×10^{-4}. Bear in mind that this is significantly lower than the ratio of 1:100 (centesimal) and 1:10 (decimal). As with much in homoeopathy the observations seem to run counter-intuitively, but in fact the dilution ratio with the LM potencies and the use of intermediate lactose might be "ideal".
- What is the optimum successive force that needs to be applied to a remedy? If the act of applying mechanical energy to the system aids in the transfer of the informational content of the solute to the new solution, then what is the optimum force and repetition of succussion?

These are questions of pertinence that need to be addressed because they have a direct bearing on the pharmaceutical process and on the efficacy of homoeopathic remedies.

Little work has been done into how potency information is retained in lactose, which is the primary substance used in the trituration process. The crystalline milk sugar (lactose monohydrate) has a flexible three-dimensional network. In this network are found many hydrogen bonds of which special mention is made of the loose hydrogen bond between the galactose and glucose molecules. In addition between the lactose molecules are found many water molecules characterised by their high mobility. Resch and Guttman (1987: 271) propose that these features contribute to the dynamic maintenance of structural features in the presence of solutes. The actions of diluting the lactose and grinding it as seen in trituration leads to the emergence of an entirely new system that is increasingly differentiated by the grinding but simultaneously the static aspects of order of the solid solution help in the retention of the structural information of the new solution, and hence favours the retention of some form of informational content of the original solute. In a similar way to that in which the hydrophobic gas and other molecules in water serve as maintainers of structural information, it is hypothesised by Resch and Guttman (1987: 272) that with increasing grinding that the development of vacancies in the crystalline lactose (so-called "void-lattices") serve to preserve the static framework of the solid material and in doing so retain the informational content of the dissolved solute.

2.5 OBJECTIVE MEANS OF ASSESSING THE PHYSICOCHEMICAL STRUCTURE OF HOMOEOPATHIC POTENCIES.

Investigations into the properties of potencies have included the measurement of electrical conductivity, relative permittivity and surface tension. Raman laser spectroscopes, UV (ultraviolet) spectroscopes, light polarizers and Nuclear Magnetic Research (NMR) spectroscopy have additionally been conducted. (Lessell, 1994: 37) In particular, attention has been focused on NMR studies as a means of assessing physicochemical structure. Bol (1997) in a review of NMR research conducted to date argues that despite the results not

3.4.1 THE MULTIFACTORIAL ANALYSIS OF VARIANCE (MANOVA)

The MANOVA has three procedural levels to test for significance:

3.4.1.1 PROCEDURE 1: TO TEST THE MAIN EFFECTS FOR SIGNIFICANCE

The effect of substances (*Stannum metallicum*, *Plumbum metallicum*, Lactose #1, Lactose #2), dilution levels (LM6, LM14, and LM22) and peaks (CH_3, CH_2, H_2O, and OH) or the relative integration values of the peaks were tested for significance. In each case the null hypothesis (H_0) states that there is no significant effect. The alternative hypothesis (H_1) states that there is a significant effect. Hence, the 3 alternative hypotheses in this procedure state that there is a significant difference between the 4 substances, between the 3 dilutions and between the 4 peaks. The null hypothesis (H_0) was rejected if the P-value is less than the level of significance, α, of the test. Otherwise, it will be accepted at the same level of significance. The level of significance, α, was fixed at 0.05 for this study.

3.4.1.2 PROCEDURE 2: TO TEST INTERACTIONS OF ORDER TWO FOR SIGNIFICANCE.

There are three interactions of order two in the multifactorial model. In reference to the first MANOVA test examining chemical shift values, the interactions respectively are:

- Substance by dilution
- Substance by chemical shift value
- Dilution by chemical shift value.

The interactions for the second MANOVA test examining the relative integration values, the interactions are:

- Substance by dilution

- Substance by relative integration value
- Dilution by relative integration value.

In each case the null hypothesis (H_0) states that there is no significant interaction effect of order two. The alternative hypothesis refers to a significant interaction of the second order. The null hypothesis (H_0) is rejected if the P-value $< \alpha$, the level of significance. Otherwise, it will be accepted at the same level of significance. For this test α=0.05.

3.4.1.3 PROCEDURE 3: TO TEST INTERACTIONS OF THE THIRD ORDER FOR SIGNIFICANCE.

There is only one interaction of order three in this model. For the first MANOVA test, this refers to the interaction between substances, dilutions and chemical shift values. For the second test this interaction looks at the effect of substance by dilution by relative integration value. The null hypothesis (H_0) states that there is no significant three-way interaction between each of these three variables. The alternative hypothesis (H_1) states that there is a significant interaction. H_0 is rejected if it is $< \alpha$, the level of significance. This is taken at 0.05 for this test.

3.4.1.4 THE MATHEMATICAL MODEL OF THE MANOVA

This is given as follows:

$$Y_{ijk} = \mu + A_i + B_j + C_k + A_iB_j + A_iC_k + B_jC_k + A_iB_jC_k + \varepsilon_{ijkl}$$

μ	=	Overall or common effect
A_i	=	the effect of substances
B_j	=	the effect of dilutions
C_k	=	the effect of chemical shift value or relative integration.
A_iB_j	=	the interaction effect between substances and dilutions
A_iC_k	=	the interaction effect between substances and chemical shift values and relative integration values.
B_jC_k	=	the interaction between dilutions and peaks.

$A_iB_jC_k$ = the three-way interaction effect between substances, dilutions and chemical shift values or relative integration values.

ε_{ijkl} = the error terms

i = 1;2;3;4 = the number of substances

j = 1;2;3 = number of dilutions per substance

k = 1;2;3;4 = number of chemical shift values (peaks) per dilution or the number of relative integration values per peak.

l = 1;...;15 = number of observations for each case.

Worku (1998)

3.4.2 TEST FOR THE UNIVARIATE HOMOGENEITY OF VARIANCE

The null hypothesis (H_0) states that there is no significant difference between the 4 groups with respect to the population variances. In this incidence the tests take into account the effect of the population variances of the different chemical shift groups (CH_3, CH_2, H_2O and OH). The alternative hypothesis (H_1) states that there is a significant difference between the two groups. In other words:

H_0: the groups have equal population variances. That is $\sigma_1^2 = \sigma_2^2 = \sigma_3^2 = \sigma_4^2$.

H_1: $\sigma_1^2;\sigma_2^2;\sigma_3^2;\sigma_4^2$ are significantly different to each other

$\alpha = 0.05$ = level of significance of test.

The decision rule is as follows:

Reject H_0 if $P \leq \alpha = 0.05$

Accept H_0 if $P > \alpha = 0.05$.

The two tests applied to the data to ensure that the population variances are significantly different are Cochrans test and the Bartlett-Box test.

3.4.3 COMPARISON OF INDIVIDUAL SAMPLE GROUPS: THE TWO-SAMPLE UNPAIRED T-TEST AND THE MANN-WHITNEY RANK SUM TEST

3.4.3.1 THE TWO-SAMPLE UNPAIRED T-TEST

The two sample unpaired t-test is employed to compare two unpaired or independent samples X and Y, where both of these are random samples drawn from respective parent populations having normal distributions and respective means μ_1 and μ_2 and variances σ_1^2 and σ_2^2. The two have a common unknown variance σ^2. These assumptions are tested by the application of the test for normality (Kolmogrov-Smirnov test) and the test for equal variance (Levens test). For both of these tests the level of significance α was set at 0.05. if both of these tests are passed then the equality of the two sample means was tested as follows:

H_0: $\mu_1 = \mu_2$ (The null hypothesis)

H_1: $\mu_1 \neq \mu_2$ (alternative hypothesis)

α = level of significance of the test = 0.05.

The null hypothesis is rejected if the absolute value of the calculated t-statistic (t_{cal}) is greater than the tabulated t-value (t_{tab}). If the absolute value of t_{cal} is less than or equals t_{tab} the H_0 is accepted ($\mu_1 = \mu_2$).

The calculated and tabulated t-values are given as follows:

$$t_{cal} = \frac{\bar{X} - \bar{Y}}{S_P\left(\frac{1}{n_1} + \frac{1}{n_2}\right)^{\frac{1}{2}}}$$

$$S_P^2 = \frac{(n_1 - 1)S_1^2 - (n_2 - 1)S_2^2}{n_1 + n_2 - 2}$$

where:

S_P^2 = the pooled error variance

S_P = the pooled error of the standard deviation

$t_{tab} = t(df)\frac{\alpha}{2}$

where $df = n_1 + n_2 - 2$ = degrees of freedom of the t - statistic

α = level of significance of the test

The values of t_{tab} are read from the t-distribution table. Worku (1999)

The unpaired t-tests where conducted at a 95% confidence interval (α = 0.05 level of significance). If the P-value > α [0.05] the H_0 was accepted (i.e. $\mu_1 = \mu_2$). Otherwise the null hypothesis was rejected at the same level. The two sample unpaired t-test was employed in

all parallel potencies (inter-substance) and in all intra-substance comparisons (e.g. *Stannum metallicum* LM6 versus *Stannum metallicum* LM22) to see if any statistically significant differences existed within groups.

3.4.3.2 THE MANN-WHITNEY RANK SUM TEST

In the event of the samples being compared not passing the tests mentioned in 3.4.3.1 (Kolmogrov-Smirnov for normality and Levens test for equal variance) then the Mann-Whitney Rank Sum test was applied to the data. This was necessary as the tests mentioned are applied to assess whether the data conform to the requirements for parametric testing. Thus if these tests are failed then the non-parametric Mann-Whitney is applied. The Mann-Whitney Sign Ranked test is similar to the two-sample unpaired t-test. Where the t-test is based on the average the Mann-Whitney is based on the median and is hence a non-parametric test. (Worku, 1999)

CHAPTER FOUR: THE RESULTS

4.1 THE CRITERIA GOVERNING THE ADMISSIBILITY OF THE DATA

Homoeopathic solutions like NMR-spectroscopy are believed to have a typically sensitive nature to disruption by external environmental influences. Therefore in all stages of the experiment (storage, drawing of samples and subsequent measurement) it was vital that the same care was taken as evidenced in the process of manufacture in 3.1 and 3.2. Samples for analysis were drawn from the same respective bottle by random means determined by the NMR technician at the University of Cape Town. Pipettes were not used between samples and all sample bottles were kept under the same conditions at all times.

The crude data was subjected to the statistical methods outlined in 3.4. The initial chemical shift (δ) values of the four peaks CH_3, CH_2, H_2O and OH were recorded as described in 3.4 and the subsequent relative integration values of the data determined. The MANOVA was applied to the data groups of the chemical shift (δ) values and the relative integration values respectively. Thereafter, the individual comparisons were applied within respective groups (e.g. *Stannum metallicum* LM6, LM14 and LM22) and between parallel groups (e.g. *Stannum metallicum* LM6 and Lactose Control #1 LM6 or *Stannum metallicum* LM6 and *Plumbum metallicum* LM6). No data was excluded from the analysis.

4.2 RESULTS OF THE MANOVA

4.2.1 MEANS AND STANDARD DEVIATIONS OF THE MANOVA

A summary of the means and standard deviations is given below in table 4.1. In addition the data has been expressed as individual tables and graphs in Appendix D. As can be seen from the table below and the tables (4.1 - 4.8) and the associated charts (4.1 – 4.16) in the appendix, the normalising effect of deriving the relative integration values from the chemical shift (δ) values is evidenced by the smaller standard deviations in the relative integration groups. The magnitude of the deviation in the chemical shift groups is seen in the first decimal place, whereas the standard deviation for the relative integration values is seen only in the second and third decimal places. In the raw data of the chemical shift (δ) values the values of the peaks are subject to greater variations in recorded value. This artefact of NMR-spectroscopy is thus "smoothed out" by the effect of this data manipulation procedure.

	Means							
	Chemical Shift (Hz)				Relative Integration			
	CH_3	CH_2	H_20	OH	CH_3	CH_2	H_20	OH
Stannum metallicum LM6	285.782	773.441	958.985	1117.729	0.450	0.349	0.061	0.140
Plumbum metallicum LM6	285.699	773.337	958.793	1117.657	0.441	0.348	0.066	0.145
Lactose Control #1 LM6	285.183	772.796	958.539	1117.365	0.470	0.346	0.059	0.124
Lactose Control #2 LM6	285.328	772.969	958.570	1117.479	0.463	0.346	0.062	0.129
Stannum metallicum LM14	285.814	773.676	959.012	1117.503	0.427	0.346	0.073	0.154
Plumbum metallicum LM14	286.610	774.466	959.575	1118.481	0.429	0.347	0.072	0.152
Lactose Control #1 LM14	285.861	773.485	958.575	1117.574	0.427	0.347	0.072	0.155
Lactose Control #2 LM14	285.946	773.541	958.624	1117.503	0.424	0.346	0.074	0.156
Stannum metallicum LM22	285.933	773.659	959.021	1117.937	0.430	0.348	0.070	0.152
Plumbum metallicum LM22	285.994	773.703	958.993	1117.905	0.428	0.347	0.072	0.153
Lactose Control #1 LM22	284.509	772.059	957.311	1116.241	0.438	0.351	0.064	0.147
Lactose Control #2 LM22	284.619	772.267	957.507	1116.422	0.434	0.350	0.067	0.149
	Standard Deviation							
Stannum metallicum LM6	0.288	0.334	0.557	0.470	0.023	0.005	0.011	0.016
Plumbum metallicum LM6	0.342	0.330	0.296	0.278	0.009	0.002	0.004	0.006
Lactose Control #1 LM6	0.593	0.577	0.741	0.662	0.019	0.004	0.006	0.014
Lactose Control #2 LM6	0.547	0.565	0.690	0.620	0.020	0.004	0.008	0.014
Stannum metallicum LM14	0.102	0.081	0.368	0.470	0.005	0.002	0.004	0.003
Plumbum metallicum LM14	0.718	0.521	0.643	0.608	0.008	0.002	0.006	0.004
Lactose Control #1 LM14	0.286	0.347	0.148	0.239	0.005	0.002	0.004	0.002
Lactose Control #2 LM14	0.672	0.765	0.690	0.620	0.003	0.001	0.003	0.002

Stannum metallicum LM22	0.393	0.384	0.354	0.221	0.006	0.002	0.005	0.004
Plumbum metallicum LM22	0.343	0.337	0.508	0.447	0.006	0.002	0.004	0.003
Lactose Control #1 LM22	0.683	0.735	0.575	0.565	0.010	0.002	0.006	0.006
Lactose Control #2 LM22	0.844	0.841	0.649	0.714	0.011	0.003	0.007	0.006

Table 4.1 Comparative Summary of the Means and Standard Deviations across all sample groups

4.2.2 RESULTS OF TESTS FOR UNIVARIATE HOMOGENEITY

Cochrans Test	P = 0.023 therefore accept H_1
Bartlett-Box Test	P = 0.000 therefore accept H_1

Table 4.2 Univariate Tests on the MANOVA for the Chemical Shift Values.

Cochrans Test	P = 0.000 therefore accept H_1
Bartlett-Box Test	P = 0.000 therefore accept H_1

Table 4.3 Univariate Tests on the MANOVA for Relative Integration Values.

As outlined in 3.4.2. the tests for the univariate homogeneity of variance must be applied to the data to assess whether the data groups under analysis have unique population variances ($\sigma_{1;2;3;4}$). In both cases this need was satisfied and the alternative hypothesis H_1 is accepted.

4.2.3 ANALYSIS OF VARIANCE TABLES

MANOVA Effects	SS	DF	MS	F	Significance of F
Substance	123.01	3	41.0	154.89	<0.0001
Dilution	77.16	2	38.58	145.73	<0.0001
Chemical Peak	70245145.46	3	23415048	88447857	<0.0001
Substance by Dilution	58.26	6	9.71	36.68	<0.0001
Substance by Chemical Peak	1.27	9	0.14	0.53	0.852
Dilution by Chemical Peak	3.73	6	0.62	2.35	<0.030
Substance by Dilution by Chemical Peak	2.40	18	0.13	0.50	0.957

Table 4.4 Analysis of Variance Table for Chemical Shift Values

SS = Sum of squares

DF = Degrees of freedom

MS = Mean squares

F = The F-statistic which is used to compare 2 or more variances with each other.

Thus as can be seen by the preceding table of the MANOVA that the following interactions where significant: in terms of the first order interactions the effect of substance, dilution and chemical shift were all highly significant ($F < 0.000$) in their contribution to the overall source of variation of the data. In terms of the second order interactions the effect of substance and dilution is significant ($F < 0.000$) and dilution and chemical peak ($F < 0.030$) in their contribution to the overall source of variation. The other second order interaction (substance by chemical peak is however not significant ($F < 0.852$). The third order interaction of all the

variables is not significant (F < 0.957). Subsequent t-tests will serve to illustrate the sources of individual variation.

MANOVA Effects	SS	DF	MS	F	Significance of F
Substance	0.00	3	0.00	0.00	1.000
Dilution	0.00	2	0.00	0.00	1.000
Relative Integration	16.02	3	5.34	83193.86	<0.0001
Substance by Dilution	0.00	6	0.00	0.00	1.000
Substance by Relative Integration	0.01	9	0.00	11.35	<0.0001
Dilution by Relative Integration	0.05	6	0.01	117.60	<0.0001
Substance by Dilution by Relative Integration	0.01	18	0.00	7.43	<0.0001

Table 4.5 **Analysis of Variance Table for the Relative Integration Values of the Chemical Shift**

SS = Sum of squares

DF = Degrees of freedom

MS = Mean squares

F = The F-statistic which is used to compare 2 or more variances with each other.

In terms of the first order interactions of the relative integration values it is seen that only the effect of the relative integration values is significant in the data group (F < 0.000). The other first order interactions (substance and dilution) are not of a significant nature (F < 1.000). However, it is seen that in the second order interactions that the effect of substance and

dilution and dilution by relative integration are significant ($F < 0.000$). The influence of the interaction of substance by dilution is not significant ($F < 1.000$). The most remarkable result however is that the influence of the third order interaction, namely substance by dilution level by relative integration value is significant ($F < 0.000$). In terms of the global analysis of the data this result is of special note as the normalising effect of calculating the relative integration value gives a better a reflection of the effect of these variables in the NMR spectra.

4.3. RESULTS OF THE t-TESTS

The objective of conducting the t-tests on the data was to isolate the sources of individual variation between groups. The tests were conducted on the respective parallel samples e.g. (*Stannum metallicum* LM6 vs. *Plumbum metallicum* LM6) and on intra-substance samples e.g. (Lactose control #1 LM14 vs. Lactose control #1 LM22). The results of those t-tests that were found to be significant are presented below. For the sake of brevity of presentation the results in this chapter are limited to the level of significance of the test. The results in Appendix E are exhaustive.

CHEMICAL SHIFT VALUES			
Data Group	**Test Comparison**	**P value (t-test)**	**P value (Mann-Whitney)**
CH3	Sm 6 : L#1 6		0.0045
CH3	Sm 6 : L#2 6	0.0081	
CH3	Sm 14 : Pm 14		<0.0001
CH3	Sm 22 : L#1 22	<0.0001	
CH3	Sm 22: L#2 22	<0.0001	
CH3	Pm 6 : Pm 14		<0.0001
CH3	Pm 6 : Pm 22	0.0225	
CH3	Pm 6 : L#1 6		0.0089
CH3	Pm 14 : Pm 22		<0.0001
CH3	Pm 14 : L#1 14		<0.0001
CH3	Pm 14 : L#2 14		0.0048
CH3	Pm 22 : L#1 22		<0.0001
CH3	Pm 22 : L#2 22		<0.0001
CH3	L#1 6 : L#1 14		0.0028
CH3	L#1 6 : L#1 22	0.0074	
CH3	L#1 14 : L#1 22		<0.0001
CH3	L#2 6 : L#2 14	0.01	
CH3	L#2 6 : L#2 22	0.0109	

Data Group	Test Comparison	P value (t-test)	P value (Mann-Whitney)
CH3	L#2 14 : L#2 22		<0.0001
CH2	Sm 6 : Sm 14		0.0464
CH2	Sm 6 : L#1 6		0.0021
CH2	Sm 6 : L#2 6	0.0096	
CH2	Sm 14 : Pm 14		<0.0001
CH2	Sm 14 : L#2 14		0.0309
CH2	Sm 22 : L#1 22	<0.0001	
CH2	Sm 22 : L#2 22		<0.0001
CH2	Pm 6 : Pm 14		<0.0001
CH2	Pm 6 : Pm 22	0.006	
CH2	Pm 6 : L#1 6	0.0038	
CH2	Pm 6 : L#2 6	0.0371	
CH2	Pm 14 : Pm 22		<0.0001
CH2	Pm 14 : L#1 14		<0.0001
CH2	Pm 14 : L#2 14		0.0225
CH2	Pm 22 : L#1 22		<0.0001
CH2	Pm 22 : L#2 22		<0.0001
CH2	L#1 6 : L#1 14	0.0005	
CH2	L#1 6 : L#1 22	0.0049	
CH2	L#1 14 : L#1 22	<0.0001	
CH2	L#2 6 : L#2 14	0.0275	
CH2	L#2 6 : L#2 22	0.0121	
CH2	L#2 14 : L#2 22		<0.0001
H2O	Sm 14 : Pm 14		<0.0001
H2O	Sm 14 : L#1 14		<0.0001
H2O	Sm 14 : L#2 14		0.0016
H2O	Sm 22 : L#1 22		<0.0001
H2O	Sm 22: L#2 22		<0.0001
H2O	Pm 6 : Pm 14		<0.0001
H2O	Pm 6 : Pm 22		0.007
H2O	Pm 14 : Pm 22		<0.0001
H2O	Pm 14 : L#1 14		<0.0001
H2O	Pm 14 : L#2 14		<0.0001
H2O	Pm 22 : L#1 22		<0.0001
H2O	Pm 22 : L#2 22		<0.0001
H2O	L#1 6 : L#1 22		0.0014
H2O	L#1 14 : L#1 22		<0.0001
H2O	L#2 6 : L#2 22	0.0002	
H2O	L#2 14 : L#2 22		<0.0001
OH	Sm 6 : Sm 22		0.0225
OH	Sm 14 : Pm 14		<0.0001
OH	Sm 14 : L#1 14		<0.0001
OH	Sm 14 : L#2 14		0.0225
OH	Sm 22 : L#1 22		<0.0001
OH	Sm 22 : L#2 22		<0.0001

Data Group	Test Comparison	P value (t-test)	P value (Mann-Whitney)
OH	Pm 6 : Pm 14		<0.0001
OH	Pm 6 : Pm 22		0.0011
OH	Pm 14 : Pm 22		<0.0001
OH	Pm 14 : L#1 14		<0.0001
OH	Pm 14 : L#2 14		<0.0001
OH	Pm 22 : L#1 22		<0.0001
OH	Pm 22: L#2 22		<0.0001
OH	L#1 6 : L#1 22	<0.0001	
OH	L#1 14 : L#2 22		<0.0001
OH	L#2 6 : L#2 22	0.0002	
OH	L#2 14 : L#2 22		<0.0001
RELATIVE INTEGRATION VALUES			
CH3	Sm 6 : Sm 14		<0.0001
CH3	Sm 6 : Sm 22		0.0028
CH3	Sm 6 : L#1 6	0.0122	
CH3	Sm 14 : Pm 14		0.0344
CH3	Sm 22 : L#1 22		0.0181
CH3	Sm 22 : L#2 14	0.0039	
CH3	Pm 6 : Pm 14		<0.0001
CH3	Pm 6 : Pm 22	<0.0001	
CH3	Pm 6 : L#1 6	<0.0001	
CH3	Pm 6 : L#2 6		<0.0001
CH3	Pm 14 : L#2 14	0.0159	
CH3	Pm 22 : L#1 22		0.0037
CH3	L#1 6 : L#1 14		<0.0001
CH3	L#1 6 : L#1 22	<0.0001	
CH3	L#1 14 : L#1 22		0.0025
CH3	L#2 6 : L#2 14		<0.0001
CH3	L#2 6 : L#2 22	<0.0001	
CH3	L#2 14 : L#2 22		0.0032
CH2	Sm 6 : Sm 14		0.0028
CH2	Sm 6 : L#1 6		0.0251
CH2	Sm 6 : L#2 6		0.0114
CH2	Sm 14 : Sm 22	0.0195	
CH2	Sm 22 : L#1 22	0.0003	
CH2	Sm 22 : L#2 22	0.0364	
CH2	Pm 6 : Pm 14		0.0443
CH2	Pm 6 : L#2 6		0.0401
CH2	Pm 22 : L#1 22	<0.0001	
CH2	Pm 22: L#2 22	0.0032	
CH2	L#1 6 : L#1 22	0.0005	
CH2	L#1 14 : L#1 22	<0.0001	
CH2	L#2 6 : L#2 22		0.007
CH2	L#2 14 : L#2 22		0.001
H2O	Sm 6 : Sm 14		0.001

Data Group	Test Comparison	P value (t-test)	P value (Mann-Whitney)
H2O	Sm 6 : Sm 22		0.0062
H2O	Sm 14 : Pm 14		0.0421
H2O	Sm 22 : L#1 22	0.0036	
H2O	Pm 6 : Pm 14		<0.0001
H2O	Pm 6 : Pm 22	0.0007	
H2O	Pm 6 : L#1 6	0.0023	
H2O	Pm 22 : L#1 22		0.001
H2O	Pm 22 : L#2 22		0.0421
H2O	L#1 6 : L#1 14	<0.0001	
H2O	L#1 14 : L#1 22		0.0016
H2O	L#1 14 : L#2 14	0.0285	
H2O	L#2 6 : L#2 14		<0.0001
H2O	L#2 14 : L#2 22		0.0037
OH	Sm 6 : Sm 14		0.0062
OH	Sm 6 : Sm 22		0.0144
OH	Sm 6 : L#1 6		0.0161
OH	Sm 14 : Pm 14		0.0381
OH	Sm 22 : L#1 22		0.0128
OH	Pm 6 : Pm 14	0.0008	
OH	Pm 6 : Pm 22	<0.0001	
OH	Pm 6 : L#1 6	<0.0001	
OH	Pm 6 : L#2 6		<0.0001
OH	Pm 14 : L#2 14	0.0081	
OH	Pm 22 : L#1 22		0.0032
OH	Pm 22 : L#2 22	0.0277	
OH	L#1 6 : L#1 14		<0.0001
OH	L#1 6 : L#1 22	<0.0001	
OH	L#2 6 : L#2 22		<0.0001
OH	L#1 14 : L#1 22		<0.0001
OH	L#2 6 : L#2 14		<0.0001
OH	L#2 14 : L#2 22		0.0025

Table 4.14 Significant t-test Comparisons

Legend to table:

Abbreviation used in table	Full description of Sample
Sm 6	Stannum metallicum LM6
Sm 14	Stannum metallicum LM14
Sm 22	Stannum metallicum LM22
Pm 6	Plumbum metallicum LM6
Pm 14	Plumbum metallicum LM14
Pm 22	Plumbum metallicum LM22
L#1 6	Lactose control #1 LM6
L#1 14	Lactose control #1 LM14
L#1 22	Lactose control #1 LM22
L#2 6	Lactose control #2 LM6
L#2 14	Lactose control #2 LM14
L#2 22	Lactose control #2 LM22

As can be seen from the results in Table 4.13, the significant test interactions are well distributed amongst all the groups in both the chemical shift values and the relative integration values. However, in each respective grouping it can be seen that there are examples of statistically significant differences in the intra-group comparisons of the second control group (Lactose control #2).

CHAPTER FIVE: DISCUSSION

The results of the study clearly indicate that the following conclusions can be made regarding the data:

I. Significant differences exist between the sample substances used in the study and the controls; namely: *Stannum metallicum*, *Plumbum metallicum* and the two lactose controls.

II. These differences are found between parallel comparisons of substances and both in the intra-group comparisons (e.g. *Stannum metallicum* LM6 compared to *Stannum metallicum* LM14). This finding serves to confirm that different substances used for the preparation of Hahnemannian LM potencies yield solutions that are found to have distinct physicochemical identities when analysed with NMR spectroscopy. Further, the effect of dilution on these different substances is found to yield distinct physicochemical identities within substance groups (intra-substance).

III. The differences are noted across the entire chemical shift groups (CH_3; CH_2; H_2O; and OH) and that these differences are seen to extend to when the data is manipulated to give the relative integration values on the chemical shift values.

IV. No significant differences were found in the parallel comparisons of the two lactose controls. It would seem therefore that no firm conclusions might be drawn as to the effect of potentisation on yielding distinct physicochemical identities in the solvent. It should be borne in mind that the only difference that existed between the two controls was the presence or absence of potentisation. Intra-substance differences are noted in the lactose controls, however the primary conclusion that can be drawn from this is that the process of dilution plays a role in the production of homoeopathic potencies (as per the previous point III). The author advances an alternative proposition to explain this result, and that is that the act of potentisation is only meaningful in rendering a unique solvent when an additional base substance is introduced into the manufacturing process. This area requires more detailed investigation, as the process of potentisation is considered to be so integral to the homoeopharmaceutical process.

In terms of the MANOVA of the chemical shift values, it was found that the first order effects (substance, dilution and chemical peak) were significant in their contribution to the overall variation of the data. This finding confirms the hypotheses that the use of different base starting substances creates different identities on the ethanol signal of the solvent. Likewise the second order interactions of substances by dilution and dilution by chemical peak were also found to be significant. Thus, the chemical shift values give information regarding the molecular environment of the different proton groups of the test solutions. Significant changes in these values indicate a relative electron shielding or deshielding of the protons of the different test substances. In the study it was observed that where a significant difference existed in the t-test and Mann-Whitney comparisons between the test substance and the control that the test substance had a higher chemical shift value than that of the lactose controls. This trend indicates that the introduction of the base substance (*Stannum metallicum, Plumbum metallicum*) causes a relative shielding of the protons of the ethanol/water solvent. These findings are consistent with those of Ross (1997: 29 - 55).

With regard to the MANOVA of the relative integration values of the chemical shift that only the one first order interaction of the effect of the relative integration values was significant. In terms of the second order interactions, those of substance by relative integration and dilution by relative integration were significant in their contribution to the source of variation. However, what was interesting was that the third order interaction (substance by dilution by relative integration values was significant). The relative integration values of the chemical shift peaks provide information as to the relative proton densities of each chemical shift signal. These findings suggest that when the singular effects are considered (first order interactions) that changes in the relative proton densities are insufficient to provide and observable difference. However, looking at the most global analysis of the data, it is evident that considered across all the groups and relative integration values of the peaks that a significant difference is observable. This perhaps would be suggestive that the effect of

electron shielding of the protons is more contributory in the formation of the unique solvent spectra than that of changes in relative proton density of the solvent. This point however needs an in depth investigation, before a firm conclusion can be arrived at.

These findings do not however provide sufficient evidence to support or disprove any of the models of the meta-structure of water described in Chapter 2, namely those of Del Giudice and Preparata (1995: 249 - 252); Anagnostatos (1995: 257 – 260); Smith (1998: 257 - 260); Antonchenko and Ilyin, (1992) and Resch and Guttman, (1991). The results do give some indication, however of a substance and dilution related change in the molecular and proton environment of the solvent molecules.

It needs to be pointed out that the choice of tin and lead as crude starting substances was far from arbitrary. Ross (1997: 62) suggested the use of more than one substance in further investigations with LM potencies. The choice of these two substances was based on the decision that they are in the first instance elemental and that it is possible to easily obtain samples of very high purity. This was done to reduce the possibility of other factors affecting the results. Secondly, as elements they exist directly below one another on the periodic table. This fact means that they have thus identical outer electron configurations. It was thus hypothesised that if significant differences did exist that were related to the influence of the substance that this would be of greater experimental and theoretical value. Thirdly, they were chosen because they do not possess a magnetic moment and thus give no NMR spectrum. This fact would further indicate that any observable differences would be attributed to changes in the water/ethanol solvent induced by the manufacturing process and not by the mere introduction of the substance. The author suggests that on consideration of the data that these issues may all be involved in the observed phenomenon.

Ross (1997: 58 - 59), found that the most significant differences existed between the LM10 dilution of sulphur and the lactose control. This study attempted to investigate whether the

ultra-molecular effects of Ross's study were accidental artefacts or valid observations. Considering that the deconcentrations of the test substances used were all beyond Avogadro's limit, the results are somewhat confirmatory of the findings of Ross. This again affirms that far more work needs to be done into the physical structure of ultra high dilutions in homoeopathy.

It should be noted however that for a more complete appraisal of the identity of LM potencies in particular, far more work needs to be done into the structure and ability of lactose to retain informational content of base solutes. This is especially so when one considers how integral lactose is to the process of manufacture of LM potencies. Work, into this area will also be beneficial to homoeopathic pharmacy in general because lactose is used extensively for other potency scales as a dispensing vehicle (granules, pillules, tablets) for ethanol based remedies.

The use of NMR spectroscopy for investigation of the identity of homoeopathic remedies needs to be more fully explored. More complex analysis techniques such as the T1 and T2 proton relaxation times and solid-state spectroscopy need to be fully exploited for the investigation of homoeopathic potencies.

The use of other base substances needs to be more completely explored due to the huge variety of substances used in homoeopathic practice. Investigation of these different classes needs to focus on remedies drawn from mineral and salt sources, plant and animal sources. Until this is done, no firm theories can be advanced as to the true physicochemical nature of homoeopathic remedies.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

It is apparent from the results of this investigation that the process of production of Hahnemannian quinquagenimillesimal potencies yields solutions that are distinct in their physicochemical identity in terms of the NMR spectra recorded. The study found that statistically significant differences exist in the MANOVA of the chemical shift values with regard to the effect of substance, dilution, chemical peak, substance by dilution and dilution by chemical peak. In terms of the MANOVA of the relative integration values it was revealed that the effects of relative integration values of the peaks, the substance by relative integration, the dilution by relative integration and substance by dilution by relative integration all contributed significantly to the source of variation. When the intra-substance and parallel substance/dilutions were compared it was found that there exists a fair spread of significant t-test and Mann-Whitney comparisons within each test substance. It is thus clear that these findings are supportive of the first and second hypotheses relating to the influence of substance and dilution on the creation of distinct physicochemical identities in the different test solutions. However, a clear conclusion cannot be drawn regarding the influence of the action of potentisation in this study. This does not preclude the possibility that this part of the pharmaceutical procedure is important in the production of viable homoeopathic potencies.

This study provides further support for the employment of NMR spectroscopy to expose more valid research data about the physical nature of homoeopathic remedies. It does also lend a degree of standing to LM potencies as a viable alternative in the clinical repertoire of the homoeopathic prescribed. As is often the case this study has raised as many questions that need addressing as it has attempted to solve. There is a need for more in depth investigation involving the collaboration of other specialists from associated fields of study. The ongoing challenge to create scientific and public respectability for homoeopathy will come from, in part, a cohesive and cogent theory of the nature of homoeopathic remedies, that will allow

for the strict standardisation of the manufacturing process, and an explanation of their action in the organism. This will in turn feedback on the clinical practice of countless homoeopaths, resulting in more successful treatment outcomes and a more widespread adoption of this healing art.

6.2 RECOMMENDATIONS

The ongoing investigation into the nature of homoeopathic remedies will require a convergence of expertise from numerous areas of specialisation. This is multi-disciplinary approach is necessary as the theoretical knowledge and expertise needed for the development of workable models of homoeopathic potency and its action in the organism is bound to come from researchers conversant in both frontier and established areas of research. The conduction of and publication of well-controlled research into the nature of homoeopathic research will create awareness of this as a valid area of investigation. However, much work still needs to be done in generating data that will allow for a refinement in the design and execution of larger collaborative studies. Recommendations for further work into the physicochemical nature of homoeopathic remedies making use of NMR are as follows:

1. Use of a pure solvent as a control

Whilst this work and that of Ross (1997) made use of a control that contained lactose (which is an integral part of the manufacture process) it would be very informative to use a control that was merely the pure solvent (that is 95% ethanol). This should be taken from the same batch that is used for production of the other potencies. This would be useful, as it would provide a reference as to how much the production process of LM potencies creates a solution that is different to the pure solvent. Thus it could be better assessed if the observed variation in this study is due merely to differences in the amount of lactose dissolved in the solvent. This could thus be judged relative to supposed changes in the solvent due to the addition of a "memory" of the base solute.

2. Standardisation of the Pharmaceutical Process

Whilst every attempt was made to keep the production process as consistent as is humanely possible, one must admit to the possibility that the observed changes might be attributable to subtle influences introduced in the production process as a result of human error. These factors that should be looked at more closely are:

- The amount of force applied during trituration and succussion. One way of doing this would be by the used of well calibrated machines (which are an accepted part of homoeopharmaceutical manufacture).
- The purity of all substances used. Whilst, the water, alcohol and lactose used in the production of the sample potencies was within acceptable pharmacopoeial standards, it is unknown whether these standards are high enough so as not to be influential in the NMR measurement process.
- The German Homoeopathic Pharmacopoeia (after Hahnemann) prescribes that the steps of trituration should be an hour each and that after the 3CH the resulting triturate is ready for dissolution. However, the degree of colloidal solubility of different base starting substances needs to be looked at in great depth to assess if in fact this stage is the optimum for equivalent levels of solubility across all substances. Indeed, could well be a need for some substances to be triturated for longer time periods.
- It might also be worthwhile to consider a process of blinding or even double blinding the manufacturing process of the sample potencies to avoid possible experimental bias.

3. Control of External Factors

According to the theory propounded by Resch and Guttman (1991) in which the presence of dissolved gas molecules in the solvent are important in the retention of the solute information, then it should follow that as Demangeat et al. (1992) did in their study, the

atmospheric pressure should be strictly controlled during all parts of the production process. This is necessary to prevent variations in the amount of dissolved gas molecules during succussion. It follows therefore that the effect of temperature should then be strictly controlled, as this will affect the solubility of the dissolved gas molecules. In this study, the temperature was monitored and controlled as effectively as possible within the constraints of the given laboratory environment.

4. Re-evaluation of the NMR Experiment

Whilst Ross (1997: 66) suggested that the an increased accuracy of the spectra might be obtained by an increase in the sampling frequency, the low standard deviations of his work and of this suggest that little benefit might be gained form this adjustment. Jackson (1998) concurred with this opinion that little additional information might be gained by an increase in the sampling frequency. However, after the work of Demangeat et al. (1992) it might be useful to apply the spin-spin T1 and T2 relaxation time process as another tool of investigation. This technique provides valuable information about the molecular dynamics of the components of a solution (Hornack, 1997).

5. Employment of More Complex Substances as Base Solutes and Correlation with Biological Activity

All NMR investigations into homoeopathic potencies have focused on using simple chemical remedies, excepting for the work of Smith and Boericke (1968) who made use of bradykinin triacetate. Whilst this is not a negative trend, the spectra of more complex plant and animal remedy sources need to be investigated. In addition the work of these two needs to be extended to try and correlate differences in the NMR spectra with differing degrees of measurable biological phenomena. To this end it might be useful to use accepted in-vitro studies that look at both pre-ultramolecular and post-ultramolecular dilutions. This area of investigation might then begin to provide useful data that correlates information about the

physicochemical identity of a homoeopathic dilution and its mechanism of action on a biological system.

6. Investigation of the Relevance of Potentisation as an Integral Part of the Pharmaceutical Process

Whilst this study attempted to try and assess the effect of potentisation on the development of a distinct physicochemical identity on the solution, this was not evident in the results, However the study only made use lactose controls where the action of potentisation was the only variable. It would be worthwhile to perform an experiment where a homoeopathic base substance used and the action of succussion is either included or omitted. These resulting solutions could then be examined to assess whether the dynamization process yields distinct physicochemical identities.

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APPENDICES

APPENDIX A: THE PREPARATION OF SAMPLE POTENCIES

1.1 AIM: To produce LM tinctures of tin (Stannum metallicum), lead (Plumbum metallicum) and 2 lactose controls.

1.2 APPARATUS:

Unglazed porcelain mortar and pestle
Spatula
95% Ethanol [S.G. 0.8031]
96% Ethanol (for flaming)
90% ethanol [S.G. 0.8203]
Cigarette lighter
Filtered water
Chemical balance accurate to 4 decimal places
Paper (20 15x15 cm sheets)
Tin powder
Lead powder
Pure lactose powder (B.P. standard)
Micropipette with clean capillary tubes
4 x 50ml amber glass bottles
9 x No. 8 Glass polytop vials
Paper towel for drying

1.3 METHOD:

1.3.1 Clean the mortar and pestle and spatula thoroughly before commencing preparation by washing well in hot water, rinsing with purified water and drying carefully. Thereafter flame all implements with 96% ethanol and allow cooling to room temperature.

1.3.2 Place a single sheet of paper on the balance and tare.

1.3.3 Mass accurately 2.100g pure lactose powder.

1.3.4 Repeat steps 1.3.2 and 1.3.3 another two times.

1.3.5 Transfer one of these quantities of lactose to the mortar.

1.3.6 Place a single sheet of paper on the balance and tare.

1.3.7 Mass 0.0630g of tin powder, lead powder or lactose.

1.3.8 Add the massed quantity of base substance i.e. tin, lead or lactose to the mortar containing the 2.100g of lactose and mix well with a spatula.

1.3.9 Triturate the mixture for 20 minutes scraping the mass from the bottom of the mortar and the pestle at regular intervals to ensure a homogenous mixture.

1.3.10 After the first 20 minutes, add the second quantity of lactose powder, stir briefly and triturate as in 1.3.11 for 20 minutes.

1.3.11 Add the third 2.100g of lactose, stir for a brief while and repeat 1.3.11.

1.3.12 Repeat steps 1.3.2 through 1.3.11 another two times replacing step 1.3.7 with 0.0630g of lead powder and lactose respectively.

1.3.13 This will yield the 1CH trituration of *Stannum metallicum*, *Plumbum metallicum* and lactose and will be stored in a tightly closed glass vial and appropriately labelled *Stannum metallicum* 1CH, *Plumbum metallicum* 1CH and lactose control 1CH. These shall be stored away from light.

1.3.14 The above process (steps 1.3.1 to 1.3.13) is to be repeated another three times to yield the 2CH trituration. Step 1.3.7 is to be replaced with the identical mass of 1CH trituration

of *Stannum metallicum, Plumbum metallicum* and lactose. The new set of vials will be labelled as the 2CH trituration of the respective substances.

1.3.15 Steps 1.3.1 to 1.3.11 will be repeated another three times and step 1.3.7 will involve the use of the identical mass of the respective 2CH triturations. The new set of vials will be labelled as the 3CH trituration of the respective substances.

1.3.16 Mass 0.0630g each of *Stannum metallicum* 3CH, *Plumbum metallicum* 3CH and lactose 3CH (control #1) and place each into respective 25ml dropper bottles.

1.3.17 Into a fourth dropper bottle place 0.0630g of pure lactose that has not been triturated. This shall be control #2.

1.3.18 Determination of precise drop volume of purified water and 90% ethanol:

- Measure the precise specific gravity of the above substances by means of a pycnometer.
- Mass 100 drops of each substance to three decimal places a total of three times and average the result.
- Volume is defined as $v = \frac{m}{S.G.}$

  where v = volume; m = average mass and SG = recorded specific gravity.
- Thus, this result will be divided by 100 to give the volume of a single drop of each liquid.
- The volumes shall then be measured by means of micropipette.

1.3.19 Into each dropper bottle place 500 drops (30.381ml, S.G. 0.964) of a mixture of one part 90% ethanol and four parts purified water (both by volume). Mix well and allow the powder to dissolve.

1.3.20 Label each respective bottle thus yielded:

- Stannum metallicum LM∅
- Plumbum metallicum LM∅
- Lactose LM∅ (control #1)

- Lactose LM∅ (control #2).

2.1 AIM: To produce LM22 potencies of *Stannum metallicum, Plumbum metallicum* and two lactose-based controls, one prepared with the aid of succussion and one prepared without.

2.2 APPARATUS:

4 storage boxes with tray inserts
5ml glass screw top bottles x 176
Micro-pipette with clean capillary tubes
95% ethanol [S.G. 0.8031]
Pre-sieved #10 lactose granules
50ml glass beaker
96% ethanol (for flaming)
Cigarette lighter
Filtered water

2.3 METHOD:

2.3.1 Clean and flame the 50ml beaker and allow for cooling.

2.3.2 The specific gravity of the 95% ethanol shall be tested by means of a pycnometer to ensure that it falls within the required reference range and the particular value recorded.

2.3.3 The procedure outlined in 1.3.18 will be applied to determine the drop volume the 95% ethanol.

2.3.4 Place one drop (60.7µl) of the respective LM∅ into a clean 5ml screw top bottle. In the case of the lactose control, the process will be repeated twice to allow one dilution to be prepared with succussion and one to be prepared without succussion. (In all the

following steps, this will entail that the second lactose control will be prepared in the same way as the other samples but with the act of succussion omitted).

2.3.5 Add the above-predetermined volume of 99 drops (2.81ml) of 95% ethanol, cap and succuss by hand one hundred times.

2.3.6 Label these respective bottles as LM1.

2.3.7 Accurately count out 500 pre-sieved #10 granules 10 times and average the mass of these samples. Use this mass so obtained to place 500 granules of lactose into the cleaned and flamed beaker.

2.3.8 Use a clean and unused dropper pipette to place one drop of LM1 on the granules.

2.3.9 Swirl the beaker to ensure that all granules are moistened and continue swirling until all the granules are dry.

2.3.10 Transfer dry granules to a clean 5ml screw top bottle and label as the respective LM1.

2.3.11 Place one granule of the respective LM1 into a clean 5ml screw top bottle and replace the cap.

2.3.12 Clean and flame the 50ml beaker and allow cooling.

2.3.13 Place the four LM1 bottles into the tray of respective storage boxes and place the used pipette alongside.

2.3.14 To the bottle containing the single LM1 granule, place one-drop (68.7µl) of purified water. Replace the cap and rotate slowly to allow dissolution of the granule.

2.3.15 Repeat the steps 2.5 through 2.13 until the LM22 potency in granules is reached. Label each successive potency appropriately.

2.3.16 For each of the sample potencies for analysis, the procedure outlined above was carried out, however, the volumes where increased by a factor of 7 to yield sufficient liquid for the NMR analysis.

2.3.17 Storage of the potency banks must be in an appropriate cool, dry place away from the influence of sunlight, strong odours and electromagnetic radiation.

APPENDIX B: Sample NMR spectra

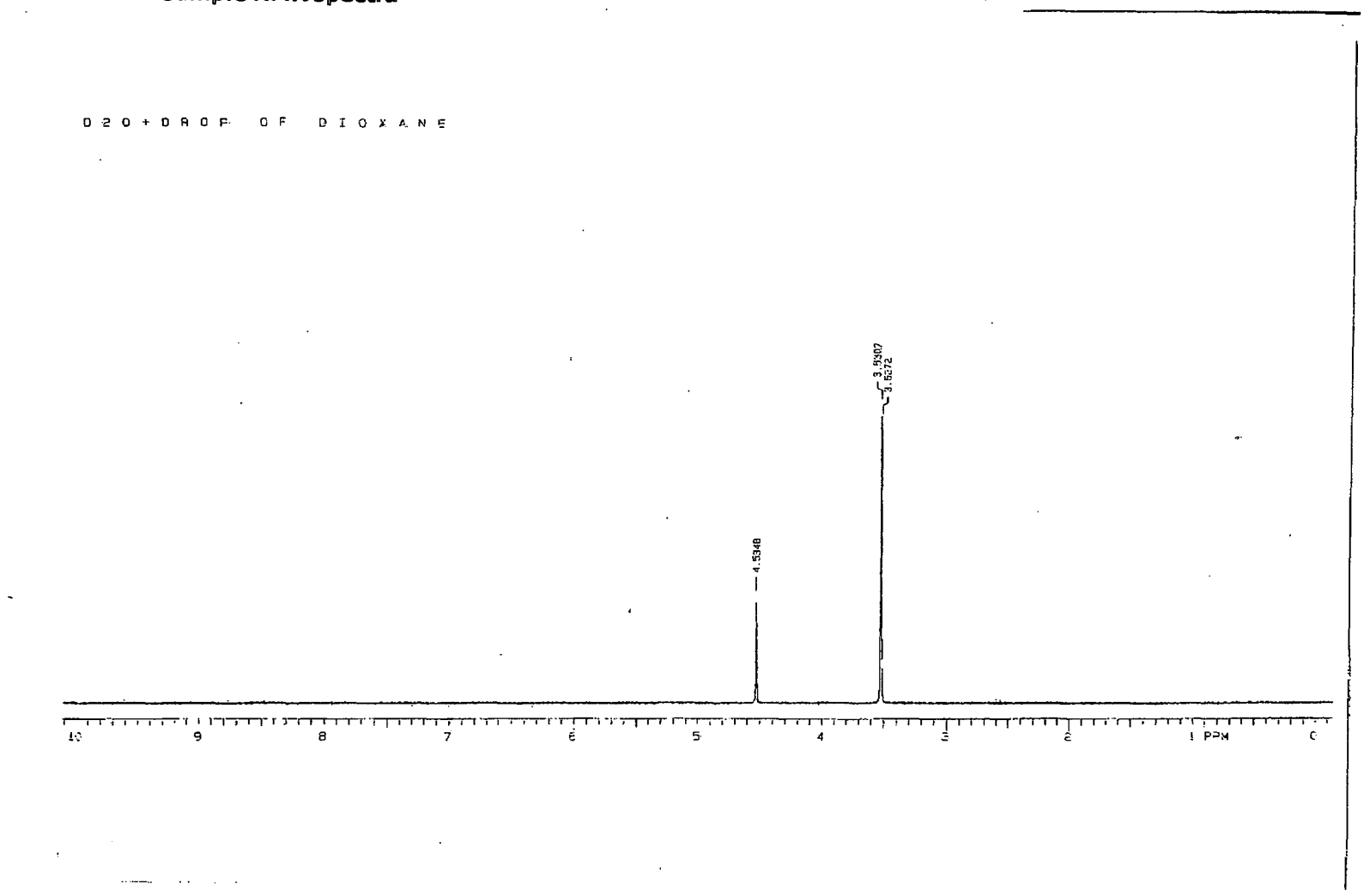


Figure 1: Specimen NMR spectrum of the Deuterium Oxide and the Dioxane

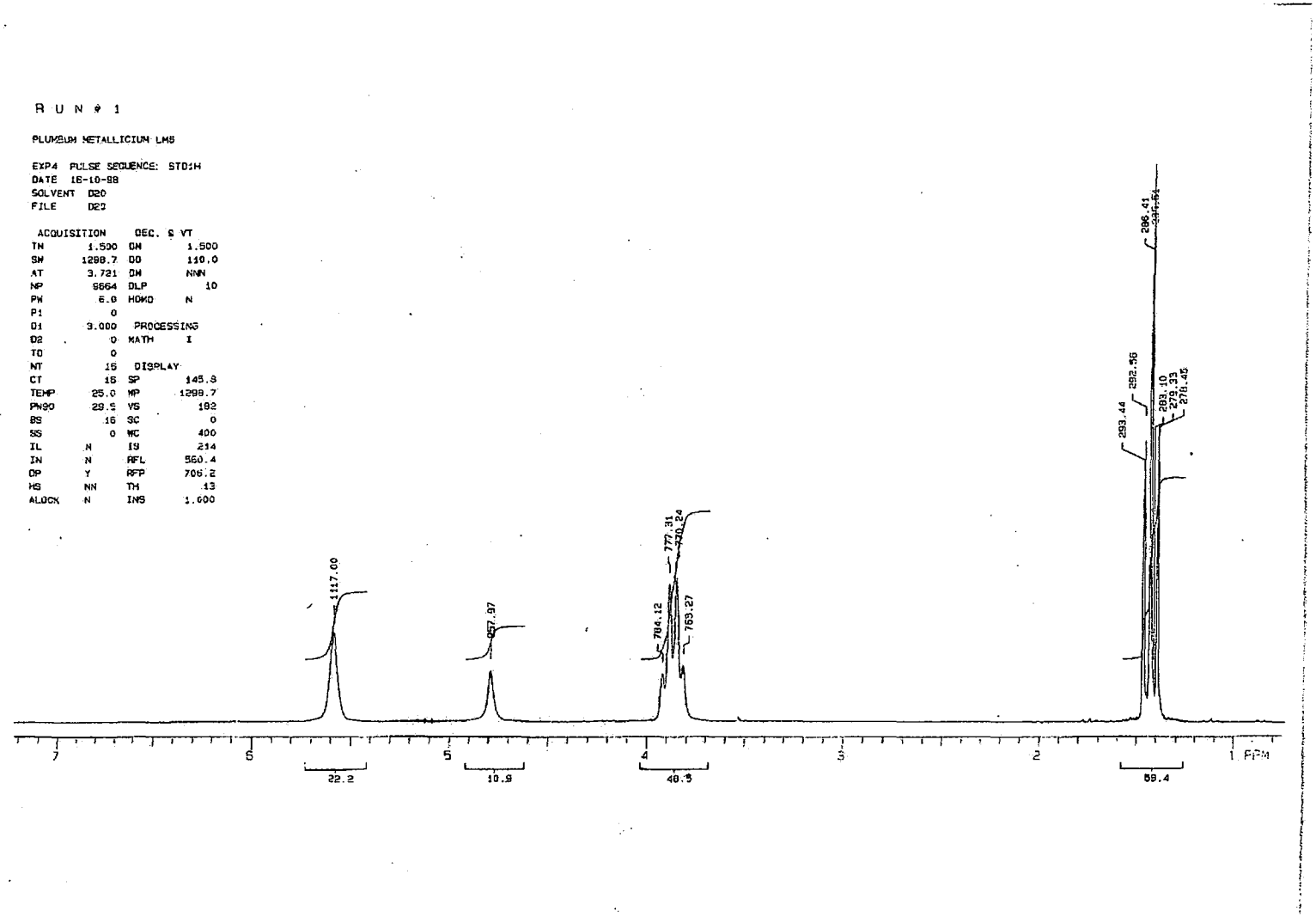


Figure 2: Specimen NMR spectrum of Plumbum metallicum LM6

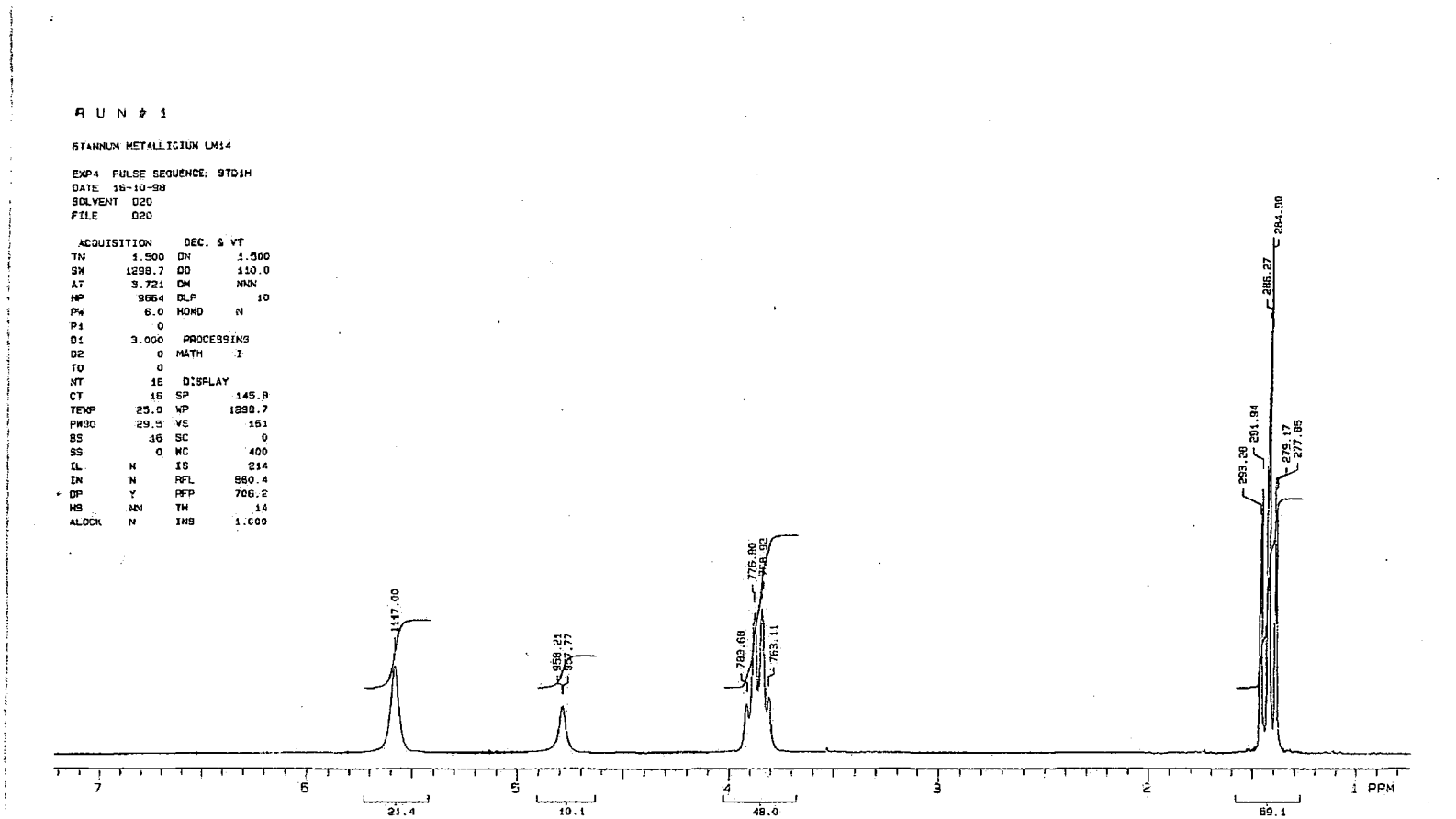


Figure 3: Specimen NMR spectrum of Stannum metallicum LM14

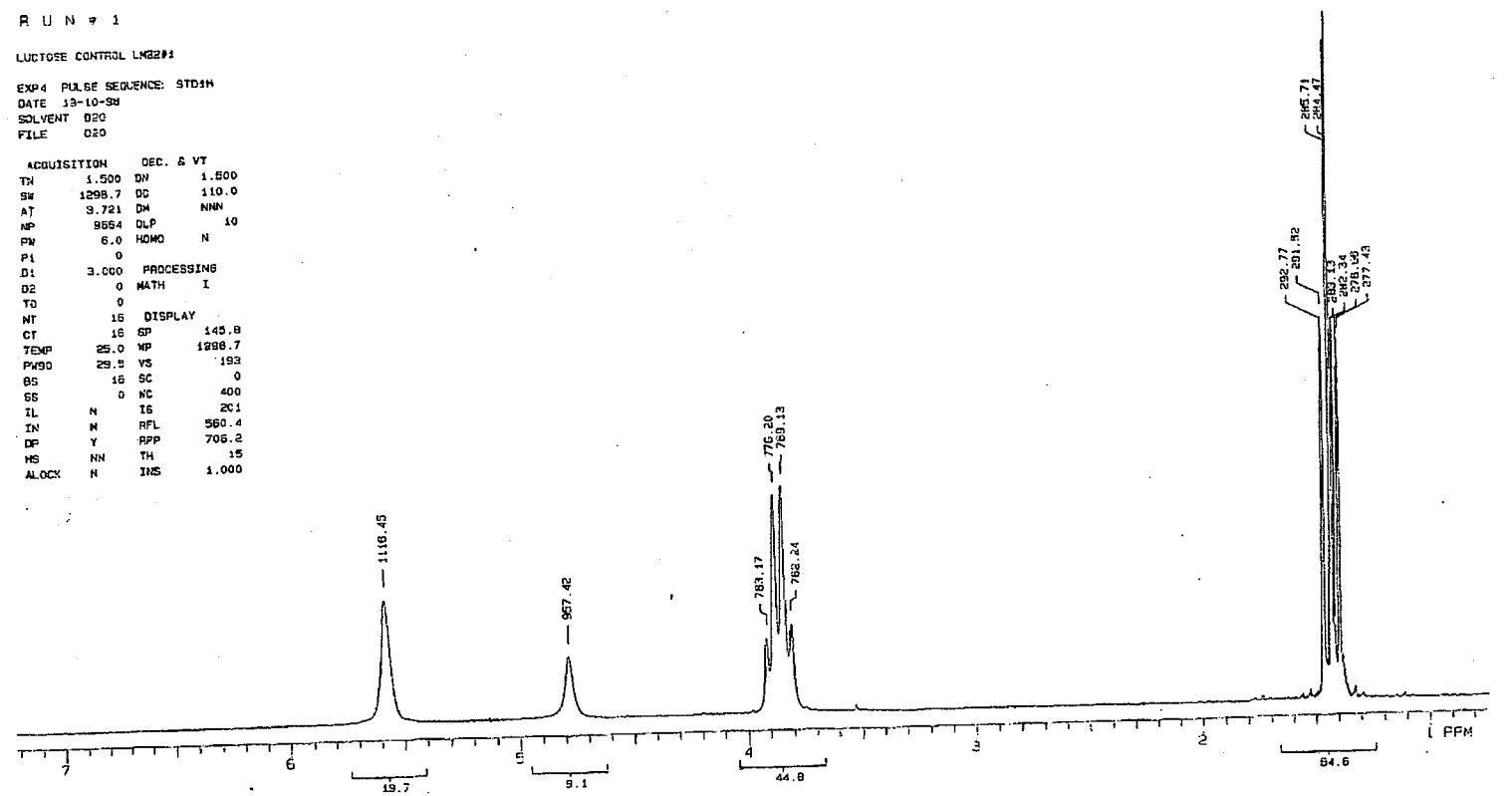


Figure 4: Specimen NMR spectrum of Lactose Control #1 LM22

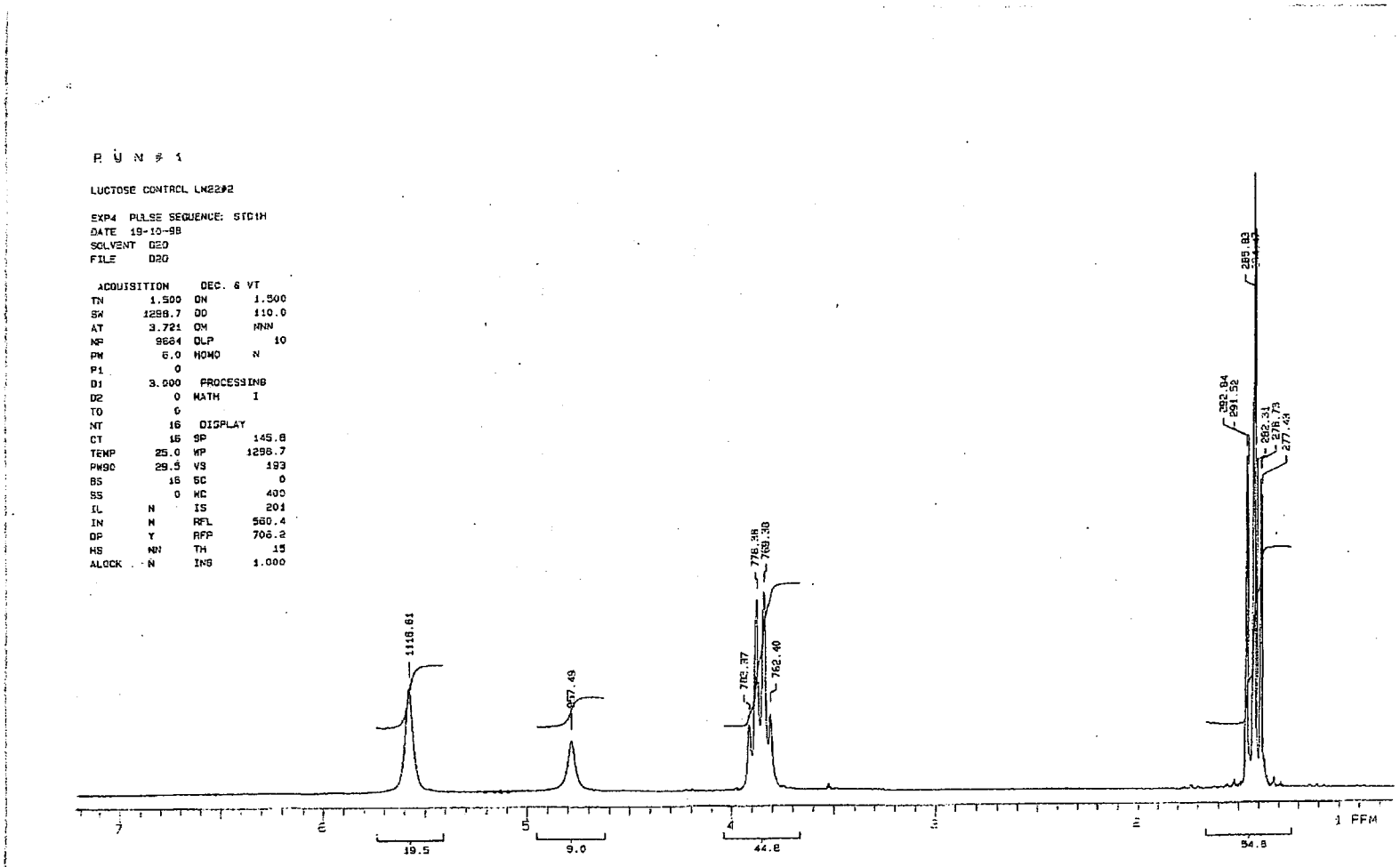


Figure 5: Specimen NMR spectrum of Lactose Control #2 LM22

APPENDIX C:

The crude data relating to the NMR-spectra.

	Chemical Shift Values								Integration Values					Relative Integration Values			
Run		CH_3			CH_2		H_20	OH	CH_3	CH_2	H_20	OH	Total	CH_3	CH_2	H_20	OH
	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point											
1	285.57	284.65	285.11	769.19	776.21	772.7	957.44	1116.36	55.2	42.6	9.1	20.8	127.70	0.432263	0.333594	0.071261	0.162882
2	286.66	285.25	285.955	770.33	777.38	773.855	959.17	1117.95	43.5	35.7	8.1	16.4	103.70	0.419479	0.344262	0.07811	0.158149
3	286.62	285.35	285.985	769.92	776.99	773.455	959.17	1117.88	42.3	34.2	6.8	15	98.30	0.430315	0.347915	0.069176	0.152594
4	285.71	286.66	286.185	770.08	777.15	773.615	959.17	1117.95	40.7	32.5	5.5	13.5	92.20	0.441432	0.352495	0.059653	0.146421
5	285.71		285.71	769.77	776.87	773.32	959.92	1117.79	41.2	32.8	5.7	13.6	93.30	0.441586	0.351554	0.061093	0.145766
6	285.67		285.67	769.89	776.9	773.395	959.24	1117.95	41.7	33.1	5.9	13.8	94.50	0.44127	0.350265	0.062434	0.146032
7	286.31	285.51	285.91	769.92	777.02	773.47	958.86	1117.88	42.1	33.3	6	13.8	95.20	0.442227	0.34979	0.063025	0.144958
8	285.99		285.99	770.37	777.34	773.855	959.8	1118.67	43.6	35.8	8.1	16.4	103.90	0.419634	0.344562	0.07796	0.157844
9	285.51	286.62	286.065	770.37	777.38	773.875	958.76	1117.63	43.1	32.3	4.7	11.7	91.80	0.469499	0.351852	0.051198	0.127451
10	285.64		285.64	769.7	776.71	773.205	959.08	1117.63	43.2	33.9	6.3	13.9	97.30	0.443988	0.348407	0.064748	0.142857
11	285.48		285.48	769.73	776.74	773.235	958.85	1117.47	43.2	32.3	4.6	11.6	91.70	0.471101	0.352236	0.050164	0.126499
12	285.51		285.51	769.57	776.67	773.12	958.85	1117.56	43	33.7	6	13.7	96.40	0.446058	0.349585	0.062241	0.142116
13	285.55		285.55	769.61	776.71	773.16	958.69	1117.63	42.9	31.6	4	10.7	89.20	0.480942	0.35426	0.044843	0.119955
14	285.55	286.48	286.015	770.33	777.31	773.82	958.76	1117.79	43.3	31.6	4	10.5	89.40	0.48434	0.353468	0.044743	0.11745
15	285.95		285.95	770.05	777.02	773.535	959.01	1117.79	46.5	33.4	4.7	10.8	95.40	0.487421	0.350105	0.049266	0.113208

Table 1: Stannum metallicum LM6

	Chemical Shift Values								Integration Values					Relative Integration Values			
Run	CH_3			CH_2			H_2O	OH	CH_3	CH_2	H_2O	OH	Total	CH_3	CH_2	H_2O	OH
	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point											
1	286.41	285.51	285.960	777.31	770.24	773.775	957.97	1117.00	59.4	48.5	10.9	22.2	141.000	0.421277	0.343972	0.077305	0.157447
2	285.48	286.50	285.990	777.02	770.01	773.515	959.32	1117.79	42.9	35.0	7.5	15.7	101.100	0.424332	0.346192	0.074184	0.155292
3	286.31	285.51	285.910	777.15	770.08	773.615	959.01	1117.79	41.7	33.6	6.5	14.6	96.400	0.432573	0.348548	0.067427	0.151452
4	286.82	285.58	286.200	777.22	770.21	773.715	958.92	1117.88	41.1	32.7	5.8	13.7	93.300	0.440514	0.350482	0.062165	0.146838
5	286.66	285.51	286.085	777.22	770.17	773.695	958.88	1118.04	41.6	33.0	6.1	13.9	94.600	0.439746	0.348837	0.064482	0.146934
6	286.46	285.60	286.030	776.99	769.92	773.455	959.01	1117.79	42.2	33.5	6.2	14.0	95.900	0.440042	0.349322	0.064651	0.145985
7	286.78	285.37	286.075	777.22	770.33	773.775	958.95	1117.95	42.1	33.3	6.2	13.9	95.500	0.440838	0.348691	0.064921	0.14555
8	285.60	284.90	285.250	776.43	769.45	772.940	958.61	1117.47	42.1	33.3	6.1	13.8	95.300	0.441763	0.349423	0.064008	0.144806
9	285.55		285.550	776.83	769.77	773.300	958.76	1117.72	43.3	34.0	6.5	14.1	97.900	0.442288	0.347293	0.066394	0.144025
10	285.35		285.350	776.43	769.41	772.920	958.60	1117.56	43.2	34.0	6.4	14.0	97.600	0.442623	0.348361	0.065574	0.143443
11	285.35		285.350	776.51	769.41	772.960	958.61	1117.17	43.2	33.9	6.2	13.8	97.100	0.444902	0.349125	0.063852	0.142122
12	285.35		285.350	776.51	769.45	772.980	958.85	1117.56	42.7	33.4	5.9	13.5	95.500	0.44712	0.349738	0.06178	0.141361
13	285.35		285.350	776.58	769.57	773.075	958.69	1117.63	43.0	33.5	6.0	13.5	96.000	0.447917	0.348958	0.0625	0.140625
14	285.60		285.600	776.83	769.73	773.280	958.87	1117.79	43.0	33.3	6.0	13.3	95.600	0.449791	0.348326	0.062762	0.139121
15	285.44		285.440	776.55	769.57	773.060	958.85	1117.72	44.7	34.3	6.4	13.5	98.900	0.451972	0.346815	0.064712	0.136502

Table 2: Plumbum metallicum LM6

	Chemical Shift Values								Integration Values					Relative Integration Values			
Run	CH_3			CH_2			H_20	OH	CH_3	CH_2	H_20	OH	Total	CH_3	CH_2	H_20	OH
	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point											
1	285.95	285.44	285.695	777.020	770.010	773.515	958.370	1117.150	59.00	48.10	10.20	21.60	138.90	0.424766	0.346292	0.073434	0.155508
2	285.79		285.79	770.010	777.020	773.515	959.080	1118.040	49.10	35.20	5.50	11.60	101.40	0.484221	0.34714	0.054241	0.114398
3	286.02		286.02	769.920	776.990	773.455	959.240	1117.950	46.30	35.20	6.60	13.70	101.80	0.454813	0.345776	0.064833	0.134578
4	285.07		285.07	769.450	776.510	772.980	959.170	1117.880	46.20	35.00	6.30	13.40	100.90	0.457879	0.346878	0.062438	0.132805
5	285.2		285.2	776.430	769.410	772.920	959.010	1117.790	45.80	34.30	5.80	12.80	98.70	0.464032	0.347518	0.058764	0.129686
6	285.83		285.83	776.710	769.730	773.220	958.920	1117.790	43.30	32.30	5.20	11.80	92.60	0.467603	0.348812	0.056156	0.12743
7	285.51		285.51	776.580	769.570	773.075	959.010	1117.630	42.70	31.60	4.70	11.10	90.10	0.473918	0.350721	0.052164	0.123196
8	284.88		284.88	776.040	769.060	772.550	958.850	1117.470	42.70	31.60	4.60	11.10	90.00	0.474444	0.351111	0.051111	0.123333
9	285.23		285.23	776.270	769.260	772.765	958.920	1117.720	43.40	32.20	4.90	11.50	92.00	0.471739	0.35	0.053261	0.125
10	285.67		285.67	776.710	769.700	773.205	958.920	1117.880	44.70	33.50	5.80	12.40	96.40	0.463693	0.34751	0.060166	0.128631
11	285.23		285.23	776.230	769.220	772.725	958.920	1117.720	44.90	33.60	5.90	12.50	96.90	0.463364	0.346749	0.060888	0.128999
12	283.93		283.93	775.160	768.180	771.670	957.330	1116.290	44.10	32.80	5.40	11.90	94.20	0.468153	0.348195	0.057325	0.126327
13	284.6		284.6	775.630	768.620	772.125	957.900	1116.450	45.80	31.40	5.00	9.40	91.60	0.5	0.342795	0.054585	0.10262
14	284.56		284.56	775.600	768.590	772.095	957.180	1116.200	50.30	34.40	6.60	10.50	101.80	0.494106	0.337917	0.064833	0.103143
15	284.53		284.53	775.630	768.620	772.125	957.260	1116.520	50.30	34.40	6.60	10.50	101.80	0.494106	0.337917	0.064833	0.103143

Table 3: Lactose Control #1 LM6

	Chemical Shift Values								Integration Values					Relative Integration Values			
Run	CH_3			CH_2			H_20	OH	CH_3	CH_2	H_20	OH	Total	CH_3	CH_2	H_20	OH
	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point											
1	286.46	285.3	285.88	777.150	770.170	773.660	958.130	1117.240	58.80	47.60	9.70	21.10	137.20	0.428571	0.346939	0.0707	0.15379
2	286.43	285.48	285.955	777.220	770.240	773.730	959.320	1118.110	46.20	35.40	6.70	13.90	102.20	0.452055	0.34638	0.065558	0.136008
3	285.35		285.35	776.670	769.610	773.140	959.010	1117.790	46.20	35.00	6.40	13.50	101.10	0.456973	0.346192	0.063304	0.133531
4	285.2		285.2	776.670	769.610	773.140	959.240	1118.040	46.00	34.60	6.00	13.00	99.60	0.461847	0.34739	0.060241	0.130522
5	285.83		285.83	776.990	770.010	773.500	959.170	1118.040	46.50	34.90	6.10	13.00	100.50	0.462687	0.347264	0.060697	0.129353
6	285.83		285.83	776.870	769.850	773.360	959.010	1117.790	43.40	32.30	5.10	11.70	92.50	0.469189	0.349189	0.055135	0.126486
7	285.48		285.48	776.580	769.570	773.075	959.010	1117.630	42.70	31.60	4.70	11.10	90.10	0.473918	0.350721	0.052164	0.123196
8	285.55		285.55	776.550	769.570	773.060	958.850	1117.720	42.90	31.60	4.60	11.10	90.20	0.47561	0.350333	0.050998	0.12306
9	285.86		285.86	776.900	769.890	773.395	958.920	1118.040	44.70	33.40	5.80	12.40	96.30	0.464174	0.346833	0.060228	0.128764
10	285.35		285.35	776.360	769.290	772.825	958.760	1117.720	44.80	33.50	5.80	12.40	96.50	0.464249	0.34715	0.060104	0.128497
11	285.51		285.51	776.550	769.570	773.060	958.920	1117.880	44.80	33.50	5.90	12.50	96.70	0.463289	0.346432	0.061013	0.129266
12	284.6		284.6	775.720	768.620	772.170	957.490	1116.520	37.30	30.70	7.00	14.20	89.20	0.418161	0.34417	0.078475	0.159193
13	284.6		284.6	775.630	768.620	772.125	957.490	1116.450	45.80	31.40	5.00	9.30	91.50	0.500546	0.343169	0.054645	0.101639
14	284.39		284.39	775.760	768.620	772.190	957.650	1116.610	51.20	35.30	7.20	11.30	105.00	0.487619	0.33619	0.068571	0.107619
15	284.53		284.53	775.600	768.620	772.110	957.580	1116.610	43.70	32.40	6.70	12.20	95.00	0.46	0.341053	0.070526	0.128421

Table 4: Lactose control #2 LM6

	Chemical Shift Values										Integration Values					Relative Integration Values			
Run	CH_3			CH_2			H_20			OH	CH_3	CH_2	H_20	OH	Total	CH_3	CH_2	H_20	OH
	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Midpoint										
1	286.27	284.90	285.585	776.90	769.92	773.410	958.21	957.77	957.99	1117.00	59.1	48.0	10.1	21.4	138.600	0.426407	0.34632	0.072872	0.154401
2	286.43	285.39	285.910	777.22	770.24	773.730	959.32		959.32	1117.95	34.0	28.0	6.5	12.9	81.400	0.41769	0.34398	0.079853	0.158477
3	286.15	285.35	285.750	777.15	770.17	773.660	958.85		958.85	1117.88	37.3	30.7	7.3	14.3	89.600	0.416295	0.342634	0.081473	0.159598
4	286.43	285.39	285.910	777.22	770.24	773.730	959.32		959.32	1117.95	32.6	26.3	5.3	11.5	75.700	0.430647	0.347424	0.070013	0.151915
5	286.15	285.35	285.750	777.15	770.17	773.660	958.85		958.85	1117.88	35.6	28.7	5.8	12.6	82.700	0.430472	0.347037	0.070133	0.152358
6	286.15	285.35	285.750	777.15	770.17	773.660	958.85		958.85	1117.88	35.6	28.8	5.9	12.6	82.900	0.429433	0.347407	0.07117	0.15199
7	286.43	285.39	285.910	777.22	770.24	773.730	959.32		959.32	1117.95	32.5	26.2	5.2	11.4	75.300	0.431607	0.347942	0.069057	0.151394
8	286.43	285.39	285.910	777.22	770.24	773.730	959.32		959.32	1117.95	32.9	26.7	5.6	11.8	77.000	0.427273	0.346753	0.072727	0.153247
9	286.15	285.35	285.750	777.15	770.17	773.660	958.85		958.85	1117.88	36.9	29.8	6.0	13.0	85.700	0.430572	0.347725	0.070012	0.151692
10	286.43	285.39	285.910	777.22	770.24	773.730	959.32		959.32	1117.95	32.8	26.5	5.4	11.7	76.400	0.429319	0.346859	0.070681	0.153141
11	286.43	285.39	285.910	777.22	770.24	773.730	959.32		959.32	1117.95	39.1	31.9	6.8	14.2	92.000	0.425	0.346739	0.073913	0.154348
12	286.15	285.35	285.750	777.15	770.17	773.660	958.85		958.85	1117.88	38.7	31.8	7.6	14.8	92.900	0.416577	0.342304	0.081808	0.159311
13	286.43	285.39	285.910	777.22	770.24	773.730	959.32		959.32	1117.95	39.1	31.8	6.8	14.2	91.900	0.425462	0.346028	0.073993	0.154516
14	286.15	285.35	285.750	777.15	770.17	773.660	958.85		958.85	1117.88	37.6	30.3	6.1	13.2	87.200	0.431193	0.347477	0.069954	0.151376
15	286.15	285.35	285.750	777.15	770.17	773.660	958.85		958.85	1117.88	37.7	30.4	6.2	13.3	87.600	0.430365	0.347032	0.070776	0.151826

Table 5: Stannum metallicum LM14

	Chemical Shift Values								Integration Values					Relative Integration Values			
Run	CH_3			CH_2			H_2O	OH	CH_3	CH_2	H_2O	OH	Total	CH_3	CH_2	H_2O	OH
	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point											
1	284.53		284.530	776.11	769.10	772.605	957.26	1116.29	59.3	48.6	10.8	21.8	140.500	0.422064	0.345907	0.076868	0.15516
2	287.13	286.11	286.620	778.01	771.03	774.520	959.80	1118.67	35.5	28.5	5.6	12.3	81.900	0.433455	0.347985	0.068376	0.150183
3	287.26		287.260	778.17	771.16	774.665	959.68	1118.58	35.5	28.4	5.3	12.0	81.200	0.437192	0.349754	0.065271	0.147783
4	287.26	284.72	285.990	778.26	771.16	774.710	959.68	1118.67	35.7	28.7	5.6	12.3	82.300	0.433779	0.348724	0.068044	0.149453
5	287.13	286.11	286.620	778.01	771.03	774.520	959.80	1118.67	36.1	29.7	6.9	13.7	86.400	0.417824	0.34375	0.079861	0.158565
6	287.26		287.260	778.17	771.16	774.665	959.68	1118.58	37.3	30.6	7.0	14.0	88.900	0.419573	0.344207	0.07874	0.15748
7	287.13	286.11	286.620	778.01	771.03	774.520	959.80	1118.67	35.5	28.5	5.6	12.3	81.900	0.433455	0.347985	0.068376	0.150183
8	287.13	286.11	286.620	778.01	771.03	774.520	959.80	1118.67	37.4	30.0	6.0	13.0	86.400	0.43287	0.347222	0.069444	0.150463
9	287.26		287.260	778.17	771.16	774.665	959.68	1118.58	33.9	27.1	5.1	11.5	77.600	0.436856	0.349227	0.065722	0.148196
10	287.13	286.11	286.620	778.01	771.03	774.520	959.80	1118.67	35.3	28.3	5.6	12.3	81.500	0.433129	0.347239	0.068712	0.15092
11	287.13	286.11	286.620	778.01	771.03	774.520	959.80	1118.67	36.7	30.2	7.1	14.0	88.000	0.417045	0.343182	0.080682	0.159091
12	287.26		287.260	778.17	771.16	774.665	959.68	1118.58	37.3	30.6	7.0	14.0	88.900	0.419573	0.344207	0.07874	0.15748
13	287.13	286.11	286.620	778.01	771.03	774.520	959.80	1118.67	34.6	27.8	5.5	12.1	80.000	0.4325	0.3475	0.06875	0.15125
14	287.26	284.72	285.990	778.26	771.16	774.710	959.68	1118.67	35.8	28.7	5.6	12.3	82.400	0.434466	0.348301	0.067961	0.149272
15	287.26		287.260	778.17	771.16	774.665	959.68	1118.58	35.8	28.6	5.5	12.2	82.100	0.436054	0.348356	0.066991	0.148599

Table 6: Plumbum metallicum LM14

	Chemical Shift Values										Integration Values					Relative Integration Values			
Run	CH_3			CH_2			H_2O			OH	CH_3	CH_2	H_2O	OH	Total	CH_3	CH_2	H_2O	OH
	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point										
1	287.08	285.64	286.360	777.69	770.81	774.250	958.92		958.92	1117.95	59.3	48.4	10.0	21.6	139.300	0.4257	0.347452	0.071788	0.155061
2	285.71		285.710	777.02	769.92	773.470	958.76	958.09	958.43	1117.56	35.4	28.8	5.9	12.8	82.900	0.427021	0.347407	0.07117	0.154403
3	285.67		285.670	776.71	769.70	773.205	958.53		958.53	1117.40	34.9	28.3	5.6	12.4	81.200	0.429803	0.348522	0.068966	0.152709
4	285.71		285.710	777.02	769.92	773.470	958.76	958.09	958.43	1117.56	35.5	28.9	6.0	12.9	83.300	0.42617	0.346939	0.072029	0.154862
5	285.67		285.670	776.71	769.70	773.205	958.53		958.53	1117.40	35.3	28.7	5.9	12.7	82.600	0.427361	0.347458	0.071429	0.153753
6	285.67		285.670	776.71	769.70	773.205	958.53		958.53	1117.40	35.0	28.4	5.6	12.5	81.500	0.429448	0.348466	0.068712	0.153374
7	285.71		285.710	777.02	769.92	773.470	958.76	958.09	958.43	1117.56	35.4	28.8	5.9	12.8	82.900	0.427021	0.347407	0.07117	0.154403
8	286.25	285.67	285.960	777.18	770.17	773.675	958.44		958.44	1117.56	36.6	30.1	6.7	13.8	87.200	0.419725	0.345183	0.076835	0.158257
9	286.27		286.270	777.22	770.21	773.715	958.69		958.69	1117.72	36.5	30.0	6.8	13.8	87.100	0.419059	0.344432	0.078071	0.158439
10	285.51		285.510	776.39	769.41	772.900	958.44		958.44	1117.40	36.3	29.8	6.6	13.6	86.300	0.420626	0.345307	0.076477	0.15759
11	285.83		285.830	777.06	770.05	773.555	958.76		958.76	1117.63	35.6	28.9	5.9	12.8	83.200	0.427885	0.347356	0.070913	0.153846
12	285.67		285.670	776.83	769.77	773.300	958.60		958.60	1117.56	36.1	29.5	6.3	13.3	85.200	0.423709	0.346244	0.073944	0.156103
13	285.64		285.640	776.67	769.61	773.140	958.53		958.53	1117.47	35.7	29.1	6.1	13.0	83.900	0.425507	0.346841	0.072706	0.154946
14	286.27		286.270	777.34	770.37	773.855	958.69		958.69	1117.72	34.5	27.8	5.2	12.0	79.500	0.433962	0.349686	0.065409	0.150943
15	286.27		286.270	777.34	770.37	773.855	958.69		958.69	1117.72	34.4	27.7	5.1	11.9	79.100	0.434893	0.35019	0.064475	0.150442

Table 7: Lactose Control #1 LM14

	Chemical Shift Values										Integration Values					Relative Integration Values			
Run	CH_3			CH_2			H_2O			OH	CH_3	CH_2	H_2O	OH	Total	CH_3	CH_2	H_2O	OH
	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point										
1	287.01	285.72	286.365	777.69	770.72	774.205	958.690		958.69	1117.63	59.2	48.2	9.9	21.5	138.800	0.426513	0.347262	0.071326	0.154899
2	285.64		285.640	776.55	769.54	773.045	958.530		958.53	1117.31	36.2	29.8	6.8	13.7	86.500	0.418497	0.344509	0.078613	0.158382
3	287.54	286.82	287.180	778.45	771.44	774.945	959.480	958.850	959.17	1118.04	31.0	25.4	5.4	11.3	73.100	0.424077	0.347469	0.073871	0.154583
4	285.64		285.640	776.55	769.54	773.045	958.530		958.53	1117.31	36.0	29.5	6.5	13.4	85.400	0.421546	0.345433	0.076112	0.156909
5	287.54	286.78	287.160	778.42	771.35	774.885	959.480	958.850	959.17	1118.04	31.4	25.6	5.6	11.5	74.100	0.423752	0.345479	0.075574	0.155196
6	287.54	286.78	287.160	778.42	771.35	774.885	959.480	958.850	959.17	1118.04	30.2	24.4	4.7	10.5	69.800	0.432665	0.34957	0.067335	0.15043
7	285.64		285.640	776.55	769.54	773.045	958.530		958.53	1117.31	35.9	29.4	6.5	13.4	85.200	0.421362	0.34507	0.076291	0.157277
8	285.79		285.790	776.87	769.77	773.320	958.530		958.53	1117.40	36.5	30.0	6.8	13.7	87.000	0.41954	0.344828	0.078161	0.157471
9	285.67		285.670	776.74	769.73	773.235	958.530		958.53	1117.31	36.3	29.7	6.7	13.6	86.300	0.420626	0.344148	0.077636	0.15759
10	285.39		285.390	776.51	769.45	772.980	958.530		958.53	1117.24	36.1	29.5	6.4	13.3	85.300	0.423212	0.345838	0.075029	0.15592
11	285.35		285.350	776.51	769.45	772.980	958.440		958.44	1117.31	36.0	29.4	6.4	13.3	85.100	0.423032	0.345476	0.075206	0.156287
12	285.55		285.550	776.67	769.57	773.120	958.440		958.44	1117.40	35.6	29.1	6.2	13.0	83.900	0.424315	0.346841	0.073897	0.154946
13	285.55		285.550	776.67	769.61	773.140	958.370		958.37	1117.40	35.6	29.0	6.1	13.0	83.700	0.425329	0.346476	0.072879	0.155317
14	285.55		285.550	776.67	769.61	773.140	958.370		958.37	1117.40	35.5	28.9	6.1	12.9	83.400	0.425659	0.346523	0.073141	0.154676
15	285.55		285.550	776.67	769.61	773.140	958.370		958.37	1117.40	35.5	28.9	6.0	12.8	83.200	0.426683	0.347356	0.072115	0.153846

Table 8: Lactose Control #2 LM14

	Chemical Shift Values													Integration Values					Relative Integration Values			
Run	CH_3				CH_2			H_2O			OH			CH_3	CH_2	H_2O	OH	Total	CH_3	CH_2	H_2O	OH
	Peak 1	Peak 2	Peak 3	Mid-point	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point									
1	286.75	285.39		286.070	777.46	770.40	773.930	958.440		958.440	1117.630	1117.12	1117.375	54.7	45.0	9.2	19.7	128.600	0.42535	0.349922	0.07154	0.153188
2	286.75			286.750	777.82	770.72	774.270	959.390		959.390	1118.110		1118.110	30.4	24.9	5.3	11.1	71.700	0.423989	0.34728	0.073919	0.154812
3	285.55			285.550	776.67	769.61	773.140	959.170	958.250	958.710	1117.880		1117.880	30.1	24.5	5.2	11.0	70.800	0.425141	0.346045	0.073446	0.155367
4	286.46	285.76		286.110	777.46	770.40	773.930	959.800		959.800	1118.350		1118.350	30.0	24.5	5.3	11.0	70.800	0.423729	0.346045	0.074859	0.155367
5	285.35			285.350	776.43	769.41	772.920	958.920	958.250	958.585	1117.790		1117.790	29.9	24.4	5.2	10.9	70.400	0.424716	0.346591	0.073864	0.15483
6	285.51			285.510	776.90	769.89	773.395	959.080		959.080	1117.880		1117.880	29.8	24.3	5.2	10.9	70.200	0.424501	0.346154	0.074074	0.155271
7	286.43	285.64		286.035	777.22	770.21	773.715	959.390	958.850	959.120	1117.950		1117.950	29.7	24.2	5.2	10.8	69.900	0.424893	0.346209	0.074392	0.154506
8	286.75	285.67		286.210	777.54	770.52	774.030	958.850		958.850	1117.950		1117.950	33.7	27.0	5.1	11.5	77.300	0.435964	0.349288	0.065977	0.148771
9	285.48			285.480	777.22	770.24	773.730	959.480		959.480	1117.950		1117.950	34.9	27.9	5.1	11.7	79.600	0.438442	0.350503	0.06407	0.146985
10	286.59	285.51		286.050	777.38	770.40	773.890	959.170	958.570	958.870	1118.040		1118.040	34.8	27.7	5.0	11.6	79.100	0.439949	0.35019	0.063211	0.14665
11	286.11	285.51		285.810	777.02	770.01	773.515	959.170		959.170	1118.040		1118.040	34.7	27.6	4.9	11.5	78.700	0.440915	0.350699	0.062262	0.146125
12	285.51			285.510	776.67	769.61	773.140	959.170		959.170	1117.880		1117.880	36.1	29.4	6.3	13.2	85.000	0.424706	0.345882	0.074118	0.155294
13	286.02			286.020	776.99	769.92	773.455	959.170	958.440	958.805	1117.720		1117.720	35.6	28.8	5.9	12.6	82.900	0.429433	0.347407	0.07117	0.15199
14	286.50	285.48	287.29	286.423	777.38	770.40	773.890	959.170	958.690	958.930	1118.190		1118.190	35.5	28.7	5.9	12.6	82.700	0.429262	0.347037	0.071342	0.152358
15	286.94	285.28		286.110	777.46	770.40	773.930	958.920		958.920	1117.950		1117.950	31.4	25.2	4.8	10.8	72.200	0.434903	0.34903	0.066482	0.149584

Table 9: Stannum metallicum LM22

	Chemical Shift Values											Integration Values					Relative Integration Values			
Run		CH_3				CH_2			H_20		OH	CH_3	CH_2	H_20	OH	Total	CH_3	CH_2	H_20	OH
	Peak 1	Peak 2		Mid-point	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point										
1	285.67	284.37		285.020	776.20	769.22	772.710	957.330		957.33	1116.36	54.6	44.8	9.2	19.8	128.400	0.425234	0.34891	0.071651	0.154206
2	286.43	285.64	287.38	286.483	777.34	770.33	773.835	959.390		959.39	1118.04	30.2	24.7	5.4	11.1	71.400	0.422969	0.345938	0.07563	0.155462
3	286.11			286.110	777.22	770.17	773.695	959.550		959.55	1118.19	30.0	24.5	5.3	11.0	70.800	0.423729	0.346045	0.074859	0.155367
4	286.15			286.150	777.22	770.17	773.695	959.040		959.04	1118.11	29.9	24.4	5.3	11.0	70.600	0.423513	0.345609	0.075071	0.155807
5	286.27	285.51		285.890	777.15	770.08	773.615	959.080		959.08	1117.79	29.8	24.4	5.3	11.0	70.500	0.422695	0.346099	0.075177	0.156028
6	286.31	285.35		285.830	777.22	770.24	773.730	959.010		959.01	1118.04	29.8	24.3	5.3	11.0	70.400	0.423295	0.34517	0.075284	0.15625
7	285.83			285.830	776.90	769.89	773.395	959.240		959.24	1117.95	39.3	32.0	6.8	14.3	92.400	0.425325	0.34632	0.073593	0.154762
8	286.31	285.67		285.990	777.31	770.24	773.775	959.010		959.01	1117.88	33.8	27.0	5.0	11.5	77.300	0.437257	0.349288	0.064683	0.148771
9	286.27	285.67		285.970	777.22	770.21	773.715	959.170		959.17	1118.04	34.8	27.8	5.2	11.7	79.500	0.437736	0.349686	0.065409	0.14717
10	286.78	285.64		286.210	777.46	770.40	773.930	959.010		959.01	1117.95	34.8	27.7	5.1	11.7	79.300	0.43884	0.349306	0.064313	0.147541
11	286.59	285.51		286.050	777.38	770.40	773.890	959.170		959.17	1117.95	36.3	29.7	6.7	13.5	86.200	0.421114	0.344548	0.077726	0.156613
12	285.67			285.670	776.99	769.92	773.455	959.010		959.01	1117.79	35.8	29.1	6.1	13.0	84.000	0.42619	0.346429	0.072619	0.154762
13	286.78	285.46		286.120	777.54	770.56	774.050	959.360		959.36	1118.11	35.5	28.7	5.9	12.6	82.700	0.429262	0.347037	0.071342	0.152358
14	286.94	285.65		286.295	777.54	770.52	774.030	958.760		958.76	1118.19	35.4	28.7	5.9	12.7	82.700	0.428053	0.347037	0.071342	0.153567
15	286.94	285.65		286.295	777.54	770.52	774.030	958.760		958.76	1118.19	31.2	25.1	4.9	10.8	72.000	0.433333	0.348611	0.068056	0.15

Table 10: Plumbum metallicum LM22

	Chemical Shift Values												Integration Values					Relative Integration Values			
Run		CH_3			CH_2			H_2O			OH		CH_3	CH_2	H_2O	OH	Total	CH_3	CH_2	H_2O	OH
	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point									
1	285.71	284.47	285.090	776.20	769.13	772.665	957.420		957.42	1116.45		1116.45	54.6	44.8	9.1	19.7	128.200	0.425897	0.349454	0.070983	0.153666
2	285.99		285.990	777.34	770.33	773.835	959.080		959.08	1118.04		1118.04	37.0	29.8	5.5	12.8	85.100	0.434783	0.350176	0.06463	0.150411
3	284.79	283.61	284.200	774.61	767.51	771.060	956.310		956.31	1115.34		1115.34	36.8	29.5	5.3	12.5	84.100	0.437574	0.350773	0.06302	0.148633
4	286.78	284.88	285.830	776.67	769.70	773.185	957.740	956.980	957.36	1116.29		1116.29	37.4	30.6	6.5	13.6	88.100	0.424518	0.347333	0.07378	0.15437
5	285.35	284.40	284.875	775.88	768.82	772.350	957.420		957.42	1116.36		1116.36	37.5	30.7	6.5	13.7	88.400	0.424208	0.347285	0.073529	0.154977
6	283.96		283.960	775.12	768.02	771.570	957.100		957.10	1116.04		1116.04	37.2	30.2	6.0	13.2	86.600	0.429561	0.34873	0.069284	0.152425
7	284.84	284.05	284.445	775.60	768.59	772.095	957.580	956.660	957.12	1116.13		1116.13	36.8	29.9	5.8	12.9	85.400	0.430913	0.350117	0.067916	0.151054
8	284.09		284.090	775.12	768.11	771.615	957.330		957.33	1116.13		1116.13	36.7	29.7	5.8	12.8	85.000	0.431765	0.349412	0.068235	0.150588
9	283.96		283.960	775.12	768.15	771.635	957.180		957.18	1116.29	1115.82	1116.06	36.1	28.6	4.8	11.6	81.100	0.445129	0.352651	0.059186	0.143033
10	284.05		284.050	775.25	768.15	771.700	957.260		957.26	1116.29		1116.29	36.2	28.7	4.8	11.6	81.300	0.445264	0.353014	0.059041	0.142681
11	284.72	284.05	284.385	775.47	768.46	771.965	957.420		957.42	1116.13		1116.13	36.3	28.8	4.8	11.6	81.500	0.445399	0.353374	0.058896	0.142331
12	283.80		283.800	774.93	767.86	771.395	957.260		957.26	1115.89		1115.89	37.6	29.7	5.0	12.0	84.300	0.446026	0.352313	0.059312	0.142349
13	285.16	284.00	284.580	775.76	768.66	772.210	957.420	956.030	956.73	1116.29		1116.29	38.1	29.8	4.5	11.6	84.000	0.453571	0.354762	0.053571	0.138095
14	285.16	284.00	284.580	775.76	768.66	772.210	957.420		957.42	1116.29		1116.29	34.6	27.3	4.5	10.9	77.300	0.447607	0.353169	0.058215	0.141009
15	283.80		283.800	774.93	767.86	771.395	957.260		957.26	1115.89		1115.89	34.1	26.9	4.5	10.8	76.300	0.44692	0.352556	0.058978	0.141547

Table 11: Lactose control #1 LM22

	Chemical Shift Values										Integration Values					Relative Integration Values			
Run		CH_3			CH_2			H_2O		OH	CH_3	CH_2	H_2O	OH	Total	CH_3	CH_2	H_2O	OH
	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point	Peak 1	Peak 2	Mid-point										
1	285.83	284.47	285.150	776.36	769.38	772.870	957.490		957.49	1116.61	54.8	44.8	9.0	19.5	128.100	0.427791	0.349727	0.070258	0.152225
2	287.26	285.67	286.465	777.54	770.56	774.050	959.170	958.250	958.71	1117.95	37.3	30.0	5.6	12.8	85.700	0.435239	0.350058	0.065344	0.149358
3	287.06	285.79	286.425	777.62	770.68	774.150	959.240		959.24	1118.19	36.9	29.5	5.3	12.5	84.200	0.438242	0.350356	0.062945	0.148456
4	284.42	283.49	283.955	775.25	768.15	771.700	956.790		956.79	1115.50	39.4	32.6	7.5	15.0	94.500	0.416931	0.344974	0.079365	0.15873
5	285.86	284.31	285.085	776.04	768.97	772.505	957.740		957.74	1116.36	37.5	30.6	6.6	13.7	88.400	0.424208	0.346154	0.074661	0.154977
6	284.21		284.210	775.56	768.50	772.030	957.490		957.49	1116.36	37.5	30.6	6.4	13.5	88.000	0.426136	0.347727	0.072727	0.153409
7	285.00	283.89	284.445	775.72	768.74	772.230	957.490		957.49	1116.45	36.9	29.9	5.9	13.0	85.700	0.430572	0.348891	0.068845	0.151692
8	285.23	284.40	284.815	775.95	768.94	772.445	957.420		957.42	1116.20	36.7	29.7	5.7	12.7	84.800	0.432783	0.350236	0.067217	0.149764
9	283.93		283.930	774.96	767.99	771.475	957.020		957.02	1116.04	36.5	29.4	5.5	12.5	83.900	0.435042	0.350417	0.065554	0.148987
10	284.09		284.090	775.32	768.30	771.810	957.260	956.820	957.04	1116.20	36.1	28.6	4.8	11.6	81.100	0.445129	0.352651	0.059186	0.143033
11	284.05		284.050	775.25	768.15	771.700	957.420		957.42	1116.13	36.2	28.7	4.8	11.6	81.300	0.445264	0.353014	0.059041	0.142681
12	283.93		283.930	775.09	768.02	771.555	957.420	956.980	957.20	1116.13	38.6	31.9	7.3	14.7	92.500	0.417297	0.344865	0.078919	0.158919
13	284.72	284.09	284.405	775.47	768.46	771.965	957.180		957.18	1116.04	34.5	27.2	4.5	10.9	77.100	0.447471	0.352789	0.058366	0.141375
14	284.72	284.09	284.405	775.47	768.46	771.965	957.180		957.18	1116.04	37.8	29.8	4.9	11.9	84.400	0.447867	0.353081	0.058057	0.140995
15	283.93		283.930	775.09	768.02	771.555	957.420	956.980	957.20	1116.13	33.8	26.7	4.6	10.8	75.900	0.445323	0.351779	0.060606	0.142292

Table 12: Lactose Control #2 LM22

APPENDIX D: Tables and Graphs of the Means and Standard Deviation

	Mean	Standard Deviation	N
Dilution: LM6			
CH_3	285.782	0.288	15
CH_2	773.441	0.334	15
H_2O	958.985	0.557	15
OH	1117.729	0.470	15
Dilution: LM14			
CH_3	285.814	0.102	15
CH_2	773.676	0.081	15
H_2O	959.012	0.368	15
OH	1117.854	0.470	15
Dilution: LM22			
CH_3	285.933	0.393	15
CH_2	773.659	0.384	15
H_2O	959.021	0.354	15
OH	1117.937	0.221	15

Table 4.1 Stannum metallicum (Chemical Shift Values)

Chart 4.1: Stannum metallicum: Chemical Shift Values (Mean)

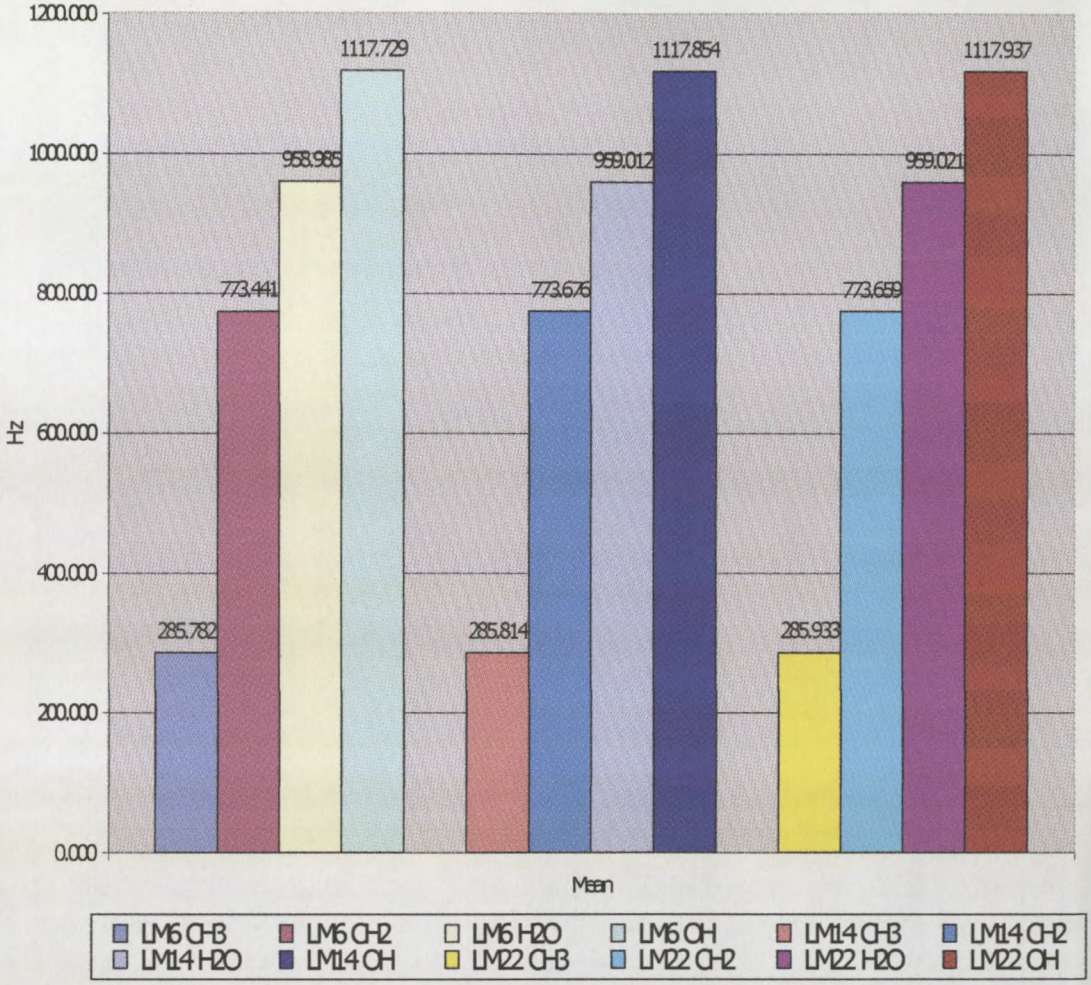
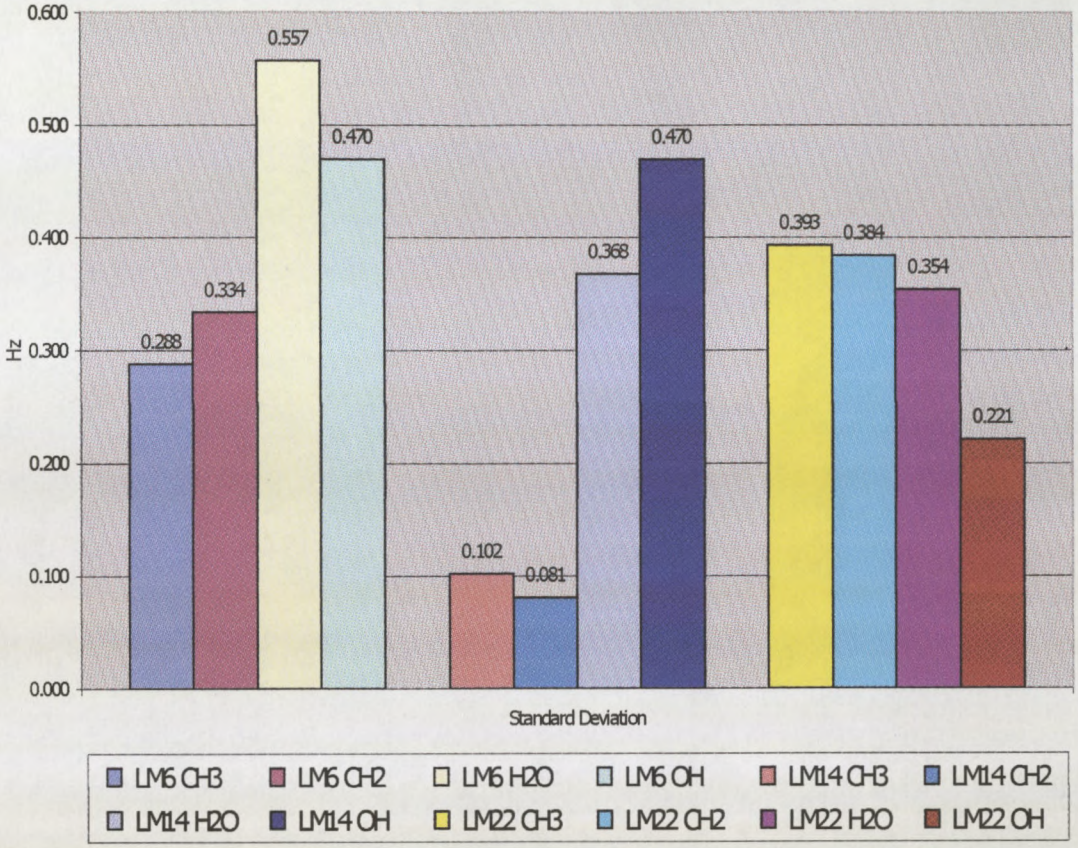


Chart 4.2: Stannum metallicum Chemical Shift Values (Std. Dev.)



	Mean	Standard Deviation	N
Dilution: LM6			
CH_3	285.699	0.393	15
CH_2	773.659	0.384	15
H_2O	959.021	0.354	15
OH	1117.937	0.221	15
Dilution: LM14			
CH_3	286.610	0.718	15
CH_2	774.466	0.521	15
H_2O	959.575	0.643	15
OH	1118.481	0.608	15
Dilution: LM22			
CH_3	285.994	0.343	15
CH_2	773.703	0.337	15
H_2O	958.993	0.508	15
OH	1117.905	0.447	15

Table 4.2 Plumbum metallicum (Chemical Shift Values)

Chart 4.3: Plumbum metallicum Chemical Shift Values (Mean)

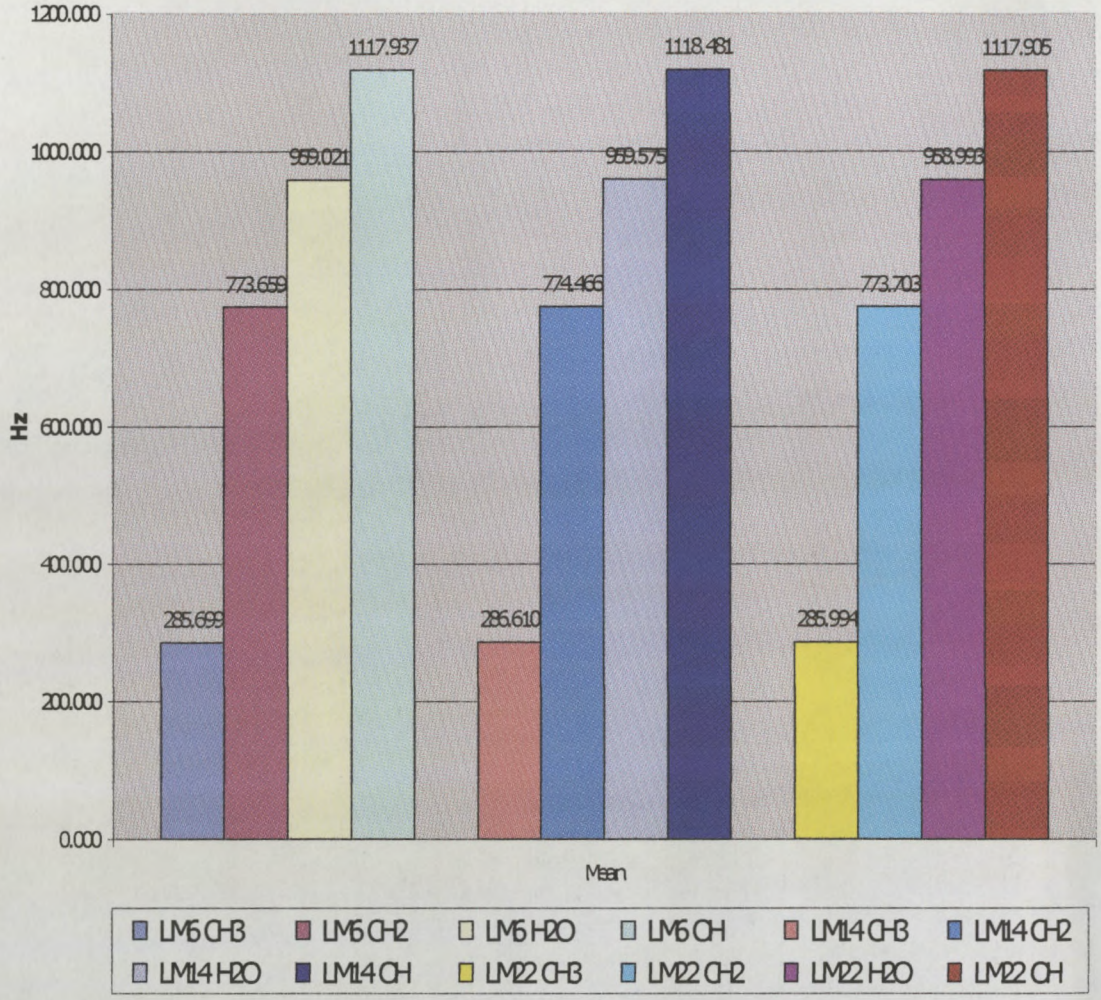
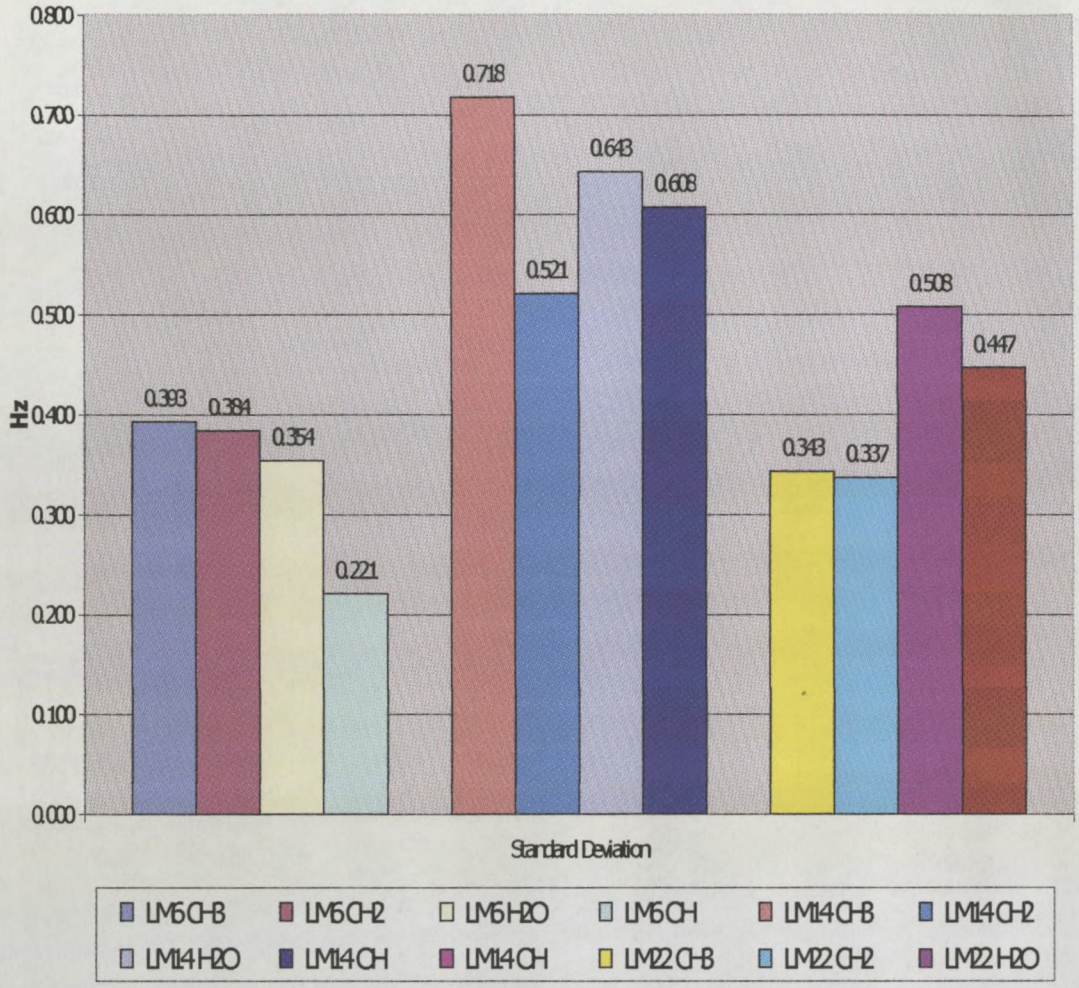


Chart 4.4: Plumbum metallicum Chemical Shift Value (Std. Dev.)



	Mean	Standard Deviation	N
Dilution: LM6			
CH_3	285.183	0.593	15
CH_2	772.796	0.577	15
H_2O	958.539	0.741	15
OH	1117.365	0.662	15
Dilution: LM14			
CH_3	285.861	0.286	15
CH_2	773.485	0.347	15
H_2O	958.575	0.148	15
OH	1117.854	0.239	15
Dilution: LM22			
CH_3	284.509	0.683	15
CH_2	772.059	0.735	15
H_2O	957.311	0.575	15
OH	1116.241	0.565	15

Table 4.3 Lactose Control #1 (Chemical Shift Values)

Chart 4.5: Lactose Control #1 Chemical Shift Values (Mean)

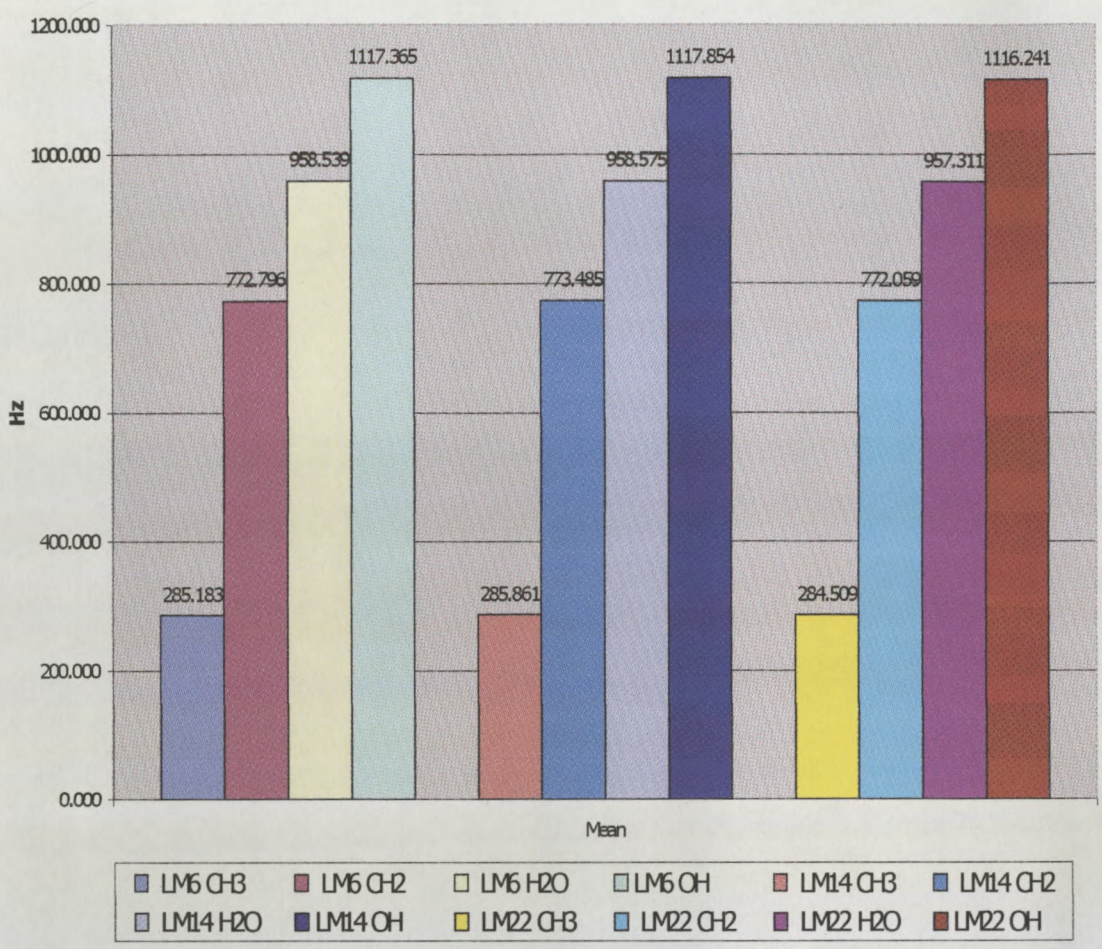
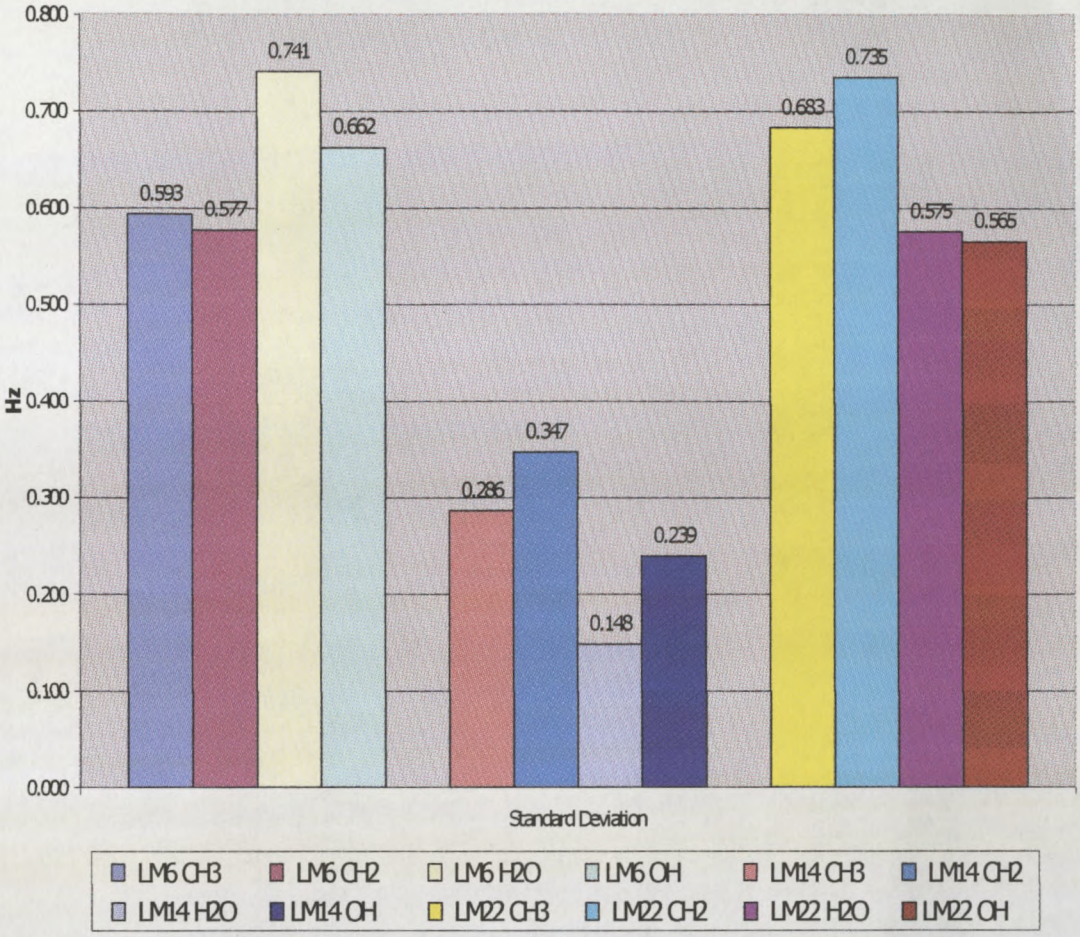


Chart 4.6: Lactose Control #1 Chemical Shift Values (Std. Dev.)



	Mean	Standard Deviation	N
Dilution: LM6			
CH_3	285.328	0.547	15
CH_2	772.969	0.565	15
H_2O	958.570	0.690	15
OH	1117.479	0.620	15
Dilution: LM14			
CH_3	285.946	0.672	15
CH_2	773.541	0.765	15
H_2O	958.570	0.690	15
OH	1117.479	0.620	15
Dilution: LM22			
CH_3	284.619	0.844	15
CH_2	772.267	0.841	15
H_2O	957.507	0.649	15
OH	1116.422	0.714	15

Table 4.4 Lactose Control #2 (Chemical Shift Values)

Chart 4.7: Lactose Control #2 Chemical Shift Values (Mean)

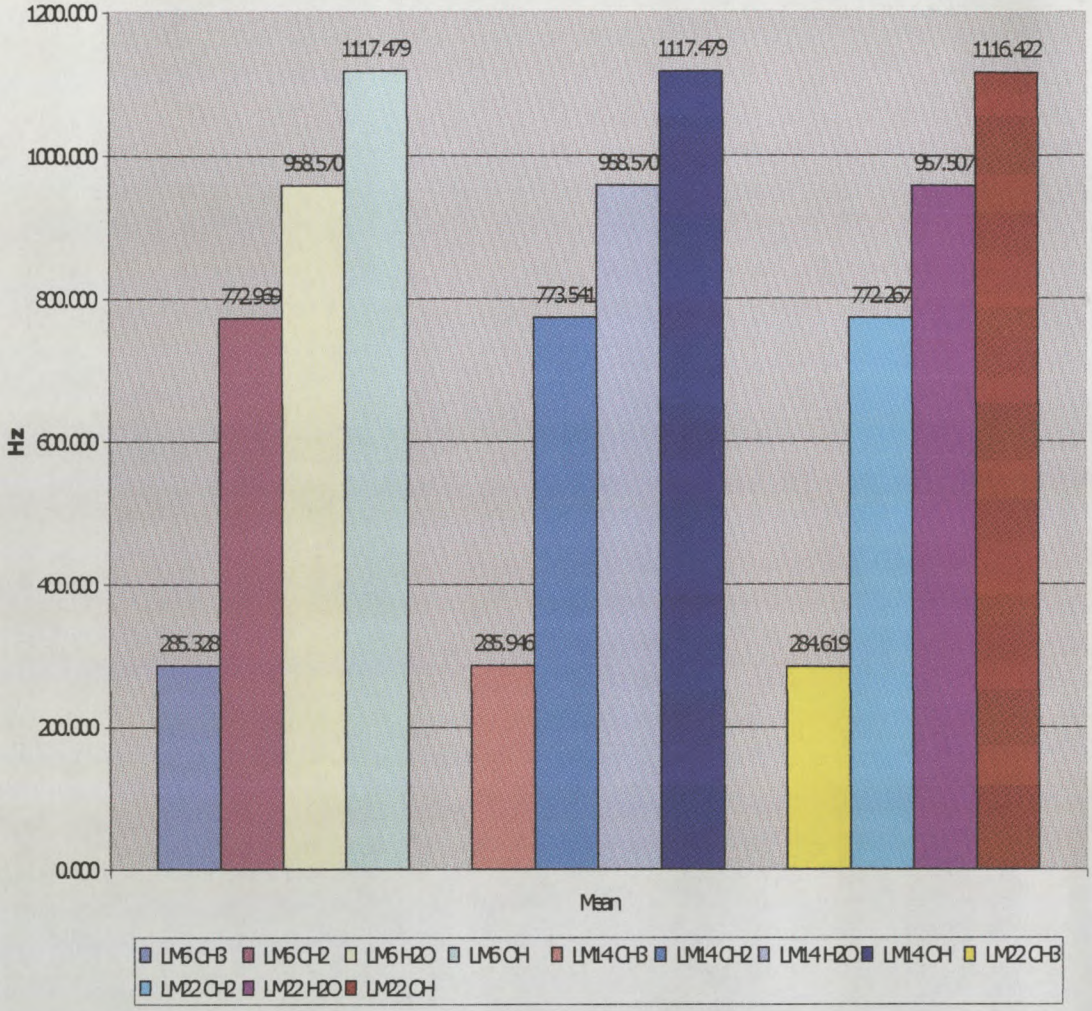
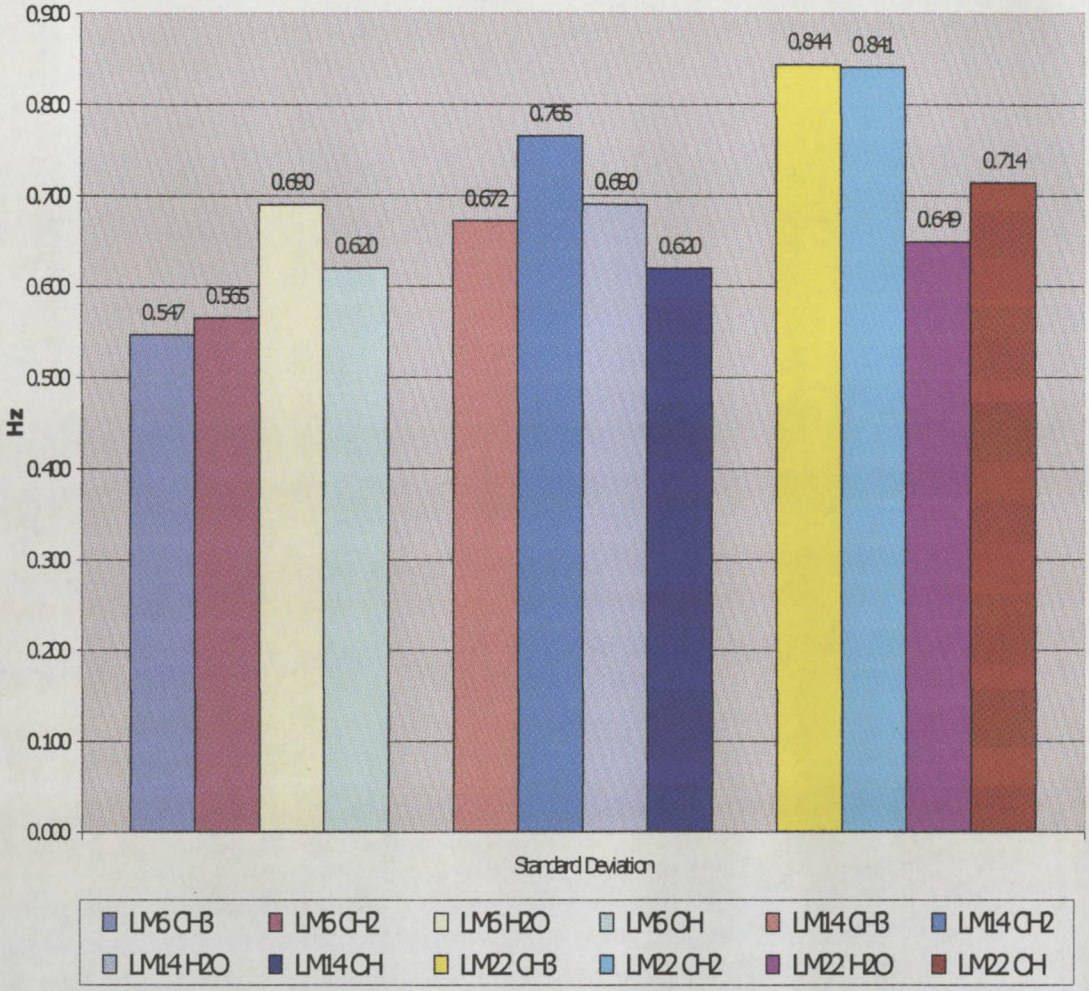


Chart 4.8: Lactose Control #2 Chemical Shift Values (Std. Dev.)



	Mean	Standard Deviation	N
Dilution: LM6			
CH_3	0.450	0.023	15
CH_2	0.349	0.005	15
H_2O	0.061	0.011	15
OH	0.140	0.016	15
Dilution: LM14			
CH_3	0.427	0.005	15
CH_2	0.346	0.002	15
H_2O	0.073	0.004	15
OH	0.154	0.003	15
Dilution: LM22			
CH_3	0.430	0.006	15
CH_2	0.348	0.002	15
H_2O	0.070	0.005	15
OH	0.152	0.004	15

Table 4.5 Stannum metallicum (Relative integration values)

Chart 4.9: Stannum metallicum Relative Integration Values (Mean)

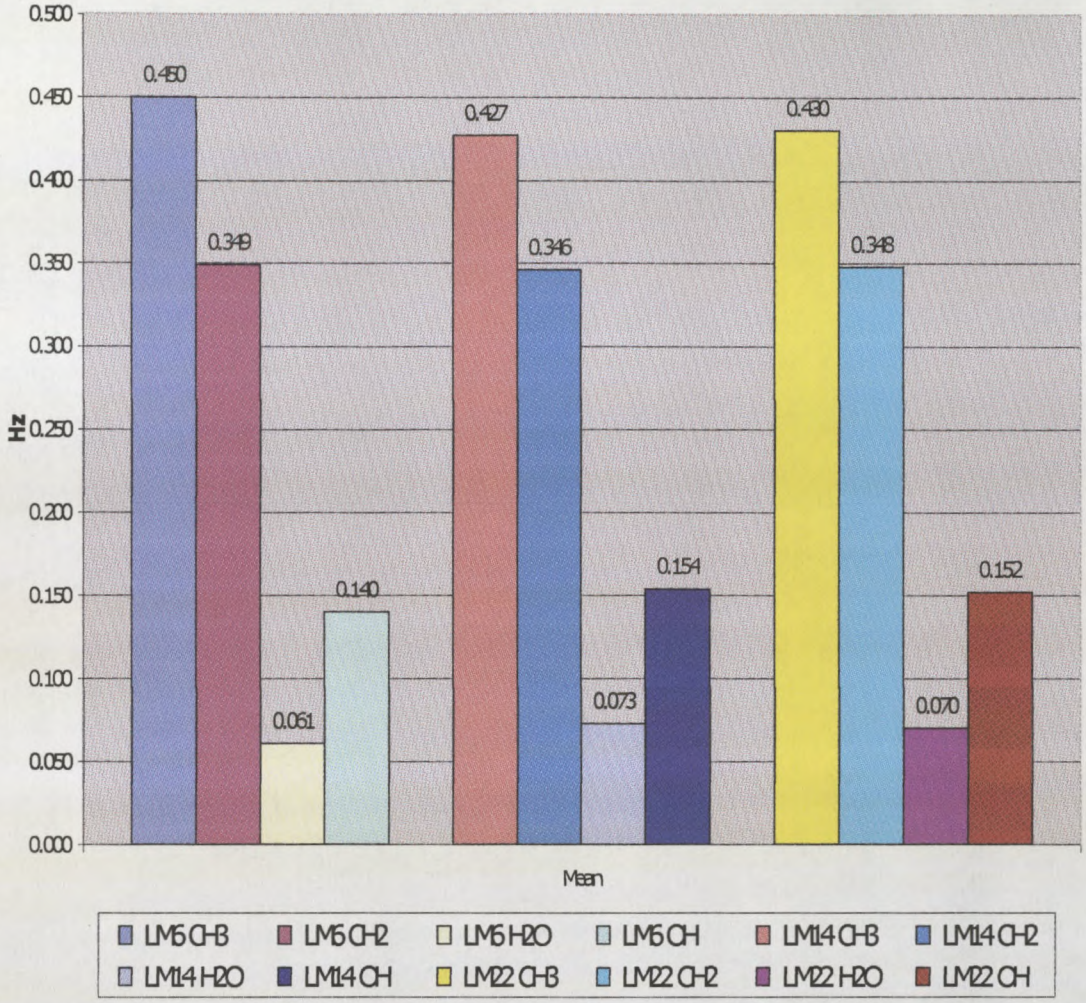
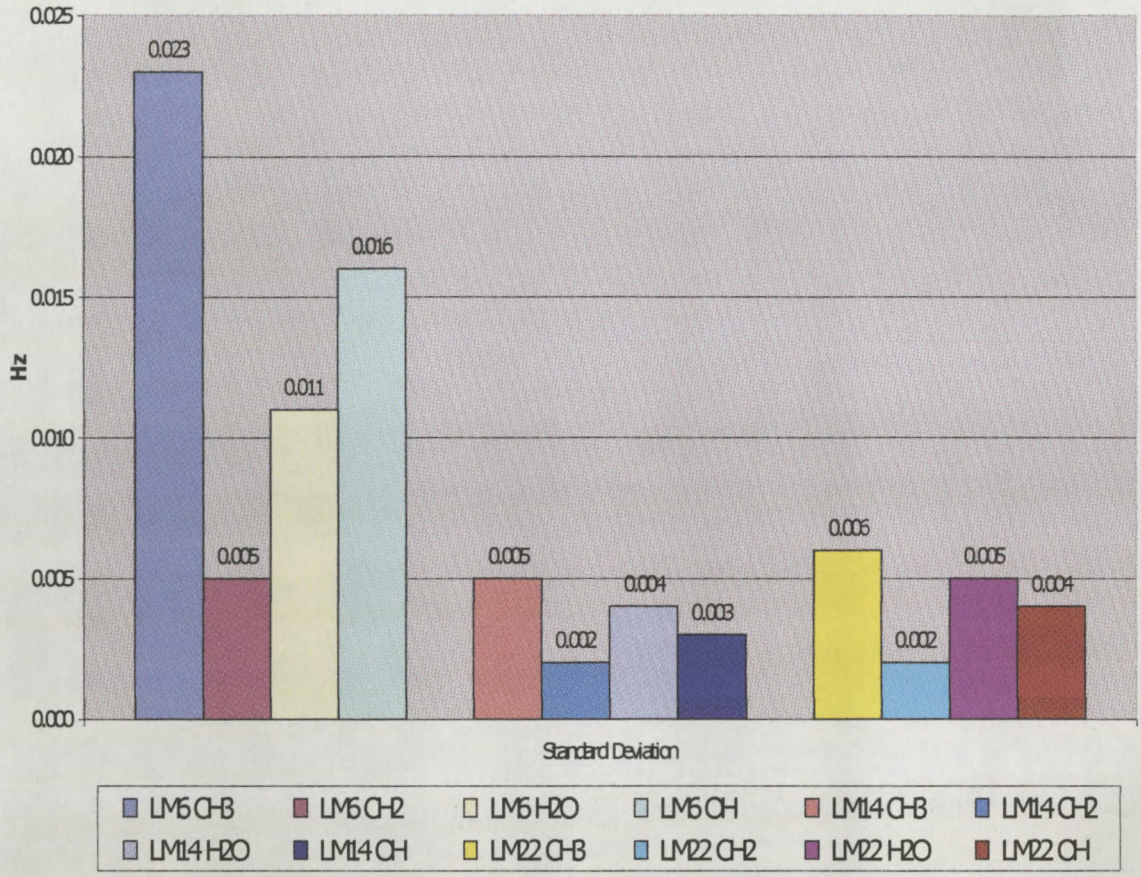


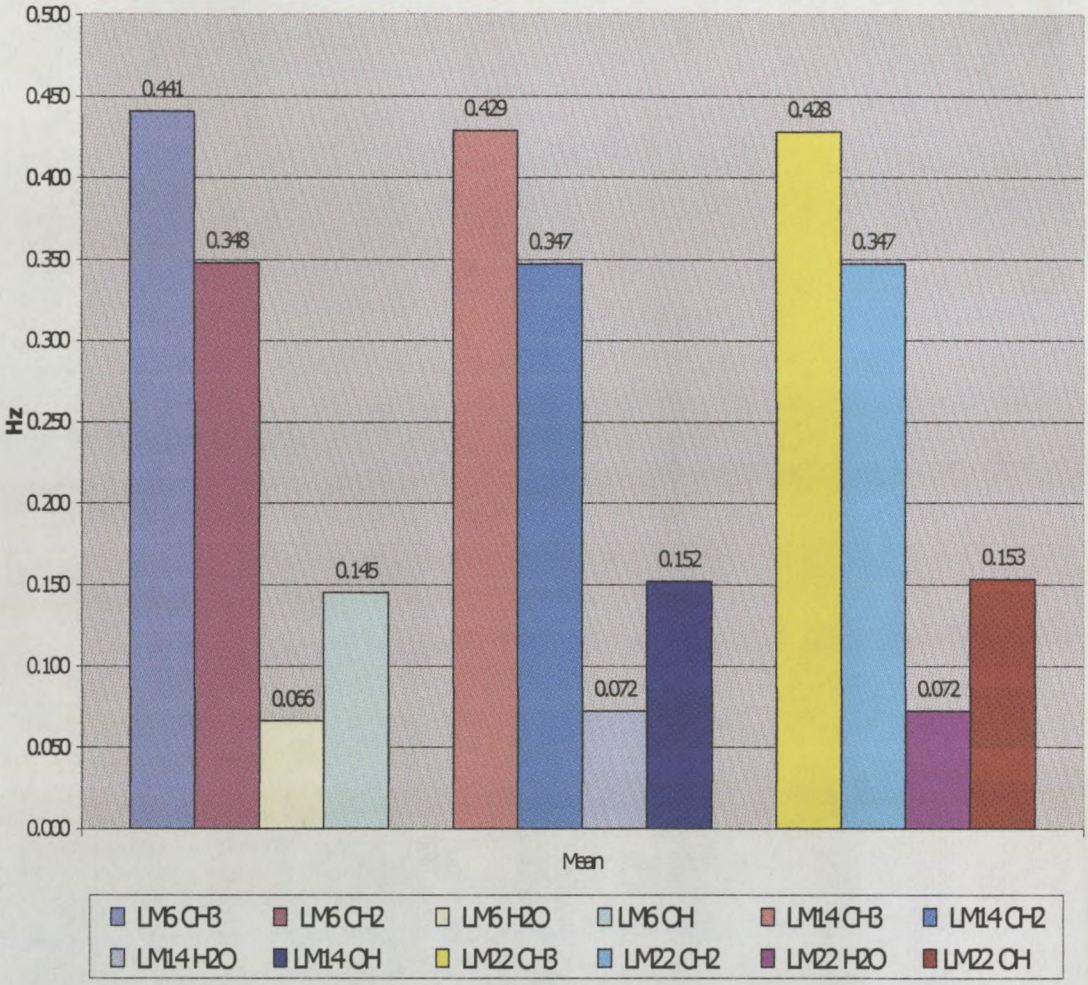
Chart 4.10: Stannum metallicum Relative Integration Values (Std. Dev.)



	Mean	Standard Deviation	N
Dilution: LM6			
CH_3	0.441	0.009	15
CH_2	0.348	0.002	15
H_2O	0.066	0.004	15
OH	0.145	0.006	15
Dilution: LM14			
CH_3	0.429	0.008	15
CH_2	0.347	0.002	15
H_2O	0.072	0.006	15
OH	0.152	0.004	15
Dilution: LM22			
CH_3	0.428	0.006	15
CH_2	0.347	0.002	15
H_2O	0.072	0.004	15
OH	0.153	0.003	15

Table 4.6 Plumbum metallicum (Relative integration values)

Chart 4.11: Plumbum metallicum Relative Integration Values (Mean)



	Mean	Standard Deviation	N
Dilution: LM6			
CH_3	0.470	0.019	15
CH_2	0.346	0.004	15
H_2O	0.059	0.006	15
OH	0.124	0.014	15
Dilution: LM14			
CH_3	0.427	0.005	15
CH_2	0.347	0.002	15
H_2O	0.072	0.004	15
OH	0.155	0.002	15
Dilution: LM22			
CH_3	0.438	0.010	15
CH_2	0.351	0.002	15
H_2O	0.064	0.006	15
OH	0.147	0.006	15

Table 4.7 Lactose Control #1 (Relative integration values)

Chart 4.13: Lactose Control #1 Relative Integration Values (Mean)

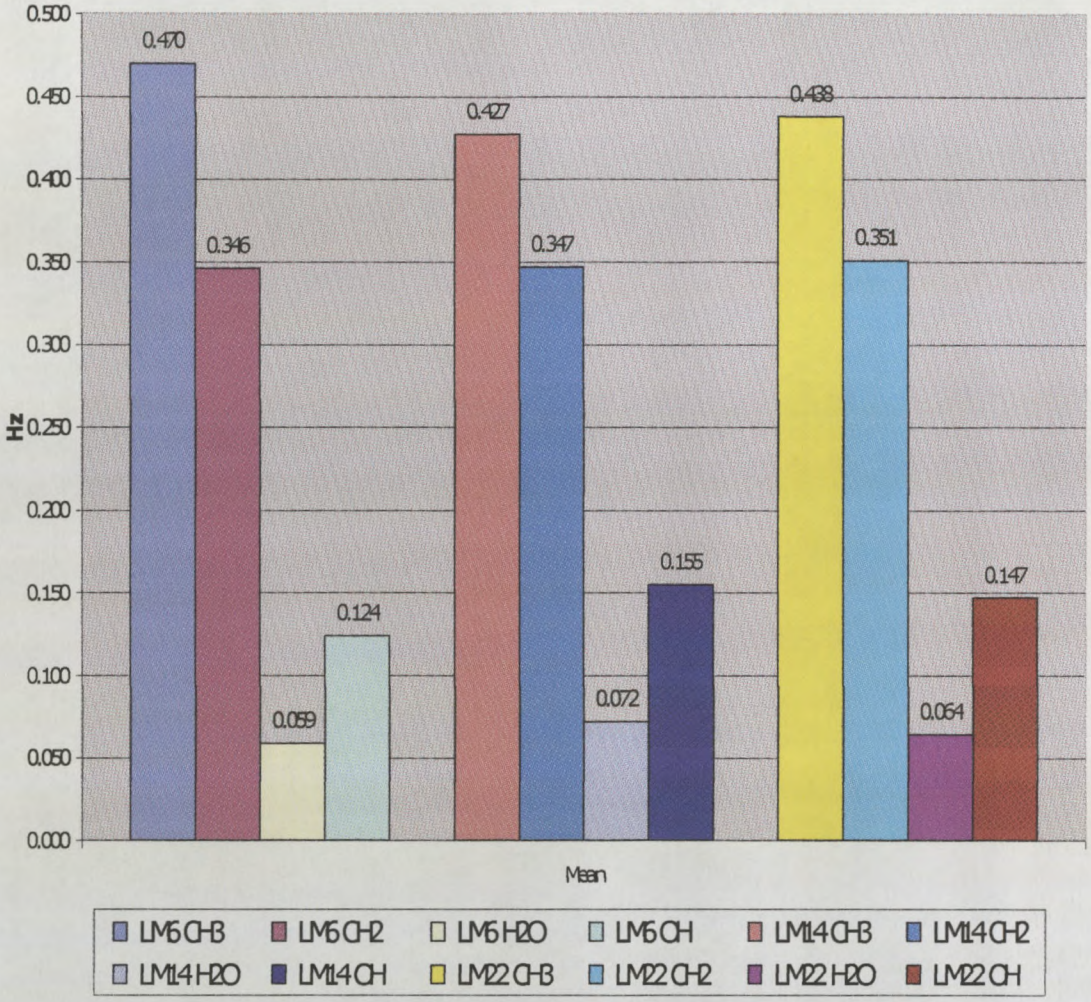
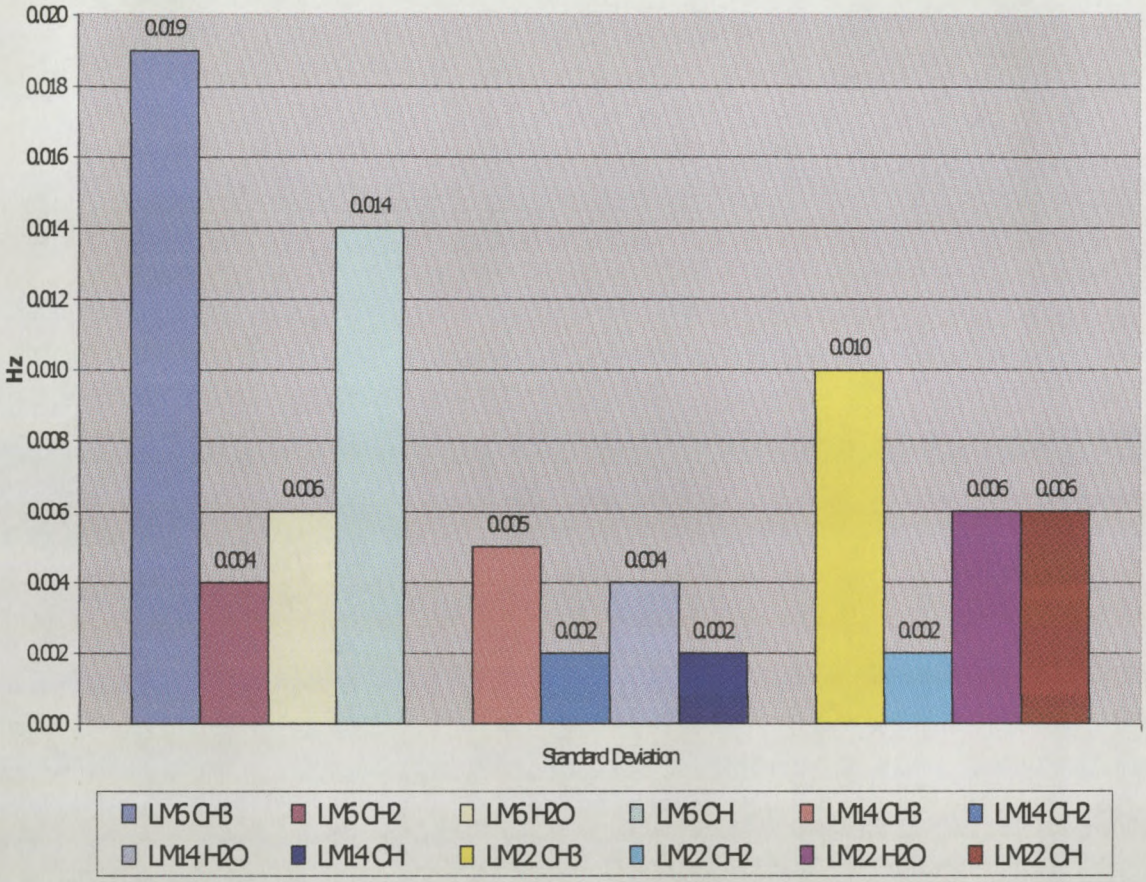


Chart 4.14: Lactose Control #1 Relative Integration Values (Std. Dev.)



	Mean	Standard Deviation	N
Dilution: LM6			
CH_3	0.463	0.020	15
CH_2	0.346	0.004	15
H_2O	0.062	0.008	15
OH	0.129	0.014	15
Dilution: LM14			
CH_3	0.424	0.003	15
CH_2	0.346	0.001	15
H_2O	0.074	0.003	15
OH	0.156	0.002	15
Dilution: LM22			
CH_3	0.434	0.011	15
CH_2	0.350	0.003	15
H_2O	0.067	0.007	15
OH	0.149	0.006	15

Table 4.8 Lactose Control #2 (Relative integration values)

Chart 4.15: Lactose Control #2 Relative Integration Values (Mean)

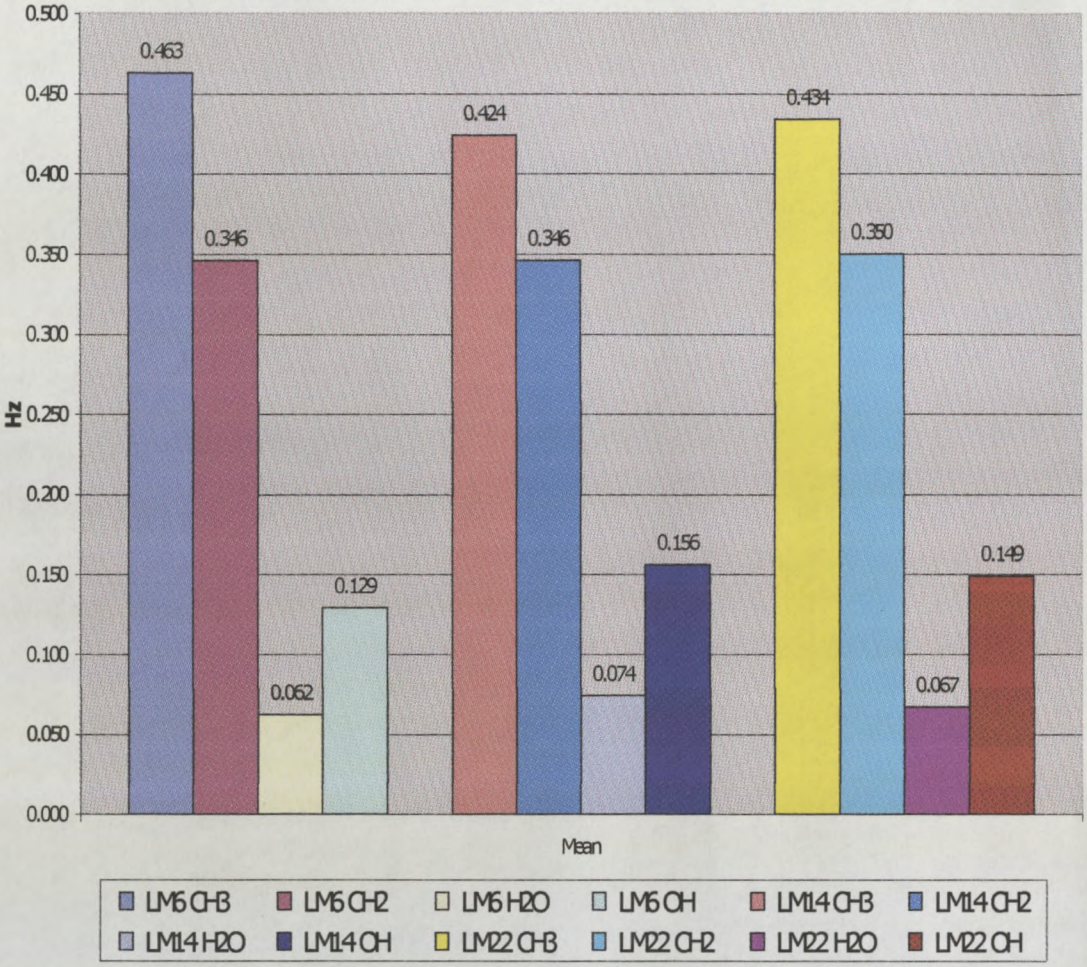
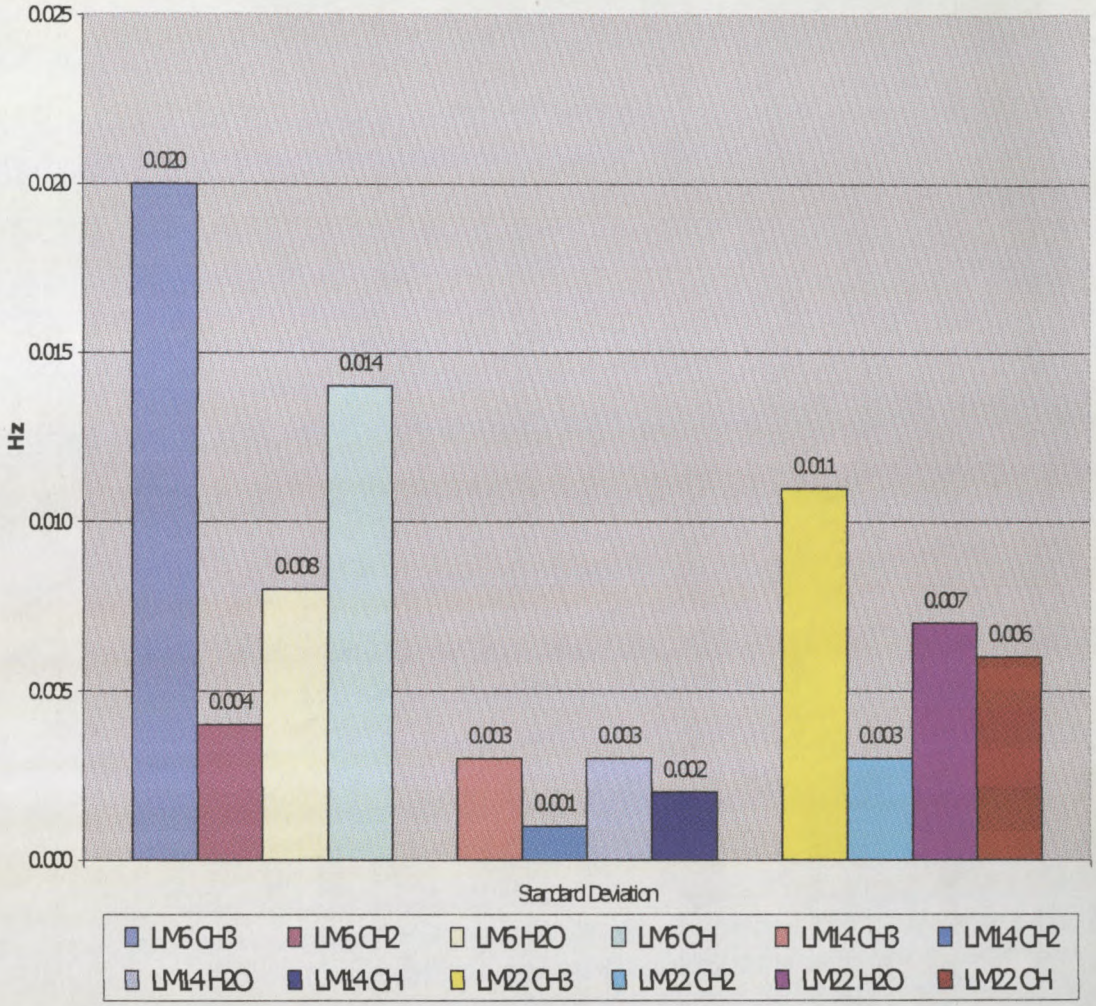


Chart 4.16: Lactose Control #2 Relative Integration Values (Std. Dev.)



APPENDIX E.1: CH_3 Test Comparisons

Test Comparison	Test for Normality	P value (Normality)	Equal Variance Test (Levens)	P value (Equal variance)
Stannum metallicum LM6 : Stannum metallicum LM22	Failed	0.0030	Failed	
Stannum metallicum LM6 : Stannum metallicum LM14	Failed	0.0257	Failed	
Stannum metallicum LM6 : Plumbum metallicum LM6	Failed	0.0320	Failed	
Stannum metallicum LM6 : Lactose control #2 LM6	Passed	0.0958	Passed	0.0685
Stannum metallicum LM6 : Lactose control #1 LM6	Passed	0.6836	Failed	0.0096
Stannum metallicum LM22: Lactose control #2 LM22	Passed	0.0841	Passed	0.0705
Stannum metallicum LM22 : Plumbum metallicum LM22	Passed	0.2416	Passed	0.4548
Stannum metallicum LM22 : Lactose control #1 LM22	Passed	0.1250	Passed	0.1345
Stannum metallicum LM14 : Stannum metallicum LM22	Failed	0.0158	Failed	
Stannum metallicum LM14 : Plumbum metallicum LM14	Failed	0.0001	Failed	
Stannum metallicum LM14 : Lactose control #2 LM14	Failed	0.0001	Failed	
Stannum metallicum LM14 : Lactose control #1 LM14	Failed	0.0074	Failed	
Plumbum metallicum LM6 : Plumbum metallicum LM22	Passed	0.5837	Passed	0.3016
Plumbum metallicum LM6 : Plumbum metallicum LM14	Passed	0.1332	Failed	
Plumbum metallicum LM6 : Lactose control #2 LM6	Passed	0.2065	Passed	0.2205
Plumbum metallicum LM6 : Lactose control #1 LM6	Passed	0.5071	Failed	0.0366
Plumbum metallicum LM22 : Lactose control #2 LM22	Passed	0.0690	Failed	0.0302
Plumbum metallicum LM22 : Lactose control #1 LM22	Passed	0.2921	Failed	0.0473
Plumbum metallicum LM14 : Plumbum metallicum LM22	Failed	0.0008	Failed	
Plumbum metallicum LM14 : Lactose control #2 LM14	Failed	0.0053	Failed	
Plumbum metallicum LM14 : Lactose control #1 LM14	Failed	0.0017	Failed	
Lactose control #2 LM6 : Lactose control #2 LM22	Passed	0.2932	Passed	0.2887
Lactose control #2 LM6 : Lactose control #2 LM14	Passed	0.1338	Passed	0.7037
Lactose control #2 LM14 : Lactose control #2 LM22	Failed	0.0001	Failed	
Lactose control #1 LM6 : Lactose control #2 LM6	Passed	0.1047	Passed	0.5438
Lactose control #1 LM6 : Lactose control #1 LM22	Passed	0.2889	Passed	0.9932
Lactose control #1 LM6 : Lactose control #1 LM14	Passed	0.3474	Failed	0.0249
Lactose control #1 LM22 : Lactose control #2 LM22	Failed	0.0165	Failed	
Lactose control #1 LM14 : Lactose control #2 LM14	Failed	0.0001	Failed	
Lactose control #1 LM14 : Lactose control #1 LM22	Failed	0.0477	Failed	

APPENDIX E.1: CH_3 Test Comparisons

Test Comparison	Mean (Sample 1)	Mean (Sample 2)	Std. Dev. (Sample 1)	Std. Dev. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM22				
Stannum metallicum LM6 : Stannum metallicum LM14				
Stannum metallicum LM6 : Plumbum metallicum LM6				
Stannum metallicum LM6 : Lactose control #2 LM6	285.8000	285.3000	0.2900	0.5467
Stannum metallicum LM6 : Lactose control #1 LM6				
Stannum metallicum LM22: Lactose control #2 LM22	285.9000	284.6000	0.3930	0.8437
Stannum metallicum LM22 : Plumbum metallicum LM22	285.9000	286.0000	0.3930	0.3426
Stannum metallicum LM22 : Lactose control #1 LM22	285.9000	284.5000	0.3930	0.6829
Stannum metallicum LM14 : Stannum metallicum LM22				
Stannum metallicum LM14 : Plumbum metallicum LM14				
Stannum metallicum LM14 : Lactose control #2 LM14				
Stannum metallicum LM14 : Lactose control #1 LM14				0.0000
Plumbum metallicum LM6 : Plumbum metallicum LM22	285.7000	286.0000	0.3419	0.3426
Plumbum metallicum LM6 : Plumbum metallicum LM14				
Plumbum metallicum LM6 : Lactose control #2 LM6	285.7000	285.3000	0.3419	0.5467
Plumbum metallicum LM6 : Lactose control #1 LM6				
Plumbum metallicum LM22 : Lactose control #2 LM22				
Plumbum metallicum LM22 : Lactose control #1 LM22				
Plumbum metallicum LM14 : Plumbum metallicum LM22				
Plumbum metallicum LM14 : Lactose control #2 LM14				
Plumbum metallicum LM14 : Lactose control #1 LM14				
Lactose control #2 LM6 : Lactose control #2 LM22	285.3000	284.6000	0.5467	0.8437
Lactose control #2 LM6 : Lactose control #2 LM14	285.3000	285.9000	0.5467	0.6718
Lactose control #2 LM14 : Lactose control #2 LM22				
Lactose control #1 LM6 : Lactose control #2 LM6	285.2000	285.3000	0.5933	0.5467
Lactose control #1 LM6 : Lactose control #1 LM22	285.2000	284.5000	0.5933	0.6829
Lactose control #1 LM6 : Lactose control #1 LM14				
Lactose control #1 LM22 : Lactose control #2 LM22				
Lactose control #1 LM14 : Lactose control #2 LM14				
Lactose control #1 LM14 : Lactose control #1 LM22				

APPENDIX E.1: CH_3 Test Comparisons

Test Comparison	SEM (Sample 1)	SEM (sample 2)	t-value (t-test)	P value (t-test)	Power of test (t-test)
Stannum metallicum LM6 : Stannum metallicum LM22					
Stannum metallicum LM6 : Stannum metallicum LM14					
Stannum metallicum LM6 : Plumbum metallicum LM6					
Stannum metallicum LM6 : Lactose control #2 LM6	0.0749	0.1412	2.8520	0.0081	0.7403
Stannum metallicum LM6 : Lactose control #1 LM6					
Stannum metallicum LM22: Lactose control #2 LM22	0.1015	0.2178	5.4650	0.0001	0.9999
Stannum metallicum LM22 : Plumbum metallicum LM22	0.1015	0.0884	-0.4581	0.6504	0.0500
Stannum metallicum LM22 : Lactose control #1 LM22	0.1015	0.1763	6.9970	0.0001	1.0000
Stannum metallicum LM14 : Stannum metallicum LM22					
Stannum metallicum LM14 : Plumbum metallicum LM14					
Stannum metallicum LM14 : Lactose control #2 LM14					
Stannum metallicum LM14 : Lactose control #1 LM14					
Plumbum metallicum LM6 : Plumbum metallicum LM22	0.0883	0.0884	-2.3600	0.0225	0.5349
Plumbum metallicum LM6 : Plumbum metallicum LM14					
Plumbum metallicum LM6 : Lactose control #2 LM6	0.0883	0.1412	2.2320	0.4771	0.0338
Plumbum metallicum LM6 : Lactose control #1 LM6					
Plumbum metallicum LM22 : Lactose control #2 LM22					
Plumbum metallicum LM22 : Lactose control #1 LM22					
Plumbum metallicum LM14 : Plumbum metallicum LM22					
Plumbum metallicum LM14 : Lactose control #2 LM14					
Plumbum metallicum LM14 : Lactose control #1 LM14					
Lactose control #2 LM6 : Lactose control #2 LM22	0.1412	0.2178	2.7290	0.0109	0.6934
Lactose control #2 LM6 : Lactose control #2 LM14	0.1412	0.1735	-2.7630	0.0100	0.7069
Lactose control #2 LM14 : Lactose control #2 LM22					
Lactose control #1 LM6 : Lactose control #2 LM6	0.1532	0.1412	-0.6945	0.4931	0.0500
Lactose control #1 LM6 : Lactose control #1 LM22	0.1532	0.1763	2.8860	0.0074	0.7526
Lactose control #1 LM6 : Lactose control #1 LM14					
Lactose control #1 LM22 : Lactose control #2 LM22					
Lactose control #1 LM14 : Lactose control #2 LM14					
Lactose control #1 LM14 : Lactose control #1 LM22					

APPENDIX E.1: CH_3 Test Comparisons

Test Comparison	Median (Sample 1)	Median (Sample 2)	25% C.I. (Sample 1)	25% C.I. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM22	285.9	286.0	285.6	285.5
Stannum metallicum LM6 : Stannum metallicum LM14	285.9	285.8	285.6	285.8
Stannum metallicum LM6 : Plumbum metallicum LM6	285.9	285.6	285.6	285.4
Stannum metallicum LM6 : Lactose control #2 LM6				
Stannum metallicum LM6 : Lactose control #1 LM6	285.9	285.2	285.6	284.7
Stannum metallicum LM22: Lactose control #2 LM22				
Stannum metallicum LM22 : Plumbum metallicum LM22				
Stannum metallicum LM22 : Lactose control #1 LM22				
Stannum metallicum LM14 : Stannum metallicum LM22	285.8	286.0	285.8	285.5
Stannum metallicum LM14 : Plumbum metallicum LM14	285.8	286.6	285.8	286.6
Stannum metallicum LM14 : Lactose control #2 LM14	285.8	285.6	285.8	285.6
Stannum metallicum LM14 : Lactose control #1 LM14	285.8	285.7	285.8	285.7
Plumbum metallicum LM6 : Plumbum metallicum LM22				
Plumbum metallicum LM6 : Plumbum metallicum LM14	285.6	286.6	285.4	286.6
Plumbum metallicum LM6 : Lactose control #2 LM6				
Plumbum metallicum LM6 : Lactose control #1 LM6	285.6	285.2	285.4	284.7
Plumbum metallicum LM22 : Lactose control #2 LM22	286.1	284.4	285.8	284.0
Plumbum metallicum LM22 : Lactose control #1 LM22	286.1	284.4	285.8	284.0
Plumbum metallicum LM14 : Plumbum metallicum LM22	286.6	286.1	286.6	285.8
Plumbum metallicum LM14 : Lactose control #2 LM14	286.6	285.6	286.6	285.6
Plumbum metallicum LM14 : Lactose control #1 LM14	286.6	285.7	286.6	285.7
Lactose control #2 LM6 : Lactose control #2 LM22				
Lactose control #2 LM6 : Lactose control #2 LM14				
Lactose control #2 LM14 : Lactose control #2 LM22	285.6	284.4	285.6	284.0
Lactose control #1 LM6 : Lactose control #2 LM6				
Lactose control #1 LM6 : Lactose control #1 LM22				
Lactose control #1 LM6 : Lactose control #1 LM14	285.2	285.7	284.7	285.7
Lactose control #1 LM22 : Lactose control #2 LM22	284.4	284.4	284.0	284.0
Lactose control #1 LM14 : Lactose control #2 LM14	285.7	285.6	285.7	285.6
Lactose control #1 LM14 : Lactose control #1 LM22	285.7	284.4	285.7	284.0

APPENDIX E.1: CH_3 Test Comparisons

Test Comparison	75% C.I. (Sample 1)	75% C.I. (Sample 2)	T value (Mann-Whitney)	P value (Mann-Whitney)
Stannum metallicum LM6 : Stannum metallicum LM22	286.0	286.1	202.0	0.2134
Stannum metallicum LM6 : Stannum metallicum LM14	286.0	285.9	239.5	0.7874
Stannum metallicum LM6 : Plumbum metallicum LM6	286.0	286.0	247.5	0.5475
Stannum metallicum LM6 : Lactose control #2 LM6				
Stannum metallicum LM6 : Lactose control #1 LM6	286.0	285.7	301.5	0.0045
Stannum metallicum LM22: Lactose control #2 LM22				
Stannum metallicum LM22 : Plumbum metallicum LM22				
Stannum metallicum LM22 : Lactose control #1 LM22				
Stannum metallicum LM14 : Stannum metallicum LM22	285.9	286.1	202.0	0.2132
Stannum metallicum LM14 : Plumbum metallicum LM14	285.9	287.3	135.0	0.0001
Stannum metallicum LM14 : Lactose control #2 LM14	285.9	286.2	273.0	0.0969
Stannum metallicum LM14 : Lactose control #1 LM14	285.9	286.2	254.0	0.3835
Plumbum metallicum LM6 : Plumbum metallicum LM22				
Plumbum metallicum LM6 : Plumbum metallicum LM14	286.0	287.3	144.0	0.0001
Plumbum metallicum LM6 : Lactose control #2 LM6				
Plumbum metallicum LM6 : Lactose control #1 LM6	286.0	285.7	296.0	0.0089
Plumbum metallicum LM22 : Lactose control #2 LM22	286.2	285.0	315.0	0.0001
Plumbum metallicum LM22 : Lactose control #1 LM22	286.2	284.8	334.5	0.0001
Plumbum metallicum LM14 : Plumbum metallicum LM22	287.3	286.2	313.0	0.0001
Plumbum metallicum LM14 : Lactose control #2 LM14	287.3	286.2	301.0	0.0048
Plumbum metallicum LM14 : Lactose control #1 LM14	287.3	286.2	322.0	0.0001
Lactose control #2 LM6 : Lactose control #2 LM22				
Lactose control #2 LM6 : Lactose control #2 LM14				
Lactose control #2 LM14 : Lactose control #2 LM22	286.2	285.0	321.0	0.0001
Lactose control #1 LM6 : Lactose control #2 LM6				
Lactose control #1 LM6 : Lactose control #1 LM22				
Lactose control #1 LM6 : Lactose control #1 LM14	285.7	286.2	160.0	0.0028
Lactose control #1 LM22 : Lactose control #2 LM22	284.8	285.0	229.5	0.9174
Lactose control #1 LM14 : Lactose control #2 LM14	286.2	286.2	263.5	0.2058
Lactose control #1 LM14 : Lactose control #1 LM22	286.2	284.8	324.5	0.0001

APPENDIX E.2: CH_2 Test Comparisons

Test Comparison	Test for Normality	P value (Normality)	Equal Variance Test (Levens)	P value (Equal variance)
Stannum metallicum LM6 : Stannum metallicum LM22	Passed	0.4842	Passed	0.5290
Stannum metallicum LM6 : Stannum metallicum LM14	Failed	0.0014	Failed	
Stannum metallicum LM6 : Plumbum metallicum LM6	Passed	0.2455	Passed	0.5921
Stannum metallicum LM6 : Lactose control #2 LM6	Passed	0.4129	Passed	0.1182
Stannum metallicum LM6 : Lactose control #1 LM6	Passed	0.7082	Failed	0.0483
Stannum metallicum LM22 : Plumbum metallicum LM22	Passed	0.0557	Passed	0.3019
Stannum metallicum LM22 : Lactose control #2 LM22	Failed	0.0232	Failed	
Stannum metallicum LM22 : Lactose control #1 LM22	Passed	0.1167	Passed	0.0775
Stannum metallicum LM14 : Stannum metallicum LM22	Failed	0.0001	Failed	
Stannum metallicum LM14 : Plumbum metallicum LM14	Failed	0.0001	Failed	
Stannum metallicum LM14 : Lactose control #2 LM14	Failed	0.0001	Failed	
Stannum metallicum LM14 : Lactose control #1 LM14	Failed	0.0001	Failed	
Plumbum metallicum LM6 : Plumbum metallicum LM22	Passed	0.6242	Passed	0.3128
Plumbum metallicum LM6 : Plumbum metallicum LM14	Failed	0.0001	Failed	
Plumbum metallicum LM6 : Lactose control #2 LM6	Passed	0.1106	Passed	0.1736
Plumbum metallicum LM6 : Lactose control #1 LM6	Passed	0.5650	Passed	0.0709
Plumbum metallicum LM22 : Lactose control #2 LM22	Failed	0.0053	Failed	
Plumbum metallicum LM22 : Lactose control #1 LM22	Failed	0.0236	Failed	
Plumbum metallicum LM14 : Plumbum metallicum LM22	Failed	0.0001	Failed	
Plumbum metallicum LM14 : Lactose control #2 LM14	Failed	0.0006	Failed	
Plumbum metallicum LM14 : Lactose control #1 LM14	Failed	0.0001	Failed	
Lactose control #2 LM6 : Lactose control #2 LM22	Passed	0.3722	Passed	0.3514
Lactose control #2 LM6 : Lactose control #2 LM14	Passed	0.0553	Passed	0.5167
Lactose control #2 LM14 : Lactose control #2 LM22	Failed	0.0001	Failed	
Lactose control #1 LM6 : Lactose control #2 LM6	Failed	0.0407	Failed	
Lactose control #1 LM6 : Lactose control #1 LM22	Passed	0.8215	Passed	0.5645
Lactose control #1 LM6 : Lactose control #1 LM14	Passed	0.8147	Passed	0.1480
Lactose control #1 LM22 : Lactose control #2 LM22	Passed	0.0596	Passed	0.7556
Lactose control #1 LM14 : Lactose control #2 LM14	Failed	0.0079	Failed	
Lactose control #1 LM14 : Lactose control #1 LM22	Passed	0.2500	Passed	0.0928

APPENDIX E.2: CH_2 Test Comparisons

Test Comparison	Mean (Sample 1)	Mean (Sample 2)	Std. Dev. (Sample 1)	Std. Dev. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM22	773.4	773.7	0.3339	0.3839
Stannum metallicum LM6 : Stannum metallicum LM14				
Stannum metallicum LM6 : Plumbum metallicum LM6	773.4	773.3	0.3339	0.3325
Stannum metallicum LM6 : Lactose control #2 LM6	773.4	773.0	0.3339	0.5654
Stannum metallicum LM6 : Lactose control #1 LM6				
Stannum metallicum LM22 : Plumbum metallicum LM22	773.7	773.7	0.3839	0.3375
Stannum metallicum LM22 : Lactose control #2 LM22				
Stannum metallicum LM22 : Lactose control #1 LM22	773.7	772.1	0.3839	0.7346
Stannum metallicum LM14 : Stannum metallicum LM22				
Stannum metallicum LM14 : Plumbum metallicum LM14				
Stannum metallicum LM14 : Lactose control #2 LM14				
Stannum metallicum LM14 : Lactose control #1 LM14				
Plumbum metallicum LM6 : Plumbum metallicum LM22	773.3	773.7	0.3325	0.3375
Plumbum metallicum LM6 : Plumbum metallicum LM14				
Plumbum metallicum LM6 : Lactose control #2 LM6	773.3	773.0	0.3325	0.5654
Plumbum metallicum LM6 : Lactose control #1 LM6	773.3	772.8	0.3325	0.5775
Plumbum metallicum LM22 : Lactose control #2 LM22				
Plumbum metallicum LM22 : Lactose control #1 LM22				
Plumbum metallicum LM14 : Plumbum metallicum LM22				
Plumbum metallicum LM14 : Lactose control #2 LM14				
Plumbum metallicum LM14 : Lactose control #1 LM14				
Lactose control #2 LM6 : Lactose control #2 LM22	773.0	772.3	0.5654	0.8413
Lactose control #2 LM6 : Lactose control #2 LM14	773.0	773.5	0.5654	0.7651
Lactose control #2 LM14 : Lactose control #2 LM22				
Lactose control #1 LM6 : Lactose control #2 LM6				
Lactose control #1 LM6 : Lactose control #1 LM22	772.8	772.1	0.5775	0.7346
Lactose control #1 LM6 : Lactose control #1 LM14	772.8	773.5	0.5775	0.3469
Lactose control #1 LM22 : Lactose control #2 LM22	772.1	772.3	0.7346	0.8413
Lactose control #1 LM14 : Lactose control #2 LM14				
Lactose control #1 LM14 : Lactose control #1 LM22	773.5	772.1	0.3469	0.7346

APPENDIX E.2: CH_2 Test Comparisons

Test Comparison	SEM (Sample 1)	SEM (sample 2)	t-value (t-test)	P value (t-test)	Power of test (t-test)
Stannum metallicum LM6 : Stannum metallicum LM22	0.0862	0.0991	-1.6570	0.1087	0.2334
Stannum metallicum LM6 : Stannum metallicum LM14					
Stannum metallicum LM6 : Plumbum metallicum LM6	0.0862	0.0859	0.8301	0.4135	0.0500
Stannum metallicum LM6 : Lactose control #2 LM6	0.0862	0.1460	2.7820	0.0096	0.7141
Stannum metallicum LM6 : Lactose control #1 LM6					
Stannum metallicum LM22 : Plumbum metallicum LM22	0.0991	0.0871	-0.3385	0.7375	0.0500
Stannum metallicum LM22 : Lactose control #2 LM22					
Stannum metallicum LM22 : Lactose control #1 LM22	0.0991	0.1897	7.4750	0.0001	1.0000
Stannum metallicum LM14 : Stannum metallicum LM22					
Stannum metallicum LM14 : Plumbum metallicum LM14					
Stannum metallicum LM14 : Lactose control #2 LM14					
Stannum metallicum LM14 : Lactose control #1 LM14					
Plumbum metallicum LM6 : Plumbum metallicum LM22	0.0859	0.8714	-2.9700	0.0060	0.7818
Plumbum metallicum LM6 : Plumbum metallicum LM14					
Plumbum metallicum LM6 : Lactose control #2 LM6	0.0859	0.1460	2.1890	0.0371	0.4572
Plumbum metallicum LM6 : Lactose control #1 LM6	0.0859	0.1491	3.1620	0.0038	0.8401
Plumbum metallicum LM22 : Lactose control #2 LM22					
Plumbum metallicum LM22 : Lactose control #1 LM22					
Plumbum metallicum LM14 : Plumbum metallicum LM22					
Plumbum metallicum LM14 : Lactose control #2 LM14					
Plumbum metallicum LM14 : Lactose control #1 LM14					
Lactose control #2 LM6 : Lactose control #2 LM22	0.1460	0.2172	2.6830	0.0121	0.6751
Lactose control #2 LM6 : Lactose control #2 LM14	0.1460	0.1975	-2.3260	0.0275	0.5196
Lactose control #2 LM14 : Lactose control #2 LM22					
Lactose control #1 LM6 : Lactose control #2 LM6					
Lactose control #1 LM6 : Lactose control #1 LM22	0.1491	0.1897	3.0550	0.0049	0.8089
Lactose control #1 LM6 : Lactose control #1 LM14	0.1491	0.0896	-3.9590	0.0005	0.9713
Lactose control #1 LM22 : Lactose control #2 LM22	0.1897	0.2172	-0.7213	0.4767	0.0500
Lactose control #1 LM14 : Lactose control #2 LM14					
Lactose control #1 LM14 : Lactose control #1 LM22	0.0896	0.1897	6.7970	0.0001	1.0000

APPENDIX E.2: CH_2 Test Comparisons

Test Comparison	Median (Sample 1)	Median (Sample 2)	25% C.I. (Sample 1)	25% C.I. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM22				
Stannum metallicum LM6 : Stannum metallicum LM14	773.5	773.7	773.2	773.7
Stannum metallicum LM6 : Plumbum metallicum LM6				
Stannum metallicum LM6 : Lactose control #2 LM6				
Stannum metallicum LM6 : Lactose control #1 LM6	773.5	772.9	773.2	772.2
Stannum metallicum LM22 : Plumbum metallicum LM22				
Stannum metallicum LM22 : Lactose control #2 LM22	773.7	772.0	773.4	771.7
Stannum metallicum LM22 : Lactose control #1 LM22				
Stannum metallicum LM14 : Stannum metallicum LM22	773.7	773.7	773.7	773.4
Stannum metallicum LM14 : Plumbum metallicum LM14	773.7	774.5	773.7	774.5
Stannum metallicum LM14 : Lactose control #2 LM14	773.7	773.1	773.7	773.0
Stannum metallicum LM14 : Lactose control #1 LM14	773.7	773.5	773.7	773.2
Plumbum metallicum LM6 : Plumbum metallicum LM22				
Plumbum metallicum LM6 : Plumbum metallicum LM14	773.3	774.5	773.0	774.5
Plumbum metallicum LM6 : Lactose control #2 LM6				
Plumbum metallicum LM6 : Lactose control #1 LM6				
Plumbum metallicum LM22 : Lactose control #2 LM22	773.7	772.0	773.6	771.7
Plumbum metallicum LM22 : Lactose control #1 LM22	773.7	772.0	773.6	771.6
Plumbum metallicum LM14 : Plumbum metallicum LM22	774.5	773.7	774.5	773.6
Plumbum metallicum LM14 : Lactose control #2 LM14	774.5	773.1	774.5	773.0
Plumbum metallicum LM14 : Lactose control #1 LM14	774.5	773.5	774.5	773.2
Lactose control #2 LM6 : Lactose control #2 LM22				
Lactose control #2 LM6 : Lactose control #2 LM14				
Lactose control #2 LM14 : Lactose control #2 LM22	773.1	772.0	773.0	771.7
Lactose control #1 LM6 : Lactose control #2 LM6	772.9	773.1	772.2	772.3
Lactose control #1 LM6 : Lactose control #1 LM22				
Lactose control #1 LM6 : Lactose control #1 LM14				
Lactose control #1 LM22 : Lactose control #2 LM22				
Lactose control #1 LM14 : Lactose control #2 LM14	773.5	773.1	773.2	773.0
Lactose control #1 LM14 : Lactose control #1 LM22				

APPENDIX E.2: CH_2 Test Comparisons

Test Comparison	75% C.I. (Sample 1)	75% C.I. (Sample 2)	T value (Mann-Whitney)	P value (Mann-Whitney)
Stannum metallicum LM6 : Stannum metallicum LM22				
Stannum metallicum LM6 : Stannum metallicum LM14	773.8	773.7	184.0	0.0464
Stannum metallicum LM6 : Plumbum metallicum LM6				
Stannum metallicum LM6 : Lactose control #2 LM6				
Stannum metallicum LM6 : Lactose control #1 LM6	773.8	773.2	307.0	0.0021
Stannum metallicum LM22 : Plumbum metallicum LM22				
Stannum metallicum LM22 : Lactose control #2 LM22	773.9	772.5	317.0	0.0001
Stannum metallicum LM22 : Lactose control #1 LM22				
Stannum metallicum LM14 : Stannum metallicum LM22	773.7	773.9	218.5	0.5753
Stannum metallicum LM14 : Plumbum metallicum LM14	773.7	774.7	135.0	0.0001
Stannum metallicum LM14 : Lactose control #2 LM14	773.7	774.0	285.0	0.0309
Stannum metallicum LM14 : Lactose control #1 LM14	773.7	773.7	280.0	0.0511
Plumbum metallicum LM6 : Plumbum metallicum LM22				
Plumbum metallicum LM6 : Plumbum metallicum LM14	773.7	774.7	135.0	0.0001
Plumbum metallicum LM6 : Lactose control #2 LM6				
Plumbum metallicum LM6 : Lactose control #1 LM6				
Plumbum metallicum LM22 : Lactose control #2 LM22	773.9	772.5	314.5	0.0001
Plumbum metallicum LM22 : Lactose control #1 LM22	773.9	772.3	334.5	0.0001
Plumbum metallicum LM14 : Plumbum metallicum LM22	774.7	773.9	330.0	0.0001
Plumbum metallicum LM14 : Lactose control #2 LM14	774.7	774.0	288.0	0.0225
Plumbum metallicum LM14 : Lactose control #1 LM14	774.7	773.7	330.0	0.0001
Lactose control #2 LM6 : Lactose control #2 LM22				
Lactose control #2 LM6 : Lactose control #2 LM14				
Lactose control #2 LM14 : Lactose control #2 LM22	774.0	772.5	323.0	0.0001
Lactose control #1 LM6 : Lactose control #2 LM6	773.2	773.4	210.5	0.3725
Lactose control #1 LM6 : Lactose control #1 LM22				
Lactose control #1 LM6 : Lactose control #1 LM14				
Lactose control #1 LM22 : Lactose control #2 LM22				
Lactose control #1 LM14 : Lactose control #2 LM14	773.7	774.0	264.5	0.1913
Lactose control #1 LM14 : Lactose control #1 LM22				

APPENDIX E.3: H_2O Test Comparisons

Test Comparison	Test for Normality	P value (Normality)	Equal Variance Test (Levens)	P value (Equal variance)
Stannum metallicum LM6 : Stannum metallicum LM22	Passed	0.0737	Passed	0.4751
Stannum metallicum LM6 : Stannum metallicum LM14	Failed	0.0009	Failed	
Stannum metallicum LM6 : Plumbum metallicum LM6	Failed	0.0020	Failed	
Stannum metallicum LM6 : Lactose control #2 LM6	Passed	0.0850	Passed	0.2778
Stannum metallicum LM6 : Lactose control #1 LM6	Failed	0.0345	Failed	
Stannum metallicum LM22: Lactose control #2 LM22	Failed	0.0083	Failed	
Stannum metallicum LM22 : Plumbum metallicum LM22	Failed	0.0381	Failed	
Stannum metallicum LM22 : Lactose control #1 LM22	Failed	0.0001	Failed	
Stannum metallicum LM14 : Stannum metallicum LM22	Passed	0.0798	Failed	0.0201
Stannum metallicum LM14 : Plumbum metallicum LM14	Failed	0.0001	Failed	
Stannum metallicum LM14 : Lactose control #2 LM14	Failed	0.0001	Failed	
Stannum metallicum LM14 : Lactose control #1 LM14	Failed	0.0001	Failed	
Plumbum metallicum LM6 : Plumbum metallicum LM22	Failed	0.0007	Failed	
Plumbum metallicum LM6 : Plumbum metallicum LM14	Failed	0.0001	Failed	
Plumbum metallicum LM6 : Lactose control #2 LM6	Failed	0.0187	Failed	
Plumbum metallicum LM6 : Lactose control #1 LM6	Failed	0.0037	Failed	
Plumbum metallicum LM22 : Lactose control #2 LM22	Failed	0.0287	Failed	
Plumbum metallicum LM22 : Lactose control #1 LM22	Failed	0.0002	Failed	
Plumbum metallicum LM14 : Plumbum metallicum LM22	Failed	0.0001	Failed	
Plumbum metallicum LM14 : Lactose control #2 LM14	Failed	0.0001	Failed	
Plumbum metallicum LM14 : Lactose control #1 LM14	Failed	0.0001	Failed	
Lactose control #2 LM6 : Lactose control #2 LM22	Passed	0.7120	Passed	0.5337
Lactose control #2 LM6 : Lactose control #2 LM14	Passed	0.0880	Passed	0.1700
Lactose control #2 LM14 : Lactose control #2 LM22	Failed	0.0001	Failed	
Lactose control #1 LM6 : Lactose control #2 LM6	Failed	0.0001	Failed	
Lactose control #1 LM6 : Lactose control #1 LM22	Failed	0.0198	Failed	
Lactose control #1 LM6 : Lactose control #1 LM14	Failed	0.0001	Failed	
Lactose control #1 LM22 : Lactose control #2 LM22	Failed	0.0001	Failed	
Lactose control #1 LM14 : Lactose control #2 LM14	Failed	0.0001	Failed	
Lactose control #1 LM14 : Lactose control #1 LM22	Failed	0.0001	Failed	

APPENDIX E.3: H_2O Test Comparisons

Test Comparison	Mean (Sample 1)	Mean (Sample 2)	Std. Dev. (Sample 1)	Std. Dev. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM22	959.0	959.0	0.5570	0.3538
Stannum metallicum LM6 : Stannum metallicum LM14				
Stannum metallicum LM6 : Plumbum metallicum LM6				
Stannum metallicum LM6 : Lactose control #2 LM6	959.0	958.6	0.5570	0.6900
Stannum metallicum LM6 : Lactose control #1 LM6				
Stannum metallicum LM22: Lactose control #2 LM22				
Stannum metallicum LM22 : Plumbum metallicum LM22				
Stannum metallicum LM22 : Lactose control #1 LM22				
Stannum metallicum LM14 : Stannum metallicum LM22				
Stannum metallicum LM14 : Plumbum metallicum LM14				
Stannum metallicum LM14 : Lactose control #2 LM14				
Stannum metallicum LM14 : Lactose control #1 LM14				
Plumbum metallicum LM6 : Plumbum metallicum LM22				
Plumbum metallicum LM6 : Plumbum metallicum LM14				
Plumbum metallicum LM6 : Lactose control #2 LM6				
Plumbum metallicum LM6 : Lactose control #1 LM6				
Plumbum metallicum LM22 : Lactose control #2 LM22				
Plumbum metallicum LM22 : Lactose control #1 LM22				
Plumbum metallicum LM14 : Plumbum metallicum LM22				
Plumbum metallicum LM14 : Lactose control #2 LM14				
Plumbum metallicum LM14 : Lactose control #1 LM14				
Lactose control #2 LM6 : Lactose control #2 LM22	958.6	957.5	0.6900	0.6488
Lactose control #2 LM6 : Lactose control #2 LM14	958.6	958.6	0.6900	0.2943
Lactose control #2 LM14 : Lactose control #2 LM22				
Lactose control #1 LM6 : Lactose control #2 LM6				
Lactose control #1 LM6 : Lactose control #1 LM22				
Lactose control #1 LM6 : Lactose control #1 LM14				
Lactose control #1 LM22 : Lactose control #2 LM22				
Lactose control #1 LM14 : Lactose control #2 LM14				
Lactose control #1 LM14 : Lactose control #1 LM22				

APPENDIX E.3: H_2O Test Comparisons

Test Comparison	SEM (Sample 1)	SEM (sample 2)	t-value (t-test)	P value (t-test)	Power of test (t-test)
Stannum metallicum LM6 : Stannum metallicum LM22	0.1438	0.0914	-0.2152	0.8312	0.0500
Stannum metallicum LM6 : Stannum metallicum LM14					
Stannum metallicum LM6 : Plumbum metallicum LM6					
Stannum metallicum LM6 : Lactose control #2 LM6	0.1438	0.1781	1.8110	0.0809	0.2932
Stannum metallicum LM6 : Lactose control #1 LM6					
Stannum metallicum LM22: Lactose control #2 LM22					
Stannum metallicum LM22 : Plumbum metallicum LM22					
Stannum metallicum LM22 : Lactose control #1 LM22					
Stannum metallicum LM14 : Stannum metallicum LM22					
Stannum metallicum LM14 : Plumbum metallicum LM14					
Stannum metallicum LM14 : Lactose control #2 LM14					
Stannum metallicum LM14 : Lactose control #1 LM14					
Plumbum metallicum LM6 : Plumbum metallicum LM22					
Plumbum metallicum LM6 : Plumbum metallicum LM14					
Plumbum metallicum LM6 : Lactose control #2 LM6					
Plumbum metallicum LM6 : Lactose control #1 LM6					
Plumbum metallicum LM22 : Lactose control #2 LM22					
Plumbum metallicum LM22 : Lactose control #1 LM22					
Plumbum metallicum LM14 : Plumbum metallicum LM22					
Plumbum metallicum LM14 : Lactose control #2 LM14					
Plumbum metallicum LM14 : Lactose control #1 LM14					
Lactose control #2 LM6 : Lactose control #2 LM22	0.1781	0.1675	4.3460	0.0002	0.9904
Lactose control #2 LM6 : Lactose control #2 LM14	0.1781	0.0760	-0.2823	0.7798	0.0500
Lactose control #2 LM14 : Lactose control #2 LM22					
Lactose control #1 LM6 : Lactose control #2 LM6					
Lactose control #1 LM6 : Lactose control #1 LM22					
Lactose control #1 LM6 : Lactose control #1 LM14					
Lactose control #1 LM22 : Lactose control #2 LM22					
Lactose control #1 LM14 : Lactose control #2 LM14					
Lactose control #1 LM14 : Lactose control #1 LM22					

APPENDIX E.3: H_2O Test Comparisons

Test Comparison	Median (Sample 1)	Median (Sample 2)	25% C.I. (Sample 1)	25% C.I. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM22				
Stannum metallicum LM6 : Stannum metallicum LM14	959.0	958.9	958.8	958.9
Stannum metallicum LM6 : Plumbum metallicum LM6	959.0	958.9	958.8	958.6
Stannum metallicum LM6 : Lactose control #2 LM6				
Stannum metallicum LM6 : Lactose control #1 LM6	959.0	958.9	958.8	958.0
Stannum metallicum LM22: Lactose control #2 LM22	958.9	957.4	958.8	957.2
Stannum metallicum LM22 : Plumbum metallicum LM22	958.9	959.0	958.8	959.0
Stannum metallicum LM22 : Lactose control #1 LM22	958.9	957.3	958.8	957.1
Stannum metallicum LM14 : Stannum metallicum LM22	958.9	958.9	958.9	958.8
Stannum metallicum LM14 : Plumbum metallicum LM14	958.9	959.7	958.9	959.7
Stannum metallicum LM14 : Lactose control #2 LM14	958.9	958.5	958.9	958.4
Stannum metallicum LM14 : Lactose control #1 LM14	958.9	958.5	958.9	958.4
Plumbum metallicum LM6 : Plumbum metallicum LM22	958.9	959.0	958.6	959.0
Plumbum metallicum LM6 : Plumbum metallicum LM14	958.9	959.7	958.6	959.7
Plumbum metallicum LM6 : Lactose control #2 LM6	958.9	958.9	958.6	957.8
Plumbum metallicum LM6 : Lactose control #1 LM6	958.9	958.9	958.6	958.0
Plumbum metallicum LM22 : Lactose control #2 LM22	959.0	957.4	959.0	957.2
Plumbum metallicum LM22 : Lactose control #1 LM22	959.0	957.3	959.0	957.1
Plumbum metallicum LM14 : Plumbum metallicum LM22	959.7	959.0	959.7	959.0
Plumbum metallicum LM14 : Lactose control #2 LM14	959.7	958.5	959.7	958.4
Plumbum metallicum LM14 : Lactose control #1 LM14	959.7	958.5	959.7	958.4
Lactose control #2 LM6 : Lactose control #2 LM22				
Lactose control #2 LM6 : Lactose control #2 LM14				
Lactose control #2 LM14 : Lactose control #2 LM22	958.5	957.4	958.4	957.2
Lactose control #1 LM6 : Lactose control #2 LM6	958.9	958.9	958.0	957.8
Lactose control #1 LM6 : Lactose control #1 LM22	958.9	957.3	958.0	957.1
Lactose control #1 LM6 : Lactose control #1 LM14	958.9	958.5	958.0	958.4
Lactose control #1 LM22 : Lactose control #2 LM22	957.3	957.4	957.1	957.2
Lactose control #1 LM14 : Lactose control #2 LM14	358.5	958.5	958.4	958.4
Lactose control #1 LM14 : Lactose control #1 LM22	958.5	957.3	958.4	957.1

APPENDIX E.3: H_2O Test Comparisons

Test Comparison	75% C.I. (Sample 1)	75% C.I. (Sample 2)	T value (Mann-Whitney)	P value (Mann-Whitney)
Stannum metallicum LM6 : Stannum metallicum LM22				
Stannum metallicum LM6 : Stannum metallicum LM14	959.2	959.3	218.0	0.5612
Stannum metallicum LM6 : Plumbum metallicum LM6	959.2	958.9	270.5	0.1198
Stannum metallicum LM6 : Lactose control #2 LM6				
Stannum metallicum LM6 : Lactose control #1 LM6	959.2	959.0	263.5	0.2058
Stannum metallicum LM22: Lactose control #2 LM22	959.2	957.5	330.5	0.0001
Stannum metallicum LM22 : Plumbum metallicum LM22	959.2	959.2	218.0	0.5614
Stannum metallicum LM22 : Lactose control #1 LM22	959.2	957.4	336.5	0.0001
Stannum metallicum LM14 : Stannum metallicum LM22	959.3	959.2	235.5	0.9174
Stannum metallicum LM14 : Plumbum metallicum LM14	959.3	959.8	135.0	0.0001
Stannum metallicum LM14 : Lactose control #2 LM14	959.3	958.7	309.0	0.0016
Stannum metallicum LM14 : Lactose control #1 LM14	959.3	958.7	323.0	0.0001
Plumbum metallicum LM6 : Plumbum metallicum LM22	958.9	959.2	167.0	0.0070
Plumbum metallicum LM6 : Plumbum metallicum LM14	958.9	959.8	135.0	0.0001
Plumbum metallicum LM6 : Lactose control #2 LM6	958.9	959.0	229.0	0.9010
Plumbum metallicum LM6 : Lactose control #1 LM6	958.9	959.0	227.0	0.8357
Plumbum metallicum LM22 : Lactose control #2 LM22	959.2	957.5	326.5	0.0001
Plumbum metallicum LM22 : Lactose control #1 LM22	959.2	957.4	331.0	0.0001
Plumbum metallicum LM14 : Plumbum metallicum LM22	959.8	959.2	135.0	0.0001
Plumbum metallicum LM14 : Lactose control #2 LM14	959.8	958.7	330.0	0.0001
Plumbum metallicum LM14 : Lactose control #1 LM14	959.8	958.7	330.0	0.0001
Lactose control #2 LM6 : Lactose control #2 LM22				
Lactose control #2 LM6 : Lactose control #2 LM14				
Lactose control #2 LM14 : Lactose control #2 LM22	958.7	957.5	318.0	0.0001
Lactose control #1 LM6 : Lactose control #2 LM6	959.0	959.0	226.5	0.8195
Lactose control #1 LM6 : Lactose control #1 LM22	959.0	957.4	310.0	0.0014
Lactose control #1 LM6 : Lactose control #1 LM14	959.0	958.7	267.0	0.1584
Lactose control #1 LM22 : Lactose control #2 LM22	957.4	957.5	211.0	0.3837
Lactose control #1 LM14 : Lactose control #2 LM14	958.7	958.7	238.5	0.8194
Lactose control #1 LM14 : Lactose control #1 LM22	958.7	957.4	330.0	0.0001

APPENDIX E.4: OH Test Comparisons

Test Comparison	Test for Normality	P value (Normality)	Equal Variance Test (Levens)	P value (Equal variance)
Stannum metallicum LM6 : Stannum metallicum LM22	Failed	0.0069	Failed	
Stannum metallicum LM6 : Stannum metallicum LM14	Failed	0.0001	Failed	
Stannum metallicum LM6 : Plumbum metallicum LM6	Failed	0.0037	Failed	
Stannum metallicum LM6 : Lactose control #2 LM6	Failed	0.0166	Failed	
Stannum metallicum LM6 : Lactose control #1 LM6	Failed	0.0186	Failed	
Stannum metallicum LM22 : Plumbum metallicum LM22	Failed	0.0002	Failed	
Stannum metallicum LM22 : Lactose control #2 LM22	Failed	0.0002	Failed	
Stannum metallicum LM22 : Lactose control #1 LM22	Failed	0.0002	Failed	
Stannum metallicum LM14 : Stannum metallicum LM22	Failed	0.0001	Failed	
Stannum metallicum LM14 : Plumbum metallicum LM14	Failed	0.0001	Failed	
Stannum metallicum LM14 : Lactose control #2 LM14	Failed	0.0004	Failed	
Stannum metallicum LM14 : Lactose control #1 LM14	Failed	0.0001	Failed	
Plumbum metallicum LM6 : Plumbum metallicum LM22	Failed	0.0001	Failed	
Plumbum metallicum LM6 : Plumbum metallicum LM14	Failed	0.0001	Failed	
Plumbum metallicum LM6 : Lactose control #2 LM6	Failed	0.0101	Failed	
Plumbum metallicum LM6 : Lactose control #1 LM14	Failed	0.0121	Failed	
Plumbum metallicum LM22: Lactose control #2 LM22	Failed	0.0001	Failed	
Plumbum metallicum LM22 : Lactose control #1 LM22	Failed	0.0001	Failed	
Plumbum metallicum LM14 : Plumbum metallicum LM22	Failed	0.0001	Failed	
Plumbum metallicum LM14 : Lactose control #2 LM14	Failed	0.0001	Failed	
Plumbum metallicum LM14 : Lactose control #1 LM14	Failed	0.0001	Failed	
Lactose control #2 LM6 : Lactose control #2 LM22	Passed	0.3478	Passed	0.7827
Lactose control #2 LM6 : Lactose control #2 LM14	Failed	0.047	Failed	
Lactose control #2 LM14 : Lactose control #2 LM22	Failed	0.0001	Failed	
Lactose control #1 LM6 : Lactose control #2 LM6	Failed	0.0001	Failed	
Lactose control #1 LM6 : Lactose control #1 LM22	Passed	0.2247	Passed	0.6132
Lactose control #1 LM6 : Lactose control #1 LM14	Failed	0.0055	Failed	
Lactose control #1 LM22 : Lactose control #2 LM22	Failed	0.0001	Failed	
Lactose control #1 LM14 : Lactose control #2 LM22	Failed	0.0001	Failed	
Lactose control #1 LM14 : Lactose control #2 LM14	Failed	0.0005	Failed	

APPENDIX E.4: OH Test Comparisons

Test Comparison	Mean (Sample 1)	Mean (Sample 2)	Std. Dev. (Sample 1)	Std. Dev. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM22				
Stannum metallicum LM6 : Stannum metallicum LM14				
Stannum metallicum LM6 : Plumbum metallicum LM6				
Stannum metallicum LM6 : Lactose control #2 LM6				
Stannum metallicum LM6 : Lactose control #1 LM6				
Stannum metallicum LM22 : Plumbum metallicum LM22				
Stannum metallicum LM22 : Lactose control #2 LM22				
Stannum metallicum LM22 : Lactose control #1 LM22				
Stannum metallicum LM14 : Stannum metallicum LM22				
Stannum metallicum LM14 : Plumbum metallicum LM14				
Stannum metallicum LM14 : Lactose control #2 LM14				
Stannum metallicum LM14 : Lactose control #1 LM14				
Plumbum metallicum LM6 : Plumbum metallicum LM22				
Plumbum metallicum LM6 : Plumbum metallicum LM14				
Plumbum metallicum LM6 : Lactose control #2 LM6				
Plumbum metallicum LM6 : Lactose control #1 LM14				
Plumbum metallicum LM22: Lactose control #2 LM22				
Plumbum metallicum LM22 : Lactose control #1 LM22				
Plumbum metallicum LM14 : Plumbum metallicum LM22				
Plumbum metallicum LM14 : Lactose control #2 LM14				
Plumbum metallicum LM14 : Lactose control #1 LM14				
Lactose control #2 LM6 : Lactose control #2 LM22	1117.5	1116.4	0.6200	0.7145
Lactose control #2 LM6 : Lactose control #2 LM14				
Lactose control #2 LM14 : Lactose control #2 LM22				
Lactose control #1 LM6 : Lactose control #2 LM6				
Lactose control #1 LM6 : Lactose control #1 LM22	1117.4	1116.3	0.6619	0.6132
Lactose control #1 LM6 : Lactose control #1 LM14				
Lactose control #1 LM22 : Lactose control #2 LM22				
Lactose control #1 LM14 : Lactose control #2 LM22				
Lactose control #1 LM14 : Lactose control #2 LM14				

APPENDIX E.4: OH Test Comparisons

Test Comparison	SEM (Sample 1)	SEM (sample 2)	t-value (t-test)	P value (t-test)	Power of test (t-test)
Stannum metallicum LM6 : Stannum metallicum LM22					
Stannum metallicum LM6 : Stannum metallicum LM14					
Stannum metallicum LM6 : Plumbum metallicum LM6					
Stannum metallicum LM6 : Lactose control #2 LM6					
Stannum metallicum LM6 : Lactose control #1 LM6					
Stannum metallicum LM22 : Plumbum metallicum LM22					
Stannum metallicum LM22 : Lactose control #2 LM22					
Stannum metallicum LM22 : Lactose control #1 LM22					
Stannum metallicum LM14 : Stannum metallicum LM22					
Stannum metallicum LM14 : Plumbum metallicum LM14					
Stannum metallicum LM14 : Lactose control #2 LM14					
Stannum metallicum LM14 : Lactose control #1 LM14					
Plumbum metallicum LM6 : Plumbum metallicum LM22					
Plumbum metallicum LM6 : Plumbum metallicum LM14					
Plumbum metallicum LM6 : Lactose control #2 LM6					
Plumbum metallicum LM6 : Lactose control #1 LM14					
Plumbum metallicum LM22: Lactose control #2 LM22					
Plumbum metallicum LM22 : Lactose control #1 LM22					
Plumbum metallicum LM14 : Plumbum metallicum LM22					
Plumbum metallicum LM14 : Lactose control #2 LM14					
Plumbum metallicum LM14 : Lactose control #1 LM14					
Lactose control #2 LM6 : Lactose control #2 LM22	0.1601	0.1845	4.329	0.0002	0.9899
Lactose control #2 LM6 : Lactose control #2 LM14					
Lactose control #2 LM14 : Lactose control #2 LM22					
Lactose control #1 LM6 : Lactose control #2 LM6					
Lactose control #1 LM6 : Lactose control #1 LM22	0.1709	0.1454	4.941	0.0001	0.9988
Lactose control #1 LM6 : Lactose control #1 LM14					
Lactose control #1 LM22 : Lactose control #2 LM22					
Lactose control #1 LM14 : Lactose control #2 LM22					
Lactose control #1 LM14 : Lactose control #2 LM14					

APPENDIX E.4: OH Test Comparisons

Test Comparison	Median (Sample 1)	Median (Sample 2)	25% C.I. (Sample 1)	25% C.I. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM22	1117.8	1118.0	1117.6	1117.9
Stannum metallicum LM6 : Stannum metallicum LM14	1117.8	1117.9	1117.6	1117.9
Stannum metallicum LM6 : Plumbum metallicum LM6	1117.8	1117.7	1117.6	1117.6
Stannum metallicum LM6 : Lactose control #2 LM6	1117.8	1117.7	1117.6	1116.8
Stannum metallicum LM6 : Lactose control #1 LM6	1117.8	1117.7	1117.6	1116.7
Stannum metallicum LM22 : Plumbum metallicum LM22	1118.0	1118.0	1117.9	1117.9
Stannum metallicum LM22 : Lactose control #2 LM22	1118.0	1116.2	1117.9	1116.1
Stannum metallicum LM22 : Lactose control #1 LM22	1118.0	1116.3	1117.9	1116.1
Stannum metallicum LM14 : Stannum metallicum LM22	1117.9	1118.0	1117.9	1117.9
Stannum metallicum LM14 : Plumbum metallicum LM14	1117.9	1118.7	1117.9	1118.6
Stannum metallicum LM14 : Lactose control #2 LM14	1117.9	1117.4	1117.9	1117.3
Stannum metallicum LM14 : Lactose control #1 LM14	1117.9	1117.6	1117.9	1117.4
Plumbum metallicum LM6 : Plumbum metallicum LM22	1117.7	1118.0	1117.6	1117.9
Plumbum metallicum LM6 : Plumbum metallicum LM14	1117.7	1118.7	1117.6	1118.6
Plumbum metallicum LM6 : Lactose control #2 LM6	1117.7	1117.7	1117.6	1116.8
Plumbum metallicum LM6 : Lactose control #1 LM14	1117.7	1117.7	1117.6	1116.7
Plumbum metallicum LM22: Lactose control #2 LM22	1118.0	1116.2	1117.9	1116.1
Plumbum metallicum LM22 : Lactose control #1 LM22	1118.0	1116.3	1117.9	1116.1
Plumbum metallicum LM14 : Plumbum metallicum LM22	1118.7	1118.0	1118.6	1117.9
Plumbum metallicum LM14 : Lactose control #2 LM14	1118.7	1117.4	1118.6	1117.3
Plumbum metallicum LM14 : Lactose control #1 LM14	1118.7	1117.6	1118.6	1117.4
Lactose control #2 LM6 : Lactose control #2 LM22				
Lactose control #2 LM6 : Lactose control #2 LM14	1117.7	1117.4	1116.8	1117.3
Lactose control #2 LM14 : Lactose control #2 LM22	1117.4	1116.2	1117.3	1116.1
Lactose control #1 LM6 : Lactose control #2 LM6	1117.7	1117.7	1116.7	1116.8
Lactose control #1 LM6 : Lactose control #1 LM22				
Lactose control #1 LM6 : Lactose control #1 LM14	1117.7	1117.6	1116.7	1117.4
Lactose control #1 LM22 : Lactose control #2 LM22	1116.3	1116.2	1116.1	1116.1
Lactose control #1 LM14 : Lactose control #2 LM22	1117.6	1116.3	1117.4	1116.1
Lactose control #1 LM14 : Lactose control #2 LM14	1117.6	1117.4	1117.4	1117.3

APPENDIX E.4: OH Test Comparisons

Test Comparison	75% C.I. (Sample 1)	75% C.I. (Sample 2)	T value (Mann-Whitney)	P value (Mann-Whitney)
Stannum metallicum LM6 : Stannum metallicum LM22	1117.9	1118.0	177.0	0.0225
Stannum metallicum LM6 : Stannum metallicum LM14	1117.9	1118.0	186.5	0.0589
Stannum metallicum LM6 : Plumbum metallicum LM6	1117.9	1117.8	253.5	0.3950
Stannum metallicum LM6 : Lactose control #2 LM6	1117.9	1118.0	242.5	0.6935
Stannum metallicum LM6 : Lactose control #1 LM6	1117.9	1117.9	262.5	0.2210
Stannum metallicum LM22 : Plumbum metallicum LM22	1118.0	1118.1	213.0	0.4305
Stannum metallicum LM22 : Lactose control #2 LM22	1118.0	1116.4	323.5	0.0001
Stannum metallicum LM22 : Lactose control #1 LM22	1118.0	1116.3	334.0	0.0001
Stannum metallicum LM14 : Stannum metallicum LM22	1118.0	1118.0	207.5	0.3089
Stannum metallicum LM14 : Plumbum metallicum LM14	1118.0	1118.7	135.0	0.0001
Stannum metallicum LM14 : Lactose control #2 LM14	1118.0	1117.6	288.0	0.0225
Stannum metallicum LM14 : Lactose control #1 LM14	1118.0	1117.7	319.5	0.0001
Plumbum metallicum LM6 : Plumbum metallicum LM22	1117.8	1118.1	153.5	0.0011
Plumbum metallicum LM6 : Plumbum metallicum LM14	1117.8	1118.7	135.0	0.0001
Plumbum metallicum LM6 : Lactose control #2 LM6	1117.8	1118.0	232.5	0.9835
Plumbum metallicum LM6 : Lactose control #1 LM14	1117.8	1117.9	249.0	0.5068
Plumbum metallicum LM22: Lactose control #2 LM22	1118.1	1116.4	323.0	0.0001
Plumbum metallicum LM22 : Lactose control #1 LM22	1118.1	1116.3	335.0	0.0001
Plumbum metallicum LM14 : Plumbum metallicum LM22	1118.7	1118.1	330.0	0.0001
Plumbum metallicum LM14 : Lactose control #2 LM14	1118.7	1117.6	330.0	0.0001
Plumbum metallicum LM14 : Lactose control #1 LM14	1118.7	1117.7	330.0	0.0001
Lactose control #2 LM6 : Lactose control #2 LM22				
Lactose control #2 LM6 : Lactose control #2 LM14	1118.0	1117.6	247.5	0.5474
Lactose control #2 LM14 : Lactose control #2 LM22	1117.6	1116.4	318.0	0.0001
Lactose control #1 LM6 : Lactose control #2 LM6	1117.9	1118.0	213.0	0.4306
Lactose control #1 LM6 : Lactose control #1 LM22				
Lactose control #1 LM6 : Lactose control #1 LM14	1117.9	1117.7	245.5	0.6041
Lactose control #1 LM22 : Lactose control #2 LM22	1116.3	1116.4	221.5	0.6631
Lactose control #1 LM14 : Lactose control #2 LM22	1117.7	1116.3	330.0	0.0001
Lactose control #1 LM14 : Lactose control #2 LM14	1117.7	1117.6	279.5	0.0536

APPENDIX E.5: Relative Integration CH_3 Test Comparisons

Test Comparison	Test for Normality	P value (Normality)	Equal Variance Test (Levens)	P value (Equal variance)
Stannum metallicum LM6 : Stannum metallicum LM22	Failed	0.0049	Failed	
Stannum metallicum LM6 : Stannum metallicum LM14	Failed	0.0012	Failed	
Stannum metallicum LM6 : Plumbum metallicum LM6	Passed	0.3404	Failed	0.0151
Stannum metallicum LM6 : Lactose control #2 LM6	Passed	0.1648	Passed	0.4606
Stannum metallicum LM6 : Lactose control #1 LM6	Passed	0.1107	Passed	0.4405
Stannum metallicum LM22 : Plumbum metallicum LM22	Failed	0.0011	Failed	
Stannum metallicum LM22 : Lactose control #2 LM14	Passed	0.2386	Passed	0.1023
Stannum metallicum LM22 : Lactose control #1 LM22	Failed	0.0292	Failed	
Stannum metallicum LM14 : Stannum metallicum LM22	Passed	0.1704	Passed	0.5327
Stannum metallicum LM14 : Plumbum metallicum LM14	Failed	0.0001	Failed	
Stannum metallicum LM14 : Lactose control #2 LM6	Passed	0.5027	Passed	0.2590
Stannum metallicum LM14 : Lactose control #1 LM14	Passed	0.0960	Passed	0.7818
Plumbum metallicum LM6 : Plumbum metallicum LM22	Passed	0.4562	Passed	0.5182
Plumbum metallicum LM6 : Plumbum metallicum LM14	Failed	0.0047	Failed	
Plumbum metallicum LM6 : Lactose control #2 LM6	Failed	0.0012	Failed	
Plumbum metallicum LM6 : Lactose control #1 LM6	Passed	0.2589	Passed	0.0532
Plumbum metallicum LM22 : Lactose control #2 LM22	Passed	0.2224	Failed	0.0300
Plumbum metallicum LM22 : Lactose control #2 LM22	Failed	0.0461	Failed	
Plumbum metallicum LM22 : Lactose control #1 LM22	Passed	0.0999	Failed	0.0095
Plumbum metallicum LM14 : Plumbum metallicum LM22	Passed	0.1048	Passed	0.5939
Plumbum metallicum LM14 : Lactose control #2 LM14	Passed	0.3673	Passed	0.0774
Plumbum metallicum LM14 : Lactose control #1 LM14	Passed	0.0998	Passed	0.2761
Lactose control #2 LM6 : Lactose control #2 LM22	Passed	0.1822	Passed	0.2811
Lactose control #2 LM6 : Lactose control #2 LM14	Failed	0.0001	Failed	
Lactose control #2 LM14 : Lactose control #2 LM22	Passed	0.2870	Failed	0.0003
Lactose control #1 LM6 : Lactose control #2 LM6	Passed	0.0561	Passed	0.9854
Lactose control #1 LM6 : Lactose control #1 LM22	Passed	0.4033	Passed	0.1855
Lactose control #1 LM6 : Lactose control #1 LM14	Failed	0.0068	Failed	
Lactose control #1 LM14 : Lactose control #2 LM14	Passed	0.4360	Passed	0.2646
Lactose control #1 LM14 : Lactose control #1 LM22	Passed	0.2362	Failed	0.0002

APPENDIX E.5: Relative Integration CH_3 Test Comparisons

Test Comparison	Mean (Sample 1)	Mean (Sample 2)	Std. Dev. (Sample 1)	Std. Dev. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM22				
Stannum metallicum LM6 : Stannum metallicum LM14				
Stannum metallicum LM6 : Plumbum metallicum LM6				
Stannum metallicum LM6 : Lactose control #2 LM6	0.45	0.46	0.0228	0.0202
Stannum metallicum LM6 : Lactose control #1 LM6	0.45	0.47	0.0228	0.0186
Stannum metallicum LM22 : Plumbum metallicum LM22				
Stannum metallicum LM22 : Lactose control #2 LM14	0.43	0.42	0.0064	0.0035
Stannum metallicum LM22 : Lactose control #1 LM22				
Stannum metallicum LM14 : Stannum metallicum LM22	0.43	0.43	0.0054	0.0064
Stannum metallicum LM14 : Plumbum metallicum LM14				
Stannum metallicum LM14 : Lactose control #2 LM6	0.43	0.42	0.0054	0.0035
Stannum metallicum LM14 : Lactose control #1 LM14	0.43	0.43	0.0054	0.0046
Plumbum metallicum LM6 : Plumbum metallicum LM22	0.44	0.43	0.0086	0.0060
Plumbum metallicum LM6 : Plumbum metallicum LM14				
Plumbum metallicum LM6 : Lactose control #2 LM6				
Plumbum metallicum LM6 : Lactose control #1 LM6	0.44	0.47	0.0086	0.0186
Plumbum metallicum LM22 : Lactose control #2 LM22				
Plumbum metallicum LM22 : Lactose control #2 LM22				
Plumbum metallicum LM22 : Lactose control #1 LM22				
Plumbum metallicum LM14 : Plumbum metallicum LM22	0.43	0.43	0.0076	0.0060
Plumbum metallicum LM14 : Lactose control #2 LM14	0.43	0.43	0.0076	0.0035
Plumbum metallicum LM14 : Lactose control #1 LM14	0.43	0.43	0.0076	0.0046
Lactose control #2 LM6 : Lactose control #2 LM22	0.46	0.43	0.0202	0.0105
Lactose control #2 LM6 : Lactose control #2 LM14				
Lactose control #2 LM14 : Lactose control #2 LM22				
Lactose control #1 LM6 : Lactose control #2 LM6	0.47	0.46	0.0186	0.2017
Lactose control #1 LM6 : Lactose control #1 LM22	0.47	0.44	0.0186	0.0097
Lactose control #1 LM6 : Lactose control #1 LM14				
Lactose control #1 LM14 : Lactose control #2 LM14	0.43	0.43	0.0046	0.0035
Lactose control #1 LM14 : Lactose control #1 LM22				

APPENDIX E.5: Relative Integration CH_3 Test Comparisons

Test Comparison	SEM (Sample 1)	SEM (sample 2)	t-value (t-test)	P value (t-test)	Power of test (t-test)
Stannum metallicum LM6 : Stannum metallicum LM22					
Stannum metallicum LM6 : Stannum metallicum LM14					
Stannum metallicum LM6 : Plumbum metallicum LM6					
Stannum metallicum LM6 : Lactose control #2 LM6	0.0059	0.0052	-1.5910	0.1229	0.0500
Stannum metallicum LM6 : Lactose control #1 LM6	0.0059	0.0048	-2.6810	0.0122	0.6740
Stannum metallicum LM22 : Plumbum metallicum LM22					
Stannum metallicum LM22 : Lactose control #2 LM14	0.0017	0.0009	3.1430	0.0039	0.8348
Stannum metallicum LM22 : Lactose control #1 LM22					
Stannum metallicum LM14 : Stannum metallicum LM22	0.0014	0.0017	-1.4570	0.1562	0.1648
Stannum metallicum LM14 : Plumbum metallicum LM14					
Stannum metallicum LM14 : Lactose control #2 LM6	0.0014	0.0009	1.6630	0.1076	0.2354
Stannum metallicum LM14 : Lactose control #1 LM14	0.0014	0.0012	0.0156	0.9876	0.0500
Plumbum metallicum LM6 : Plumbum metallicum LM22	0.0022	0.0016	4.6450	0.0001	0.9964
Plumbum metallicum LM6 : Plumbum metallicum LM14					
Plumbum metallicum LM6 : Lactose control #2 LM6					
Plumbum metallicum LM6 : Lactose control #1 LM6	0.0022	0.0048	-5.6530	0.0001	0.9999
Plumbum metallicum LM22 : Lactose control #2 LM22					
Plumbum metallicum LM22 : Lactose control #2 LM22					
Plumbum metallicum LM22 : Lactose control #1 LM22					
Plumbum metallicum LM14 : Plumbum metallicum LM22	0.0020	0.0016	0.5674	0.5749	0.0500
Plumbum metallicum LM14 : Lactose control #2 LM14	0.0020	0.0009	2.5680	0.0159	0.6267
Plumbum metallicum LM14 : Lactose control #1 LM14	0.0020	0.0012	1.2210	0.2322	0.0978
Lactose control #2 LM6 : Lactose control #2 LM22	0.0052	0.0027	4.8070	0.0001	0.9979
Lactose control #2 LM6 : Lactose control #2 LM14					
Lactose control #2 LM14 : Lactose control #2 LM22					
Lactose control #1 LM6 : Lactose control #2 LM6	0.0048	0.0052	1.1090	0.2767	0.0711
Lactose control #1 LM6 : Lactose control #1 LM22	0.0048	0.0025	5.9940	0.0001	1.0000
Lactose control #1 LM6 : Lactose control #1 LM14					
Lactose control #1 LM14 : Lactose control #2 LM14	0.0012	0.0009	1.8450	0.0756	0.3071
Lactose control #1 LM14 : Lactose control #1 LM22					

APPENDIX E.5: Relative Integration CH_3 Test Comparisons

Test Comparison	Median (Sample 1)	Median (Sample 2)	25% C.I. (Sample 1)	25% C.I. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM22	0.44	0.43	0.43	0.42
Stannum metallicum LM6 : Stannum metallicum LM14	0.44	0.43	0.43	0.43
Stannum metallicum LM6 : Plumbum metallicum LM6	0.44	0.44	0.43	0.44
Stannum metallicum LM6 : Lactose control #2 LM6				
Stannum metallicum LM6 : Lactose control #1 LM6				
Stannum metallicum LM22 : Plumbum metallicum LM22	0.43	0.43	0.42	0.42
Stannum metallicum LM22 : Lactose control #2 LM14				
Stannum metallicum LM22 : Lactose control #1 LM22	0.43	0.44	0.42	0.43
Stannum metallicum LM14 : Stannum metallicum LM22				
Stannum metallicum LM14 : Plumbum metallicum LM14	0.43	0.43	0.43	0.42
Stannum metallicum LM14 : Lactose control #2 LM6				
Stannum metallicum LM14 : Lactose control #1 LM14				
Plumbum metallicum LM6 : Plumbum metallicum LM22				
Plumbum metallicum LM6 : Plumbum metallicum LM14	0.44	0.43	0.44	0.42
Plumbum metallicum LM6 : Lactose control #2 LM6	0.44	0.46	0.44	0.46
Plumbum metallicum LM6 : Lactose control #1 LM6				
Plumbum metallicum LM22 : Lactose control #2 LM22	0.43	0.44	0.42	0.43
Plumbum metallicum LM22 : Lactose control #2 LM22	0.44	0.44	0.43	0.43
Plumbum metallicum LM22 : Lactose control #1 LM22	0.43	0.44	0.42	0.43
Plumbum metallicum LM14 : Plumbum metallicum LM22				
Plumbum metallicum LM14 : Lactose control #2 LM14				
Plumbum metallicum LM14 : Lactose control #1 LM14				
Lactose control #2 LM6 : Lactose control #2 LM22				
Lactose control #2 LM6 : Lactose control #2 LM14	0.46	0.42	0.46	0.42
Lactose control #2 LM14 : Lactose control #2 LM22	0.42	0.44	0.42	0.43
Lactose control #1 LM6 : Lactose control #2 LM6				
Lactose control #1 LM6 : Lactose control #1 LM22				
Lactose control #1 LM6 : Lactose control #1 LM14	0.47	0.43	0.46	0.42
Lactose control #1 LM14 : Lactose control #2 LM14				
Lactose control #1 LM14 : Lactose control #1 LM22	0.43	0.44	0.42	0.43

APPENDIX E.5: Relative Integration CH_3 Test Comparisons

Test Comparison	75% C.I. (Sample 1)	75% C.I. (Sample 2)	T value (Mann-Whitney)	P value (Mann-Whitney)
Stannum metallicum LM6 : Stannum metallicum LM22	0.47	0.44	305.0	0.0028
Stannum metallicum LM6 : Stannum metallicum LM14	0.47	0.43	315.0	0.0001
Stannum metallicum LM6 : Plumbum metallicum LM6	0.47	0.45	249.0	0.5069
Stannum metallicum LM6 : Lactose control #2 LM6				
Stannum metallicum LM6 : Lactose control #1 LM6				
Stannum metallicum LM22 : Plumbum metallicum LM22	0.44	0.43	259.0	0.2808
Stannum metallicum LM22 : Lactose control #2 LM14				
Stannum metallicum LM22 : Lactose control #1 LM22	0.44	0.45	175.0	0.0181
Stannum metallicum LM14 : Stannum metallicum LM22				
Stannum metallicum LM14 : Plumbum metallicum LM14	0.43	0.43	181.0	0.0344
Stannum metallicum LM14 : Lactose control #2 LM6				
Stannum metallicum LM14 : Lactose control #1 LM14				
Plumbum metallicum LM6 : Plumbum metallicum LM22				
Plumbum metallicum LM6 : Plumbum metallicum LM14	0.45	0.43	315.0	0.0001
Plumbum metallicum LM6 : Lactose control #2 LM6	0.45	0.47	148.0	0.0001
Plumbum metallicum LM6 : Lactose control #1 LM6				
Plumbum metallicum LM22 : Lactose control #2 LM22	0.43	0.45	187.0	0.0620
Plumbum metallicum LM22 : Lactose control #2 LM22	0.45	0.45	251.5	0.4429
Plumbum metallicum LM22 : Lactose control #1 LM22	0.42	0.45	162.0	0.0037
Plumbum metallicum LM14 : Plumbum metallicum LM22				
Plumbum metallicum LM14 : Lactose control #2 LM14				
Plumbum metallicum LM14 : Lactose control #1 LM14				
Lactose control #2 LM6 : Lactose control #2 LM22				
Lactose control #2 LM6 : Lactose control #2 LM14	0.47	0.43	329.0	0.0001
Lactose control #2 LM14 : Lactose control #2 LM22	0.43	0.45	161.0	0.0032
Lactose control #1 LM6 : Lactose control #2 LM6				
Lactose control #1 LM6 : Lactose control #1 LM22				
Lactose control #1 LM6 : Lactose control #1 LM14	0.48	0.43	334.0	0.0001
Lactose control #1 LM14 : Lactose control #2 LM14				
Lactose control #1 LM14 : Lactose control #1 LM22	0.43	0.45	159.0	0.0025

APPENDIX E.6: Relative Integration CH_2 Test Comparisons

Test Comparison	Test for Normality	P value (Normality)	Equal Variance Test (Levens)	P value (Equal variance)
Stannum metallicum LM6 : Stannum metallicum LM22	Failed	0.0031	Failed	
Stannum metallicum LM6 : Stannum metallicum LM14	Failed	0.0008	Failed	
Stannum metallicum LM6 : Plumbum metallicum LM6	Failed	0.0022	Failed	
Stannum metallicum LM6 : Lactose control #2 LM6	Failed	0.0007	Failed	
Stannum metallicum LM6 : Lactose control #1 LM6	Failed	0.0009	Failed	
Stannum metallicum LM22: Plumbum metallicum LM22	Failed	0.0213	Failed	
Stannum metallicum LM22 : Lactose control #2 LM22	Passed	0.5550	Passed	0.2728
Stannum metallicum LM22 : Lactose control #1 LM22	Passed	0.1228	Passed	0.2669
Stannum metallicum LM14: Plumbum metallicum LM14	Failed	0.0003	Failed	
Stannum metallicum LM14: Lactose control #1 LM14	Failed	0.0104	Failed	
Stannum metallicum LM14 : Stannum metallicum LM22	Passed	0.1288	Passed	0.4095
Stannum metallicum LM14 : Lactose control #2 LM14	Passed	0.0975	Failed	0.9105
Plumbum metallicum LM6 : Plumbum metallicum LM22	Passed	0.6679	Passed	0.5538
Plumbum metallicum LM6 : Plumbum metallicum LM14	Failed	0.0013	Failed	
Plumbum metallicum LM6 : Lactose control #2 LM6	Failed	0.0001	Failed	
Plumbum metallicum LM6 : Lactose control #1 LM6	Failed	0.0005	Failed	
Plumbum metallicum LM22: Lactose control #2 LM22	Passed	0.7213	Passed	0.1510
Plumbum metallicum LM22 : Lactose control #1 LM22	Passed	0.1069	Passed	0.1169
Plumbum metallicum LM14 : Plumbum metallicum LM22	Passed	0.3719	Passed	0.5081
Plumbum metallicum LM14 : Lactose control #2 LM14	Passed	0.1628	Passed	0.2003
Plumbum metallicum LM14 : Lactose control #1 LM14	Passed	0.0651	Passed	0.3468
Lactose control #2 LM6 : Lactose control #2 LM22	Failed	0.0051	Failed	
Lactose control #2 LM6 : Lactose control #2 LM14	Failed	0.0257	Failed	
Lactose control #1 LM6 : Lactose control #2 LM6	Failed	0.0004	Failed	
Lactose control #1 LM6 : Lactose control #1 LM22	Passed	0.2514	Passed	0.4038
Lactose control #1 LM6 : Lactose control #1 LM14	Failed	0.0065	Failed	
Lactose control #1 LM22 : Lactose control #2 LM22	Passed	0.6417	Passed	0.7579
Lactose control #1 LM14 : Lactose control #2 LM14	Passed	0.5271	Passed	0.7559
Lactose control #1 LM14 : Lactose control #1 LM22	Failed	0.6177	Passed	0.0587
Lactose control #2 LM14 : Lactose control #2 LM22	Passed	0.7711	Failed	0.0500

APPENDIX E.6: Relative Integration CH_2 Test Comparisons

Test Comparison	Mean (Sample 1)	Mean (Sample 2)	Std. Dev. (Sample 1)	Std. Dev. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM22				
Stannum metallicum LM6 : Stannum metallicum LM14				
Stannum metallicum LM6 : Plumbum metallicum LM6				
Stannum metallicum LM6 : Lactose control #2 LM6				
Stannum metallicum LM6 : Lactose control #1 LM6				
Stannum metallicum LM22: Plumbum metallicum LM22				
Stannum metallicum LM22 : Lactose control #2 LM22	0.348	0.350	0.0018	0.0028
Stannum metallicum LM22 : Lactose control #1 LM22	0.348	0.351	0.0018	0.0023
Stannum metallicum LM14: Plumbum metallicum LM14				
Stannum metallicum LM14: Lactose control #1 LM14				
Stannum metallicum LM14 : Stannum metallicum LM22	0.346	0.348	0.0018	0.0018
Stannum metallicum LM14 : Lactose control #2 LM14	0.346	0.346	0.0018	0.0014
Plumbum metallicum LM6 : Plumbum metallicum LM22	0.348	0.347	0.0016	0.0017
Plumbum metallicum LM6 : Plumbum metallicum LM14				
Plumbum metallicum LM6 : Lactose control #2 LM6				
Plumbum metallicum LM6 : Lactose control #1 LM6				
Plumbum metallicum LM22: Lactose control #2 LM22	0.347	0.350	0.0017	0.0028
Plumbum metallicum LM22 : Lactose control #1 LM22	0.347	0.351	0.0017	0.0023
Plumbum metallicum LM14 : Plumbum metallicum LM22	0.347	0.347	0.0021	0.0017
Plumbum metallicum LM14 : Lactose control #2 LM14	0.347	0.346	0.0021	0.0014
Plumbum metallicum LM14 : Lactose control #1 LM14	0.347	0.347	0.0021	0.0016
Lactose control #2 LM6 : Lactose control #2 LM22				
Lactose control #2 LM6 : Lactose control #2 LM14				
Lactose control #1 LM6 : Lactose control #2 LM6				
Lactose control #1 LM6 : Lactose control #1 LM22	0.346	0.351	0.0040	0.0023
Lactose control #1 LM6 : Lactose control #1 LM14				
Lactose control #1 LM22 : Lactose control #2 LM22	0.351	0.350	0.0023	0.0028
Lactose control #1 LM14 : Lactose control #2 LM14	0.347	0.346	0.0016	0.0014
Lactose control #1 LM14 : Lactose control #1 LM22	0.347	0.351	0.0016	0.0023
Lactose control #2 LM14 : Lactose control #2 LM22				

APPENDIX E.6: Relative Integration CH_2 Test Comparisons

Test Comparison	SEM (Sample 1)	SEM (sample 2)	t-value (t-test)	P value (t-test)	Power of test (t-test)
Stannum metallicum LM6 : Stannum metallicum LM22					
Stannum metallicum LM6 : Stannum metallicum LM14					
Stannum metallicum LM6 : Plumbum metallicum LM6					
Stannum metallicum LM6 : Lactose control #2 LM6					
Stannum metallicum LM6 : Lactose control #1 LM6					
Stannum metallicum LM22: Plumbum metallicum LM22					
Stannum metallicum LM22 : Lactose control #2 LM22	0.0005	0.0007	-2.1970	0.0364	0.4612
Stannum metallicum LM22 : Lactose control #1 LM22	0.0005	0.0006	-4.1080	0.0003	0.9808
Stannum metallicum LM14: Plumbum metallicum LM14					
Stannum metallicum LM14: Lactose control #1 LM14					
Stannum metallicum LM14 : Stannum metallicum LM22	0.0005	0.0005	-2.4780	0.0195	0.5875
Stannum metallicum LM14 : Lactose control #2 LM14	0.0005	0.0004	0.1535	0.8791	0.0500
Plumbum metallicum LM6 : Plumbum metallicum LM22	0.0004	0.0004	1.9950	0.0559	0.3708
Plumbum metallicum LM6 : Plumbum metallicum LM14					
Plumbum metallicum LM6 : Lactose control #2 LM6					
Plumbum metallicum LM6 : Lactose control #1 LM6					
Plumbum metallicum LM22: Lactose control #2 LM22	0.0004	0.0007	-3.2280	0.0032	0.8577
Plumbum metallicum LM22 : Lactose control #1 LM22	0.0004	0.0006	-5.3650	0.0001	0.9998
Plumbum metallicum LM14 : Plumbum metallicum LM22	0.0005	0.0004	-0.2391	0.8127	0.0500
Plumbum metallicum LM14 : Lactose control #2 LM14	0.0005	0.0004	1.1410	0.2636	0.0783
Plumbum metallicum LM14 : Lactose control #1 LM14	0.0005	0.0004	-0.5205	0.6068	0.0500
Lactose control #2 LM6 : Lactose control #2 LM22					
Lactose control #2 LM6 : Lactose control #2 LM14					
Lactose control #1 LM6 : Lactose control #2 LM6					
Lactose control #1 LM6 : Lactose control #1 LM22	0.0010	0.0006	-3.9070	0.0005	0.9672
Lactose control #1 LM6 : Lactose control #1 LM14					
Lactose control #1 LM22 : Lactose control #2 LM22	0.0006	0.0007	1.3120	0.2002	0.1218
Lactose control #1 LM14 : Lactose control #2 LM14	0.0004	0.0004	2.0200	0.0530	0.3818
Lactose control #1 LM14 : Lactose control #1 LM22	0.0004	0.0006	-0.0037	0.0001	0.9995
Lactose control #2 LM14 : Lactose control #2 LM22					

APPENDIX E.6: Relative Integration CH_2 Test Comparisons

Test Comparison	Median (Sample 1)	Median (Sample 2)	25% C.I. (Sample 1)	25% C.I. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM22	0.350	0.347	0.348	0.346
Stannum metallicum LM6 : Stannum metallicum LM14	0.350	0.347	0.348	0.346
Stannum metallicum LM6 : Plumbum metallicum LM6	0.350	0.349	0.348	0.348
Stannum metallicum LM6 : Lactose control #2 LM6	0.350	0.347	0.348	0.345
Stannum metallicum LM6 : Lactose control #1 LM6	0.350	0.347	0.348	0.346
Stannum metallicum LM22: Plumbum metallicum LM22	0.347	0.346	0.346	0.346
Stannum metallicum LM22 : Lactose control #2 LM22				
Stannum metallicum LM22 : Lactose control #1 LM22				
Stannum metallicum LM14: Plumbum metallicum LM14	0.347	0.348	0.346	0.345
Stannum metallicum LM14: Lactose control #1 LM14	0.347	0.347	0.346	0.346
Stannum metallicum LM14 : Stannum metallicum LM22				
Stannum metallicum LM14 : Lactose control #2 LM14				
Plumbum metallicum LM6 : Plumbum metallicum LM22				
Plumbum metallicum LM6 : Plumbum metallicum LM14	0.349	0.348	0.348	0.345
Plumbum metallicum LM6 : Lactose control #2 LM6	0.349	0.347	0.348	0.345
Plumbum metallicum LM6 : Lactose control #1 LM6	0.349	0.347	0.348	0.346
Plumbum metallicum LM22: Lactose control #2 LM22				
Plumbum metallicum LM22 : Lactose control #1 LM22				
Plumbum metallicum LM14 : Plumbum metallicum LM22				
Plumbum metallicum LM14 : Lactose control #2 LM14				
Plumbum metallicum LM14 : Lactose control #1 LM14				
Lactose control #2 LM6 : Lactose control #2 LM22	0.347	0.350	0.345	0.350
Lactose control #2 LM6 : Lactose control #2 LM14	0.347	0.346	0.345	0.345
Lactose control #1 LM6 : Lactose control #2 LM6	0.347	0.347	0.346	0.345
Lactose control #1 LM6 : Lactose control #1 LM22				
Lactose control #1 LM6 : Lactose control #1 LM14	0.347	0.347	0.346	0.346
Lactose control #1 LM22 : Lactose control #2 LM22				
Lactose control #1 LM14 : Lactose control #2 LM14				
Lactose control #1 LM14 : Lactose control #1 LM22				
Lactose control #2 LM14 : Lactose control #2 LM22	0.346	0.350	0.345	0.348

APPENDIX E.6: Relative Integration CH_2 Test Comparisons

Test Comparison	75% C.I. (Sample 1)	75% C.I. (Sample 2)	T value (Mann-Whitney)	P value (Mann-Whitney)
Stannum metallicum LM6 : Stannum metallicum LM22	0.352	0.350	275.0	0.0815
Stannum metallicum LM6 : Stannum metallicum LM14	0.352	0.347	305.0	0.0028
Stannum metallicum LM6 : Plumbum metallicum LM6	0.352	0.349	277.0	0.0680
Stannum metallicum LM6 : Lactose control #2 LM6	0.352	0.347	294.0	0.0114
Stannum metallicum LM6 : Lactose control #1 LM6	0.352	0.349	287.0	0.0251
Stannum metallicum LM22: Plumbum metallicum LM22	0.350	0.349	265.5	0.1776
Stannum metallicum LM22 : Lactose control #2 LM22				
Stannum metallicum LM22 : Lactose control #1 LM22				
Stannum metallicum LM14: Plumbum metallicum LM14	0.347	0.348	194.0	0.1150
Stannum metallicum LM14: Lactose control #1 LM14	0.347	0.348	202.0	0.2134
Stannum metallicum LM14 : Stannum metallicum LM22				
Stannum metallicum LM14 : Lactose control #2 LM14				
Plumbum metallicum LM6 : Plumbum metallicum LM22				
Plumbum metallicum LM6 : Plumbum metallicum LM14	0.349	0.348	281.5	0.0443
Plumbum metallicum LM6 : Lactose control #2 LM6	0.349	0.347	282.5	0.0401
Plumbum metallicum LM6 : Lactose control #1 LM6	0.349	0.349	270.0	0.1249
Plumbum metallicum LM22: Lactose control #2 LM22				
Plumbum metallicum LM22 : Lactose control #1 LM22				
Plumbum metallicum LM14 : Plumbum metallicum LM22				
Plumbum metallicum LM14 : Lactose control #2 LM14				
Plumbum metallicum LM14 : Lactose control #1 LM14				
Lactose control #2 LM6 : Lactose control #2 LM22	0.347	0.352	167.0	0.0070
Lactose control #2 LM6 : Lactose control #2 LM14	0.347	0.347	245.5	0.6041
Lactose control #1 LM6 : Lactose control #2 LM6	0.349	0.347	247.5	0.5475
Lactose control #1 LM6 : Lactose control #1 LM22				
Lactose control #1 LM6 : Lactose control #1 LM14	0.349	0.348	232.0	1.0000
Lactose control #1 LM22 : Lactose control #2 LM22				
Lactose control #1 LM14 : Lactose control #2 LM14				
Lactose control #1 LM14 : Lactose control #1 LM22				
Lactose control #2 LM14 : Lactose control #2 LM22	0.347	0.352	153.0	0.0010

APPENDIX E.7: Relative Integration H_2O Test Comparisons

Test Comparison	Test for Normality	P value (Normality)	Equal Variance Test (Levens)	P value (Equal variance)
Stannum metallicum LM6 : Stannum metallicum LM14	Passed	0.1014	Failed	0.0087
Stannum metallicum LM6 : Stannum metallicum LM22	Passed	0.0502	Failed	0.0127
Stannum metallicum LM6 : Plumbum metallicum LM6	Passed	0.0673	Failed	0.0048
Stannum metallicum LM6 : Lactose control #1 LM6	Passed	0.6089	Passed	0.0649
Stannum metallicum LM6 : Lactose control #2 LM6	Passed	0.3989	Passed	0.1950
Stannum metallicum LM14 : Stannum metallicum LM22	Passed	0.4199	Passed	0.6426
Stannum metallicum LM14 : Plumbum metallicum LM14	Failed	0.0001	Failed	
Stannum metallicum LM14 : Lactose control #1 LM14	Failed	0.0479	Failed	
Stannum metallicum LM14 : Lactose control #2 LM14	Passed	0.3077	Passed	0.4072
Stannum metallicum LM22 : Plumbum metallicum LM22	Failed	0.0077	Failed	
Stannum metallicum LM22 : Lactose control #1 LM22	Passed	0.0592	Passed	0.0825
Stannum metallicum LM22 : Lactose control #2 LM22	Passed	0.4354	Passed	0.0712
Plumbum metallicum LM6 : Plumbum metallicum LM14	Failed	0.0002	Failed	
Plumbum metallicum LM6 : Plumbum metallicum LM22	Passed	0.4099	Passed	0.4985
Plumbum metallicum LM6 : Lactose control #1 LM6	Passed	0.087	Passed	0.0845
Plumbum metallicum LM6 : Lactose control #2 LM6	Failed	0.008	Failed	
Plumbum metallicum LM14 : Plumbum metallicum LM22	Passed	0.1242	Passed	0.5602
Plumbum metallicum LM14 : Lactose control #1 LM14	Passed	0.1273	Passed	0.2947
Plumbum metallicum LM14 : Lactose control #2 LM14	Passed	0.3386	Passed	0.1319
Plumbum metallicum LM22 : Lactose control #1 LM22	Passed	0.1689	Failed	0.0417
Plumbum metallicum LM22 : Lactose control #2 LM22	Passed	0.3855	Failed	0.0417
Lactose control #1 LM6 : Lactose control #1 LM14	Passed	0.795	Passed	0.0574
Lactose control #1 LM6 : Lactose control #1 LM22	Failed	0.0267	Failed	
Lactose control #1 LM6 : Lactose control #2 LM6	Passed	0.5791	Passed	0.5993
Lactose control #1 LM14 : Lactose control #1 LM22	Passed	0.4366	Failed	0.0090
Lactose control #1 LM14 : Lactose control #2 LM14	Passed	0.3278	Passed	0.5073
Lactose control #1 LM22 : Lactose control #2 LM22	Passed	0.0837	Passed	0.6913
Lactose control #2 LM6 : Lactose control #2 LM14	Passed	0.1296	Failed	0.0164
Lactose control #2 LM6 : Lactose control #2 LM22	Passed	0.2331	Passed	0.0875
Lactose control #2 LM14 : Lactose control #2 LM22	Passed	0.6397	Failed	0.0023

APPENDIX E.7: Relative Integration H_2O Test Comparisons

Test Comparison	Mean (Sample 1)	Mean (Sample 2)	Std. Dev. (Sample 1)	Std. Dev. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM14				
Stannum metallicum LM6 : Stannum metallicum LM22				
Stannum metallicum LM6 : Plumbum metallicum LM6				
Stannum metallicum LM6 : Lactose control #1 LM6	0.061	0.059	0.0109	0.0061
Stannum metallicum LM6 : Lactose control #2 LM6	0.061	0.062	0.0109	0.0076
Stannum metallicum LM14 : Stannum metallicum LM22	0.073	0.070	0.0043	0.0046
Stannum metallicum LM14 : Plumbum metallicum LM14				
Stannum metallicum LM14 : Lactose control #1 LM14				
Stannum metallicum LM14 : Lactose control #2 LM14	0.073	0.074	0.0043	0.0029
Stannum metallicum LM22 : Plumbum metallicum LM22				
Stannum metallicum LM22 : Lactose control #1 LM22	0.070	0.064	0.0046	0.0063
Stannum metallicum LM22 : Lactose control #2 LM22	0.070	0.067	0.0046	0.0073
Plumbum metallicum LM6 : Plumbum metallicum LM14				
Plumbum metallicum LM6 : Plumbum metallicum LM22	0.066	0.072	0.0044	0.0043
Plumbum metallicum LM6 : Lactose control #1 LM6	0.066	0.059	0.0044	0.0061
Plumbum metallicum LM6 : Lactose control #2 LM6				
Plumbum metallicum LM14 : Plumbum metallicum LM22	0.072	0.072	0.0056	0.0043
Plumbum metallicum LM14 : Lactose control #1 LM14	0.072	0.072	0.0056	0.0038
Plumbum metallicum LM14 : Lactose control #2 LM14	0.072	0.074	0.0056	0.0029
Plumbum metallicum LM22 : Lactose control #1 LM22				
Plumbum metallicum LM22 : Lactose control #2 LM22				
Lactose control #1 LM6 : Lactose control #1 LM14	0.059	0.072	0.0061	0.0038
Lactose control #1 LM6 : Lactose control #1 LM22				
Lactose control #1 LM6 : Lactose control #2 LM6	0.059	0.062	0.0061	0.0076
Lactose control #1 LM14 : Lactose control #1 LM22				
Lactose control #1 LM14 : Lactose control #2 LM14	0.072	0.074	0.0038	0.0029
Lactose control #1 LM22 : Lactose control #2 LM22	0.064	0.067	0.0063	0.0073
Lactose control #2 LM6 : Lactose control #2 LM14				
Lactose control #2 LM6 : Lactose control #2 LM22	0.062	0.067	0.0076	0.0073
Lactose control #2 LM14 : Lactose control #2 LM22				

APPENDIX E.7: Relative Integration H_2O Test Comparisons

Test Comparison	SEM (Sample 1)	SEM (sample 2)	t-value (t-test)	P value (t-test)	Power of test (t-test)
Stannum metallicum LM6 : Stannum metallicum LM14					
Stannum metallicum LM6 : Stannum metallicum LM22					
Stannum metallicum LM6 : Plumbum metallicum LM6					
Stannum metallicum LM6 : Lactose control #1 LM6	0.0028	0.0016	0.433	0.6683	0.0500
Stannum metallicum LM6 : Lactose control #2 LM6	0.0028	0.0020	-0.437	0.6652	0.0500
Stannum metallicum LM14 : Stannum metallicum LM22	0.0011	0.0012	1.793	0.0838	0.2859
Stannum metallicum LM14 : Plumbum metallicum LM14					
Stannum metallicum LM14 : Lactose control #1 LM14					
Stannum metallicum LM14 : Lactose control #2 LM14	0.0011	0.0008	-0.928	0.3612	0.0500
Stannum metallicum LM22 : Plumbum metallicum LM22					
Stannum metallicum LM22 : Lactose control #1 LM22	0.0012	0.0016	3.180	0.0036	0.8450
Stannum metallicum LM22 : Lactose control #2 LM22	0.0012	0.0019	1.612	0.1183	0.2169
Plumbum metallicum LM6 : Plumbum metallicum LM14					
Plumbum metallicum LM6 : Plumbum metallicum LM22	0.0011	0.0011	-3.792	0.0007	0.9563
Plumbum metallicum LM6 : Lactose control #1 LM6	0.0011	0.0016	3.362	0.0023	0.8891
Plumbum metallicum LM6 : Lactose control #2 LM6					
Plumbum metallicum LM14 : Plumbum metallicum LM22	0.0015	0.0011	-0.154	0.8789	0.0500
Plumbum metallicum LM14 : Lactose control #1 LM14	0.0015	0.0010	-0.060	0.9529	0.0500
Plumbum metallicum LM14 : Lactose control #2 LM14	0.0015	0.0008	-1.817	0.0799	0.2956
Plumbum metallicum LM22 : Lactose control #1 LM22					
Plumbum metallicum LM22 : Lactose control #2 LM22					
Lactose control #1 LM6 : Lactose control #1 LM14	0.0016	0.0010	-6.636	0.0001	1.0000
Lactose control #1 LM6 : Lactose control #1 LM22					
Lactose control #1 LM6 : Lactose control #2 LM6	0.0016	0.0020	-1.148	0.2606	0.2606
Lactose control #1 LM14 : Lactose control #1 LM22					
Lactose control #1 LM14 : Lactose control #2 LM14	0.0010	0.0008	-2.309	0.0285	0.5118
Lactose control #1 LM22 : Lactose control #2 LM22	0.0016	0.0019	-1.139	0.2644	0.0779
Lactose control #2 LM6 : Lactose control #2 LM14					
Lactose control #2 LM6 : Lactose control #2 LM22	0.0020	0.0019	-1.687	0.1026	0.2448
Lactose control #2 LM14 : Lactose control #2 LM22					

APPENDIX E.7: Relative Integration H_2O Test Comparisons

Test Comparison	Median (Sample 1)	Median (Sample 2)	25% C.I. (Sample 1)	25% C.I. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM14	0.062	0.071	0.050	0.070
Stannum metallicum LM6 : Stannum metallicum LM22	0.062	0.072	0.050	0.066
Stannum metallicum LM6 : Plumbum metallicum LM6	0.062	0.065	0.050	0.063
Stannum metallicum LM6 : Lactose control #1 LM6				
Stannum metallicum LM6 : Lactose control #2 LM6				
Stannum metallicum LM14 : Stannum metallicum LM22				
Stannum metallicum LM14 : Plumbum metallicum LM14	0.071	0.069	0.070	0.068
Stannum metallicum LM14 : Lactose control #1 LM14	0.071	0.071	0.070	0.069
Stannum metallicum LM14 : Lactose control #2 LM14				
Stannum metallicum LM22 : Plumbum metallicum LM22	0.072	0.017	0.066	0.069
Stannum metallicum LM22 : Lactose control #1 LM22				
Stannum metallicum LM22 : Lactose control #2 LM22				
Plumbum metallicum LM6 : Plumbum metallicum LM14	0.065	0.069	0.063	0.068
Plumbum metallicum LM6 : Plumbum metallicum LM22				
Plumbum metallicum LM6 : Lactose control #1 LM6				
Plumbum metallicum LM6 : Lactose control #2 LM6	0.065	0.061	0.063	0.056
Plumbum metallicum LM14 : Plumbum metallicum LM22				
Plumbum metallicum LM14 : Lactose control #1 LM14				
Plumbum metallicum LM14 : Lactose control #2 LM14				
Plumbum metallicum LM22 : Lactose control #1 LM22	0.073	0.063	0.069	0.059
Plumbum metallicum LM22 : Lactose control #2 LM22	0.073	0.066	0.069	0.060
Lactose control #1 LM6 : Lactose control #1 LM14				
Lactose control #1 LM6 : Lactose control #1 LM22	0.059	0.063	0.054	0.059
Lactose control #1 LM6 : Lactose control #2 LM6				
Lactose control #1 LM14 : Lactose control #1 LM22	0.071	0.063	0.069	0.059
Lactose control #1 LM14 : Lactose control #2 LM14				
Lactose control #1 LM22 : Lactose control #2 LM22				
Lactose control #2 LM6 : Lactose control #2 LM14	0.061	0.075	0.056	0.073
Lactose control #2 LM6 : Lactose control #2 LM22				
Lactose control #2 LM14 : Lactose control #2 LM22	0.075	0.066	0.073	0.060

APPENDIX E.7: Relative Integration H_2O Test Comparisons

Test Comparison	75% C.I. (Sample 1)	75% C.I. (Sample 2)	T value (Mann-Whitney)	P value (Mann-Whitney)
Stannum metallicum LM6 : Stannum metallicum LM14	0.068	0.074	153.0	0.0010
Stannum metallicum LM6 : Stannum metallicum LM22	0.068	0.074	166.0	0.0062
Stannum metallicum LM6 : Plumbum metallicum LM6	0.068	0.066	193.0	0.1057
Stannum metallicum LM6 : Lactose control #1 LM6				
Stannum metallicum LM6 : Lactose control #2 LM6				
Stannum metallicum LM14 : Stannum metallicum LM22				
Stannum metallicum LM14 : Plumbum metallicum LM14	0.074	0.078	282.0	0.0421
Stannum metallicum LM14 : Lactose control #1 LM14	0.074	0.074	244.0	0.6482
Stannum metallicum LM14 : Lactose control #2 LM14				
Stannum metallicum LM22 : Plumbum metallicum LM22	0.074	0.075	203.5	0.2371
Stannum metallicum LM22 : Lactose control #1 LM22				
Stannum metallicum LM22 : Lactose control #2 LM22				
Plumbum metallicum LM6 : Plumbum metallicum LM14	0.066	0.078	147.0	0.0001
Plumbum metallicum LM6 : Plumbum metallicum LM22				
Plumbum metallicum LM6 : Lactose control #1 LM6				
Plumbum metallicum LM6 : Lactose control #2 LM6	0.066	0.068	277.0	0.0680
Plumbum metallicum LM14 : Plumbum metallicum LM22				
Plumbum metallicum LM14 : Lactose control #1 LM14				
Plumbum metallicum LM14 : Lactose control #2 LM14				
Plumbum metallicum LM22 : Lactose control #1 LM22	0.075	0.069	312.0	0.0010
Plumbum metallicum LM22 : Lactose control #2 LM22	0.075	0.072	282.0	0.0421
Lactose control #1 LM6 : Lactose control #1 LM14				
Lactose control #1 LM6 : Lactose control #1 LM22	0.064	0.069	187.0	0.0620
Lactose control #1 LM6 : Lactose control #2 LM6				
Lactose control #1 LM14 : Lactose control #1 LM22	0.074	0.069	309.0	0.0016
Lactose control #1 LM14 : Lactose control #2 LM14				
Lactose control #1 LM22 : Lactose control #2 LM22				
Lactose control #2 LM6 : Lactose control #2 LM14	0.068	0.076	137.0	0.0001
Lactose control #2 LM6 : Lactose control #2 LM22				
Lactose control #2 LM14 : Lactose control #2 LM22	0.076	0.072	303.0	0.0037

APPENDIX E.8: Relative Integration OH Test Comparisons

Test Comparison	Test for Normality	P value (Normality)	Equal Variance Test (Levens)	P value (Equal variance)
Stannum metallicum LM6 : Stannum metallicum LM14	Failed	0.0001	Failed	
Stannum metallicum LM6 : Stannum metallicum LM22	Failed	0.0390	Failed	
Stannum metallicum LM6 : Plumbum metallicum LM6	Passed	0.4555	Failed	
Stannum metallicum LM6 : Lactose control #1 LM6	Failed	0.0137	Failed	
Stannum metallicum LM6 : Lactose control #2 LM6	Passed	0.1139	Passed	0.4179
Stannum metallicum LM14 : Stannum metallicum LM22	Passed	0.4472	Passed	0.3063
Stannum metallicum LM14 : Plumbum metallicum LM14	Failed	0.0011	Failed	
Stannum metallicum LM14 : Lactose control #1 LM14	Failed	0.0107	Failed	
Stannum metallicum LM14 : Lactose control #2 LM14	Passed	0.3134	Passed	0.2817
Stannum metallicum LM22 : Plumbum metallicum LM22	Failed	0.0157	Failed	
Stannum metallicum LM22 : Lactose control #1 LM22	Failed	0.0409	Failed	
Stannum metallicum LM22 : Lactose control #2 LM22	Passed	0.2874	Passed	0.0600
Plumbum metallicum LM6 : Plumbum metallicum LM14	Passed	0.0832	Passed	0.3916
Plumbum metallicum LM6 : Plumbum metallicum LM22	Passed	0.1693	Passed	0.2088
Plumbum metallicum LM6 : Lactose control #1 LM6	Passed	0.2566	Passed	0.0571
Plumbum metallicum LM6 : Lactose control #2 LM6	Failed	0.0014	Failed	
Plumbum metallicum LM14 : Plumbum metallicum LM22	Passed	0.6407	Passed	0.6666
Plumbum metallicum LM14 : Lactose control #1 LM14	Passed	0.1018	Passed	0.1782
Plumbum metallicum LM14 : Lactose control #2 LM14	Passed	0.1885	Passed	0.0587
Plumbum metallicum LM22 : Lactose control #1 LM22	Passed	0.0531	Failed	0.0109
Plumbum metallicum LM22 : Lactose control #2 LM22	Passed	0.2355	Passed	0.0550
Lactose control #1 LM6 : Lactose control #1 LM14	Failed	0.0005	Failed	
Lactose control #1 LM6 : Lactose control #1 LM22	Passed	0.1732	Passed	0.0997
Lactose control #1 LM6 : Lactose control #2 LM6	Failed	0.0192	Failed	
Lactose control #1 LM14 : Lactose control #1 LM22	Passed	0.5800	Failed	0.0001
Lactose control #1 LM14 : Lactose control #2 LM14	Passed	0.3080	Passed	0.3913
Lactose control #1 LM22 : Lactose control #2 LM22	Passed	0.0539	Passed	0.7671
Lactose control #2 LM6 : Lactose control #2 LM14	Failed	0.0001	Failed	
Lactose control #2 LM6 : Lactose control #2 LM22	Failed	0.0399	Failed	
Lactose control #2 LM14 : Lactose control #2 LM22	Failed	0.0162	Failed	

APPENDIX E.8: Relative Integration OH Test Comparisons

Test Comparison	Mean (Sample 1)	Mean (Sample 2)	Std. Dev. (Sample 1)	Std. Dev. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM14				
Stannum metallicum LM6 : Stannum metallicum LM22				
Stannum metallicum LM6 : Plumbum metallicum LM6				
Stannum metallicum LM6 : Lactose control #1 LM6				
Stannum metallicum LM6 : Lactose control #2 LM6	0.140	0.129	0.0157	0.0143
Stannum metallicum LM14 : Stannum metallicum LM22	0.154	0.152	0.0029	0.0035
Stannum metallicum LM14 : Plumbum metallicum LM14				
Stannum metallicum LM14 : Lactose control #1 LM14				
Stannum metallicum LM14 : Lactose control #2 LM14	0.154	0.156	0.0029	0.0019
Stannum metallicum LM22 : Plumbum metallicum LM22				
Stannum metallicum LM22 : Lactose control #1 LM22				
Stannum metallicum LM22 : Lactose control #2 LM22	0.152	0.149	0.0035	0.0060
Plumbum metallicum LM6 : Plumbum metallicum LM14	0.145	0.152	0.0057	0.0041
Plumbum metallicum LM6 : Plumbum metallicum LM22	0.145	0.153	0.0057	0.0033
Plumbum metallicum LM6 : Lactose control #1 LM6	0.145	0.124	0.0057	0.0139
Plumbum metallicum LM6 : Lactose control #2 LM6				
Plumbum metallicum LM14 : Plumbum metallicum LM22	0.152	0.153	0.0041	0.0033
Plumbum metallicum LM14 : Lactose control #1 LM14	0.152	0.155	0.0041	0.0023
Plumbum metallicum LM14 : Lactose control #2 LM14	0.152	0.156	0.0041	0.0019
Plumbum metallicum LM22 : Lactose control #1 LM22				
Plumbum metallicum LM22 : Lactose control #2 LM22	0.153	0.149	0.0033	0.0060
Lactose control #1 LM6 : Lactose control #1 LM14				
Lactose control #1 LM6 : Lactose control #1 LM22	0.124	0.147	0.0139	0.0057
Lactose control #1 LM6 : Lactose control #2 LM6				
Lactose control #1 LM14 : Lactose control #1 LM22				
Lactose control #1 LM14 : Lactose control #2 LM14	0.155	0.156	0.0023	0.0019
Lactose control #1 LM22 : Lactose control #2 LM22	0.147	0.149	0.0057	0.0060
Lactose control #2 LM6 : Lactose control #2 LM14				
Lactose control #2 LM6 : Lactose control #2 LM22				
Lactose control #2 LM14 : Lactose control #2 LM22				

APPENDIX E.8: Relative Integration OH Test Comparisons

Test Comparison	SEM (Sample 1)	SEM (sample 2)	t-value (t-test)	P value (t-test)	Power of test (t-test)
Stannum metallicum LM6 : Stannum metallicum LM14					
Stannum metallicum LM6 : Stannum metallicum LM22					
Stannum metallicum LM6 : Plumbum metallicum LM6					
Stannum metallicum LM6 : Lactose control #1 LM6					
Stannum metallicum LM6 : Lactose control #2 LM6	0.0041	0.0037	2.003	0.0550	0.3741
Stannum metallicum LM14 : Stannum metallicum LM22	0.0007	0.0009	1.621	0.1162	0.2203
Stannum metallicum LM14 : Plumbum metallicum LM14					
Stannum metallicum LM14 : Lactose control #1 LM14					
Stannum metallicum LM14 : Lactose control #2 LM14	0.0007	0.0005	-1.792	0.0840	0.2854
Stannum metallicum LM22 : Plumbum metallicum LM22					
Stannum metallicum LM22 : Lactose control #1 LM22					
Stannum metallicum LM22 : Lactose control #2 LM22	0.0009	0.0016	1.635	0.1132	0.2253
Plumbum metallicum LM6 : Plumbum metallicum LM14	0.0015	0.0010	-3.773	0.0008	0.9543
Plumbum metallicum LM6 : Plumbum metallicum LM22	0.0015	0.0008	-4.585	0.0001	0.9955
Plumbum metallicum LM6 : Lactose control #1 LM6	0.0015	0.0036	5.547	0.0001	0.9999
Plumbum metallicum LM6 : Lactose control #2 LM6					
Plumbum metallicum LM14 : Plumbum metallicum LM22	0.0010	0.0008	-0.723	0.4758	0.0500
Plumbum metallicum LM14 : Lactose control #1 LM14	0.0010	0.0006	-1.931	0.0636	0.3432
Plumbum metallicum LM14 : Lactose control #2 LM14	0.0010	0.0005	-2.849	0.0081	0.7394
Plumbum metallicum LM22 : Lactose control #1 LM22					
Plumbum metallicum LM22 : Lactose control #2 LM22	0.0008	0.0016	2.323	0.0277	0.5183
Lactose control #1 LM6 : Lactose control #1 LM14					
Lactose control #1 LM6 : Lactose control #1 LM22	0.0036	0.0015	-5.989	0.0001	1.0000
Lactose control #1 LM6 : Lactose control #2 LM6					
Lactose control #1 LM14 : Lactose control #1 LM22					
Lactose control #1 LM14 : Lactose control #2 LM14	0.0006	0.0005	-1.240	0.2254	0.1025
Lactose control #1 LM22 : Lactose control #2 LM22	0.0015	0.0016	-0.923	0.3638	0.0500
Lactose control #2 LM6 : Lactose control #2 LM14					
Lactose control #2 LM6 : Lactose control #2 LM22					
Lactose control #2 LM14 : Lactose control #2 LM22					

APPENDIX E.8: Relative Integration OH Test Comparisons

Test Comparison	Median (Sample 1)	Median (Sample 2)	25% C.I. (Sample 1)	25% C.I. (Sample 2)
Stannum metallicum LM6 : Stannum metallicum LM14	0.145	0.153	0.127	0.152
Stannum metallicum LM6 : Stannum metallicum LM22	0.145	0.153	0.127	0.149
Stannum metallicum LM6 : Plumbum metallicum LM6	0.145	0.145	0.127	0.142
Stannum metallicum LM6 : Lactose control #1 LM6	0.145	0.126	0.127	0.117
Stannum metallicum LM6 : Lactose control #2 LM6				
Stannum metallicum LM14 : Stannum metallicum LM22				
Stannum metallicum LM14 : Plumbum metallicum LM14	0.153	0.151	0.152	0.149
Stannum metallicum LM14 : Lactose control #1 LM14	0.153	0.154	0.152	0.154
Stannum metallicum LM14 : Lactose control #2 LM14				
Stannum metallicum LM22 : Plumbum metallicum LM22	0.153	0.155	0.149	0.151
Stannum metallicum LM22 : Lactose control #1 LM22	0.153	0.149	0.149	0.142
Stannum metallicum LM22 : Lactose control #2 LM22				
Plumbum metallicum LM6 : Plumbum metallicum LM14				
Plumbum metallicum LM6 : Plumbum metallicum LM22				
Plumbum metallicum LM6 : Lactose control #1 LM6				
Plumbum metallicum LM6 : Lactose control #2 LM6	0.145	0.129	0.142	0.124
Plumbum metallicum LM14 : Plumbum metallicum LM22				
Plumbum metallicum LM14 : Lactose control #1 LM14				
Plumbum metallicum LM14 : Lactose control #2 LM14				
Plumbum metallicum LM22 : Lactose control #1 LM22	0.155	0.149	0.151	0.142
Plumbum metallicum LM22 : Lactose control #2 LM22				
Lactose control #1 LM6 : Lactose control #1 LM14	0.126	0.154	0.117	0.154
Lactose control #1 LM6 : Lactose control #1 LM22				
Lactose control #1 LM6 : Lactose control #2 LM6	0.126	0.129	0.117	0.124
Lactose control #1 LM14 : Lactose control #1 LM22	0.154	0.149	0.154	0.142
Lactose control #1 LM14 : Lactose control #2 LM14				
Lactose control #1 LM22 : Lactose control #2 LM22				
Lactose control #2 LM6 : Lactose control #2 LM14	0.129	0.155	0.124	0.155
Lactose control #2 LM6 : Lactose control #2 LM22	0.129	0.149	0.124	0.143
Lactose control #2 LM14 : Lactose control #2 LM22	0.155	0.149	0.155	0.143

APPENDIX E.8: Relative Integration OH Test Comparisons

Test Comparison	75% C.I. (Sample 1)	75% C.I. (Sample 2)	T value (Mann-Whitney)	P value (Mann-Whitney)
Stannum metallicum LM6 : Stannum metallicum LM14	0.151	0.155	166.0	0.0062
Stannum metallicum LM6 : Stannum metallicum LM22	0.151	0.155	173.0	0.0144
Stannum metallicum LM6 : Plumbum metallicum LM6	0.151	0.147	224.5	0.7557
Stannum metallicum LM6 : Lactose control #1 LM6	0.151	0.130	291.0	0.0161
Stannum metallicum LM6 : Lactose control #2 LM6				
Stannum metallicum LM14 : Stannum metallicum LM22				
Stannum metallicum LM14 : Plumbum metallicum LM14	0.155	0.157	283.0	0.0381
Stannum metallicum LM14 : Lactose control #1 LM14	0.155	0.156	206.0	0.2808
Stannum metallicum LM14 : Lactose control #2 LM14				
Stannum metallicum LM22 : Plumbum metallicum LM22	0.155	0.156	201.0	0.1985
Stannum metallicum LM22 : Lactose control #1 LM22	0.155	0.152	293.0	0.0128
Stannum metallicum LM22 : Lactose control #2 LM22				
Plumbum metallicum LM6 : Plumbum metallicum LM14				
Plumbum metallicum LM6 : Plumbum metallicum LM22				
Plumbum metallicum LM6 : Lactose control #1 LM6				
Plumbum metallicum LM6 : Lactose control #2 LM6	0.147	0.133	317.0	0.0001
Plumbum metallicum LM14 : Plumbum metallicum LM22				
Plumbum metallicum LM14 : Lactose control #1 LM14				
Plumbum metallicum LM14 : Lactose control #2 LM14				
Plumbum metallicum LM22 : Lactose control #1 LM22	0.156	0.152	304.0	0.0032
Plumbum metallicum LM22 : Lactose control #2 LM22				
Lactose control #1 LM6 : Lactose control #1 LM14	0.130	0.156	131.0	0.0001
Lactose control #1 LM6 : Lactose control #1 LM22				
Lactose control #1 LM6 : Lactose control #2 LM6	0.130	0.133	207.5	0.3095
Lactose control #1 LM14 : Lactose control #1 LM22	0.156	0.152	320.0	0.0001
Lactose control #1 LM14 : Lactose control #2 LM14				
Lactose control #1 LM22 : Lactose control #2 LM22				
Lactose control #2 LM6 : Lactose control #2 LM14	0.133	0.157	136.0	0.0001
Lactose control #2 LM6 : Lactose control #2 LM22	0.133	0.153	147.0	0.0001
Lactose control #2 LM14 : Lactose control #2 LM22	0.157	0.153	306.0	0.0025