

A comparison of Hahnemannian and Korsakovian potentiising
methods using Nuclear Magnetic Resonance Spectroscopy.

By

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DEDICATION

I dedicate this work to the sun, the moon, the stars, and my one true love. All of whom
bring meaning and light to my life.

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ABSTRACT

The purpose of this study was to analyse and compare the NMR spectra of a homoeopathic remedy (in this case *Natrum muriaticum* was used for its easy solubility and purity), that was prepared in the classical single vial Hahnemannian method, and also the widely used multi-vial Korsakovian method. Comparison was made in terms of the chemical shift (δ) and relative integration values of the CH_3 , CH_2 , H_2O , and OH signals. A control was employed for both methods. The only difference between control and test remedies was the actual inclusion of *Natrum muriaticum* in the latter, and the same weight of solvent as solute in the former.

Comparison was made between both test methods, between test and control, and between the two controls. It was hypothesized that the method of dilution plays an important part in the potentisation process, and thus becomes part of the remedy's information content. The evolution of distinct physicochemical identities was hypothesized to occur specific to each method in ascending potency levels. Differences were therefore also hypothesized to exist between both methods at parallel potency levels in terms of chemical shift and relative integration values.

The experiment was conducted as per the limitations of the scientific method. Both methods and their controls of *Natrum muriaticum* were potentised to the 9C, 30C, and 200C potency levels. They were prepared in 16ml volumes and transported to the NMR spectroscopy laboratory in Pietermaritzburg for analysis.

The twelve sample groups were then run in a Varian 500MHz INOVA spectrometer a total of ten times per group. The pulse angle was set at 20.4 degrees with an acquisition time of 1.9 seconds with four transients per run. A constant temperature of 24°C was maintained during NMR analysis. A new sample was drawn from the original 16ml volume with a new, unused micropipette in 0.6ml volumes. The samples were inserted into a coaxial tube, using acetone both as the external lock and internal reference.

The data was recorded and represented in the form of NMR spectra giving chemical shift and integration values for the CH₃, CH₂, H₂O, and OH peaks. The data was then subjected to statistical analysis using non-parametric methods. The level of significance for all tests was set at $\alpha = 0.05$. Intra-potency comparison was made initially across all three potency levels using Friedman's F-test for all dilution methods. All comparisons were found to be significant ($p \leq 0.006$) for all methods and controls, for both the chemical shift and relative integration values. Pairwise comparison between potency levels was therefore required using Wilcoxon's Signed Ranks test to elucidate where the differences actually existed. An overwhelming majority of results proved significant (87 of the 96 tests conducted), however the Hahnemannian method was the only method in which all potency comparisons were significant ($p \leq 0.037$).

Parallel potency comparisons of the different methods and controls were initially conducted using the Kruskal-Wallis H-Test. This involved a simultaneous comparison of all four dilution methods (ie. Hahnemannian, Korsakovian and two controls). All chemical shift values proved significant ($p = 0.000$) for all peaks and potency levels, while the vast majority of relative integration comparisons were greater than the level of

significance for the test for all peaks and potencies. The only exceptions were the 30C comparison of the H₂O peak ($p = 0.007$), the CH₂ peak ($p = 0.011$), and the CH₃ peak ($p = 0.041$) which were all significant. More specific pairwise comparison was then conducted using the Mann-Whitney U-test to isolate the differences between methods. Results showed that only 6 of the 48 relative integration values were significant. The apparent randomness of the significant values made any explanation difficult, however the overwhelming insignificance may have some meaning. This is in light of the fact that 45 of the 48 chemical shift comparisons were significant across all method comparisons.

The results of the study did not allow a conclusive explanation on the specific structures responsible for homoeopathic remedy action. However the results did serve to hypothesize a model which is based on electromagnetic fields produced within remedies which are specific to the substance employed, and are modulated by factors such as the method of dilution. This was hypothesized due to the fact that significant results were observed on an apparatus measuring and employing electromagnetic fields.

The results of the study showed that statistically significant differences are observable on NMR spectroscopy between Hahnemannian and Korsakovian potentiising techniques. This makes their equivalent use in public practice and the pharmaceutical industry questionable. The study also served to confirm the use of NMR spectroscopy as a valuable tool in remedy research.

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TABLE OF ABBREVIATIONS

B ₀	-	Applied or static magnetic field
CH	-	Centesimal Hahnemannienne
δ	-	Delta, representing the chemical shift
LM	-	Quinquagenimillesimal potency
MANOVA	-	Multifactorial analysis of Variance
S.G.	-	Specific gravity
μl	-	Microlitre
μm	-	Micrometre
μs	-	Microsecond

DEFINITIONS OF TERMS

Avagadro's number: the number of units contained in one mole of a substance, normally represented as $N_A = 6,022 \times 10^{23}$. One molecule of a remedy substance in a mole is considered to be equivalent to the 24X, 12C or Q3 dilution levels ie. not one molecule of the original substance or material can be found at these dilution levels.

Centesimal: 1:100 deconcentration scale originally introduced by Hahnemann.

Chemical Shift (δ): indicates the amount by which a proton resonance is shifted from a reference standard (eg. acetone), measured in parts per million (ppm) of the spectrometer's operating frequency.

Fourier transform: the representation of a property which varies periodically with time by an infinite series of harmonically varying functions, each having repetition frequencies equal to multiples of the base frequency.

Heisenberg Uncertainty Principle: the uncertainty of a simultaneous measurement concerning both the momentum and position of a subatomic particle, where $\Delta p \Delta x \geq \hbar/2$. This also follows the energy/time uncertainty relation $\Delta E \Delta t \geq \hbar/2$, where ΔE is the uncertainty in the energy of a system and Δt the time interval characteristic of the rate of change in the system.

Integration: the process of finding the area under the respective peaks. It is a value proportional to the number of protons generating each of the peaks.

Law of Similars: the doctrine that any drug which is capable of producing morbid symptoms in the healthy, will remove similar symptoms occurring as an expression of disease.

LM (Q) potency: a deconcentration scale introduced by Hahnemann where the deconcentration is achieved in two stages: initially being 1:100 and then 1:500, thus resulting in an effective deconcentration of 1:50 000. LM is actually a misnomer meaning 50M ie. 50 000 C. They are therefore correctly termed Quinquagenimillesimal (Q) potencies.

Magnetic moment (μ): it is the intrinsic magnitude of a magnetic dipole, which itself is generated by the overall spin of a charged nucleus along its spin axis.

Magnetogyric ratio (γ): the ratio of a nucleus' magnetic moment to angular momentum which is a constant for each nucleus and determines its energy dependence on the applied magnetic field.

Magnetic vector potential (MVP): that part of a quantum mechanical wave equation influencing properties such as the phase difference of two propagating waves or probability amplitudes.

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

Materia medica: in homoeopathy, a reference work listing remedies and their therapeutic actions.

NMR Spectroscopy: an experimental technique used for chemical analysis whereby the protons of a test substance are exposed to a magnetic field and an interacting radiofrequency in order to achieve resonance. The energy absorption and emission results in a spectrum of the resonant protons.

Potentisation (dynamisation): the process of preparing a homoeopathic remedy by repeated dilution and succussion (shaking). It is believed to involve the transfer of information from one substance to another.

Pharmacopoeia: a reference book where the preparation, uses, and contents of medicines are described.

Planck's constant (h): A universal constant introduced by Max Planck in 1900 to satisfy the quantisation of energy which deduced that vibrational energy is proportional to its frequency, where $h = 6.626 \times 10^{-34}$ J.s in the equation $E = hf$ (see also Heisenberg's Uncertainty Principle).

Proving: the administration of substances in crude or potentised form to healthy human subjects in order to observe and record symptoms, observed as unusual sensations, symptoms or alterations from the normal healthy state by the person taking the drug.

Remedy: As opposed to a drug or medicine, a homoeopathic remedy remedies a situation, causing symptoms (which are an expression of disease) to be cured, leaving in their place a more healthy, functioning individual.

Simillimum: the remedy most closely corresponding to the totality of symptoms.

Specific Gravity: the ratio of the mass of a given volume of substance to the mass of an equal volume of distilled water.

CHAPTER ONE: INTRODUCTION

Hahnemannian and Korsakovian potentising techniques are probably the two most widely used in the world. However because of the lack of standardisation of the Korsakovian method, it has been omitted in numerous countries or used only from a higher Hahnemannian potency level due to time and resource constraints (Gaier, 1991:460-462).

Before the mid 1950's more than half of all potencies in France were made using the Korsakovian method (Kayne, 1997:51). However with the introduction of homoeopathic medicines into the French Pharmacopoeia in 1965, and lack of standardisation, the Korsakovian method was outlawed in France. The same fate has met Korsakovian potencies in Germany. It is used in Great Britain, but only above the 1M (1000) potency level. In Belgium it is almost exclusively used (Gaier, 1991:458). However, as Lourie (1994) points out, it remains a method now used extensively around the world. This is despite the regulations mentioned in certain countries. The prescriptions following case studies in most homoeopathic journals bear testament to the vast utilisation of this method in homoeopathic practice.

The reason for such a lack of standardisation within homoeopathic pharmacy can only be seen to develop from a poor understanding of the mechanisms underlying the potentisation process. This has led to a situation where a various number of potentising processes have developed, some questionable, yet no concrete evidence can refute them because the remedies seem to maintain clinical efficacy. Schulte (1999) explains that for homoeopathy to progress and be accepted by the scientific community, it requires

arguments based on well-accepted scientific grounds. An understanding of order formation within aqueous solutions on an atomistic level is therefore required.

NMR spectroscopy has been perhaps the most frequently used tool in the ongoing investigation to measure changes in homoeopathic remedies, especially exceeding Avagadro's limit. Studies by Smith and Boericke (1966, 1968), Sacks (1983), Weingärtner (1990), Demangeat *et al* (1992), Ross (1997), Power (1999), and Sukul *et al* (2000) all show that statistically significant results are observed on the NMR spectra comparisons of homoeopathic dilutions. However the number of studies remains small, and the evidence inconclusive, requiring further investigation into the field in order to consolidate a coherent theory on ultra high dilutions.

An attempt to provide statistically reliable data with NMR spectroscopy may provide the means to properly classify homoeopathic remedies according to their inherent properties, both physically and chemically. To compare Hahnemannian and Korsakovian methods on a purely chemical level, when numerous studies show physical changes within the solvent, may be erroneous. Such a study will then provide evidence on the equivalence of the two methods, for the homoeopathic practitioner and the homoeopharmaceutical companies, both of whom may be incorrectly combining the two methods, thus bringing current pharmaceutical practice into question.

1.1 THE AIM OF THE STUDY

The purpose of the study was to compare parallel Hahnemannian and Korsakovian potencies of Natrum muriaticum using Nuclear Magnetic Resonance Spectroscopy, in order to evaluate their equivalence in homoeopathic pharmacy.

1.2 STATEMENT OF THE OBJECTIVES

1.2.1. The first objective.

To compare and evaluate the NMR spectra of Natrum muriaticum with respect to the chemical shifts and relative integration values of the CH₂, CH₃, H₂O and OH signals, which have been potentised using Hahnemannian methods to the 9CH, 30CH and 200CH potency levels so as to determine differences in their respective physical structures.

1.2.2. The second objective.

To compare and evaluate the NMR spectra of Natrum muriaticum with respect to the chemical shifts and relative integration values of the CH₂, CH₃, H₂O and OH signals, which have been potentised using Korsakovian methods to the 9CK, 30CK and 200CK potency level so as to determine differences in their respective physical structures.

1.2.3 The third objective.

To compare and evaluate the NMR spectra of a Hahnemannian control method without Natrum muriaticum with respect to the chemical shifts and relative integration values of the CH₂, CH₃, H₂O and OH signals at the 9CH, 30CH and 200CH potency levels so as to determine differences in their respective physical structures.

1.2.4 The fourth objective.

To compare and evaluate the NMR spectra of a Korsakovian control method without Natrum muriaticum with respect to the chemical shifts and relative integration values of CH₂, CH₃, H₂O and OH signals at the 9CK, 30CK and 200CK potency levels so as to determine differences in their respective physical structures.

1.2.5 The fifth objective.

To compare and evaluate parallel potencies in terms of substance versus substance, substance versus control, and control versus control, so that any differences or similarities between methods and between potency levels in terms of NMR spectra and statistical analyses can be elucidated.

1.3 THE HYPOTHESES

1.3.1 The first hypothesis

It is hypothesized that significant differences exist between the chemical shift (δ) and relative integration values of CH₂, CH₃, H₂O and OH signals of respective 9C, 30C and 200C potency levels which have been potentised using Korsakovian and Hahnemannian methods, and that these indicate differences inherent to each method between potency levels.

1.3.2 The second hypothesis

It is hypothesized that significant differences exist between the chemical shift (δ) and

relative integration values of CH₂, CH₃, H₂O and OH signals of respective 9C, 30C and 200C potency levels which have been potentised using Korsakovian and Hahnemannian control methods, and that these indicate differences inherent to each method between potency levels.

1.3.3 The third hypothesis

It is hypothesized that the method of dilution plays an important part in the development of distinct physicochemical properties specific to homoeopathic remedies. It is therefore hypothesized that statistically significant differences exist between parallel potencies of Natrum muriaticum in terms of substance versus substance, substance versus control, and control versus control, with regard to the chemical shift (δ) and relative integration values of the CH₂, CH₃, H₂O and OH signals of the respective potency levels.

CHAPTER TWO: THE REVIEW OF THE RELATED LITERATURE

2.1 THE INTRODUCTION

An important factor contributing to homoeopathy's lack of deserved credit within the medical world can only be seen as a result of unsubstantial evidence. Thus poor standardisation has crept in, purely because nobody can irrefutably explain the process between remedy preparation, giving it to a patient, and cure. Schulte (1994:171-172) states that there is one issue requiring attention in homoeopathy, in particular beyond all others. This is standardisation of the manufacturing process of homoeopathic remedies. Remedies of different origin show distinctly different characteristics under assay methods. However, as Bellavite and Signorini (1995:244) explain, there is a need to go beyond chemistry and biochemistry, thus entering into the *biophysical paradigm*. The need for experimental research to elucidate the physico-chemical changes theorised once Avagadro's limit has been passed is obviously required. A clear, repeatable, and provable theory will provide the means of standardisation, and also a starting point for following research.

A review of Hahnemann and his development of potentisation is explained, as well as the relation to Korsakov. An explanation of current theories on the nature of homoeopathic remedies, together with the mechanism and reasoning of NMR spectroscopy as the tool of choice in this investigation is explored.

2.2 CHRISTIAN FRIEDRICH SAMUEL HAHNEMANN

'Non inutilis vixi'

Some of Hahnemann's early education was conducted at home by his parents, who instilled in him strong ethical and moral values. Hahnemann also developed a strong love for the countryside and botany. Despite constant interruptions due to his family's economic problems, teachers at his school noted his excellent academic ability, and gave him free tuition in order to limit the interruptions. By age twelve Hahnemann was himself tutoring younger pupils in Greek. He acquired a degree of Doctor of Medicine in August of 1779 (Cook, 1981:32-37) at the Frederick Alexander University in Erlanger,

In 1785 he moved to Dresden, staying there until 1789, virtually giving up any kind of medical practice. His interest was devoted to the translation and studying of chemistry and medical texts. He had long become disillusioned with the corrupt medical system, which encouraged huge amounts of venesection, leeching, and nostrums (Cook, 1981: 39-41).

It was while translating Cullen's *Materia Medica* in 1789 that he came across the use of Cinchona bark for malaria. Cullen explained the action being due to the substances tonic effect on the stomach. Hahnemann rejected this theory, and conducted the first homoeopathic proving on himself. He found that it produced symptoms of intermittent fever in healthy individuals. It was by this action of being able to produce similar symptoms, he felt, that it was able to exert a healing action.

Hahnemann continued his literary work, preparing his *Pharmaceutical Lexicon* which proposed ideal pharmacy of the future, eventually leading to four volumes. It soon became a standard reference for apothecaries at the time. Much of the *Lexicon* is also contained in the provisions of the Medicines Act 1968, governing the quality control of homoeopathic medicines today (Cook, 1981:71-77). This being despite the fact that Hahnemann received much antagonism from the apothecaries, preventing him from preparing his own medicines for a good deal of time. The main reasons being financial loss due to Hahnemann's constantly decreasing dose, and his endorsement of simplex remedies. He criticised the apothecaries for their unsubstantiated high prices, and their lack of pharmaceutical ability (Kayne, 1997:20).

In 1796 Hahnemann produced his 'Essay on a New Principle for Ascertaining the Curative Power of Drugs and Some Examinations of Previous Principles'. This is considered as the year of the birth of homoeopathy. Between 1799 and 1800 Hahnemann again took up medicine, however now practising the beginning of his homoeopathic principles. In 1801 he published his 'Cure and Prevention of Scarlet Fever'. It provided information on his very successful cure and prophylaxis of Scarlet Fever with very small doses. He was persecuted by the apothecaries and doctors on the matter for a number of reasons, one being that such small doses could not be efficacious.

Hahnemann continued his extraordinarily immense literary output, producing in 1805 'Fragmenta di viribus Medicamentorum positivus sive in sano corpore humane observatis'. It contained the drug symptoms of twenty-six substances on healthy bodies.

In 1810 he published his first edition of the 'Organon of Rational Healing'. It contained the fundamental principles of homoeopathy, most importantly the Law of Similars.

However he also described his experimentation with different strengths of remedies, finding through experimentation that the therapeutic power of infinitesimally small doses of remedies was maintained and even increased, for which he received public criticism.

In 1828 he published his last great work 'Chronic Diseases : Their Peculiar Nature and Their Homoeopathic cure'.

Leary (1993:286) goes so far as to say that any criticism or slight disagreement with his views was almost intolerable, and that even his close friends breathed a sigh of relief when he left for Paris later in life. Unfortunately, Hahnemann lost many students as a result and others only came to experience the humour of his outrageous fits at public lectures when commenting on orthodox medicine. It is this aspect of Hahnemann which perhaps led to homoeopathy's less than warm welcome into the medical arena. It was with the defeat of Napoleon's army to the Prussian army in Leipzig in 1813, that Hahnemann's fame spread through Europe. He treated 180 cases of typhus, losing only one patient (Kayne, 1997:21), while the 'Orthodox Regime' lost 20-30 percent of their patients. The cholera epidemic of 1831 and 1832 also saw homoeopathy deliver a mortality rate less than half that of the orthodox school.

By the late thirties, Hahnemann's practice was the most popular in Europe. Homoeopathy by now was becoming extremely popular, and numerous homoeopathic societies from around the world had awarded Hahnemann with accolades for his life achievements.

'Orthodox medical practice' was also beginning to change. The importance of diet, exercise, rest, and hygiene were becoming a normal part of medical practice. Mental illness was soon also to lend to compassion, instead of the cruel methods often employed (Cook, 1981:164-184). In April 1843 a few days after his eighty-eighth birthday he suffered a bronchial catarrh lasting 10 weeks, ending in his death on 2 July 1843.

2.3 HAHNEMANN AND POTENTISATION

When Hahnemann tested the effect of Cinchona bark on himself in 1790, he had rediscovered the simile principle of homoeopathy. Initially he prescribed his remedies in crude doses, however they were often followed by severe aggravations. In his Lesser Writings, he describes a number of remedies prepared in 2 – 3 dilution steps, shaking the remedies at each dilution level (Dellmour, 1994). In his 1801 publication 'Cure and Prevention of Scarlet Fever' in 1801, he described the use of Belladonna in very small doses in the order of 'one hundred and thirty-two thousandth part of a grain' (Cook, 1981:89).

Dellmour (1994) explains Hahnemann's dilution of drug substances as the practical result of a method required to lessen the toxicity of drug substances, and is a common dilution method still used in chemistry and microbiology today. It requires less work and material, and the smaller volumes make homogenisation through strong steady stirring, or shaking easier. However Hahnemann soon noticed that the shaking of the remedy seemed to

impart some form of therapeutic power. As the remedies were diluted further their efficacy seemed to increase.

In his *Materia Medica Pura* vol. vi, 2nd edition, first published in 1827 (Hahnemann, 1992:43-46), Hahnemann devotes a chapter entitled "How can small doses of such very attenuated medicine as homoeopathy employs still possess great power?". Disbelieving critics of the day likened a homoeopathic remedy to that of putting a drop of medicine into Lake Geneva, and the result would be that every drop in the lake would become therapeutically active. In response to such ridicule, Hahnemann gave the following explanation : "*a small portion of medicine is not merely added to an enormous quantity of non-medicinal fluid, or only slightly mingled with it, but, by the prolonged succussion or trituration, there ensues not only the most intimate mixture, but at the same time – and this is the most important circumstance – there ensues such a great, and hitherto unknown and undreamt change, by the development and liberation of the dynamic powers of the medicinal substance so treated, as to excite astonishment.*" He continues on the effect which is induced: "*Medicinal substances are not dead masses ..., their true nature is only dynamically spiritual – is pure force, which may be increased in potency almost to an infinite degree.... This is so true that we must act with moderation in order to avoid increasing the powers of the medicines to an undue extent by such trituration (and succussion).*" By 1821, he gave in his first edition of *Materia Medica Pura*, a systematic, centesimal method of dilution, with 2 succussions or strokes of the arm at each stage of dilution. For many remedies such as *Pulsatilla* and *Arsenicum*, he instructs potentising up to the 30th vial.

In previous years between 1801 and 1811 Hahnemann had worked with dilutions up to the sixtillionth (Barthel, 1991). Initially he succussed for 'several minutes' (in 1801), then 3 minutes (in 1814), in 1821 bringing the arm down ten times, and from 1824 onwards bringing the arm down twice. From 1837 onwards he went back to ten strokes of the arm, and in Paris he experimented with 30, 100, and 200 strokes (Barthel, 1993). In Hahnemann's 6th edition of the 'Organon of Medicine', representing his last unpublished work before his death, he instructs the use of 100 firm strokes against a leather bound book (Hahnemann, 1994:294). This was introduced with his LM potencies which represents a far greater dilution level at each stage than is acquired with the centesimal method of dilution.

In 1829 Hahnemann appealed to all homoeopaths not to exceed the thirtieth potency level. This was in order to maintain some level of uniformity and standardisation amongst homoeopaths in their cures, so that later discussion could be understood in terms of the same tools used (Gaier, 1991:435). The motivation behind Hahnemann's comments can be understood from a footnote in 'The Chronic Diseases': *"After many experiments and searching comparisons with the patients I have for several years preferred from conviction to give the medicinal fluids which are to be elevated to higher potencies and at the same time to be rendered milder, only two shakes (with two strokes of the arm) instead of the ten shakes given by others, because of the potentising in the latter case by the repeated attenuation at every step (though this is one hundred fold) ; while yet the end striven for is to develop the medicinal powers only in the degree that the attenuation*

may reach the end aimed for : to moderate in some degree the strength of the medicine while its power of penetration is increased. The double shake also increases the quantity of the medicinal forces developed, like the tenfold shake, but not in as high a degree as the latter, so that its strength may, nevertheless, be kept down by the one hundred fold attenuation effected, and we thus obtain every time a weaker though somewhat more highly potentised and more penetrating medicine” (Hahnemann, 1991:254).

It becomes quite evident that Hahnemann exhibited a large degree of hesitation when it came to the higher potencies. The reason being that his discovery of succussion at each dilution level had the ability to almost make the remedy too potent, to the detriment of the patient. Thus his call for moderation in the ‘Materia Medica Pura’, and the lowering of the number of succussions at each stage in ‘The Chronic Diseases’. He has already been quoted as saying that : *“Medicinal substances are ... pure force, which may be increased in potency almost to an infinite degree”*. Thus Hahnemann acknowledges that the level to which a homoeopathically potentised remedy maintains its efficacy seems almost limitless, but for the patients safety, he felt it best to stay within specified limits.

2.4 KORSAKOV AND POTENTISATION

General Simeon Nicolaevich Korsakov (or von Korsakoff) was not a doctor, however he was probably one of the earliest Russian converts to practice homoeopathy. Although not a great deal of documentation exists on the man, he was known to be in charge of the preparation of Tsar Nicholas I’s remedies while he was travelling, and also the

development of high potencies with the method attributed to his name (Kayne, 1997:51). Leary (1994) also provides evidence for his occupation as district inspector of hospitals during the cholera epidemics of 1830 and 1847, during which homoeopathic doctors claimed results superceeding their allopathic counterparts.

Once Hahnemann introduced the centesimal method of remedy preparation, it represented a systematic, unerring method of manufacture. He explains the method in 'The Chronic Diseases' (1991:253-255) with careful precision. The concentration of alcohol is unimportant with regards to this study. However his method of dilution clearly states that in a sequential order, *"one drop (of the previous potency) of this is added to ninety-nine or one hundred drops of pure alcohol, the stoppered vial is then shaken with two strokes of the arm and marked with the name of the medicine and designated ..."* In a footnote he states that the label must show, with the dilution level, that the remedy has been shaken twice, together with the date. Hahnemann makes it quite clear in another footnote explaining the potentisation process that, : *"Homoeopathy must avoid all indefiniteness, and inexactness as much as possible"*, and then later continues : *"Vials that have contained a remedy must never be used for the reception of any other medicine, though they be rinsed ever so often, but new vials must be taken every time"*. It has already been stated that Hahnemann had an uncompromising nature when it came to carrying out his theories. This makes his response to Korsakovian potencies all the more surprising.

Korsakov had suggested that instead of taking one drop of a dilution and transferring it to ninety-nine drops of the succeeding dilution in a new vial in sequential order, rather remove the contents of the vial by inversion or suction. The remaining liquid adhering to the glass walls could be considered equivalent to the one drop of the previous potency. The same vial is then filled with ninety-nine drops of solvent, and succussed a number of times, depending on the manufacturer involved. The following diagrams adapted from Gaier (1991:456-457), display this process.

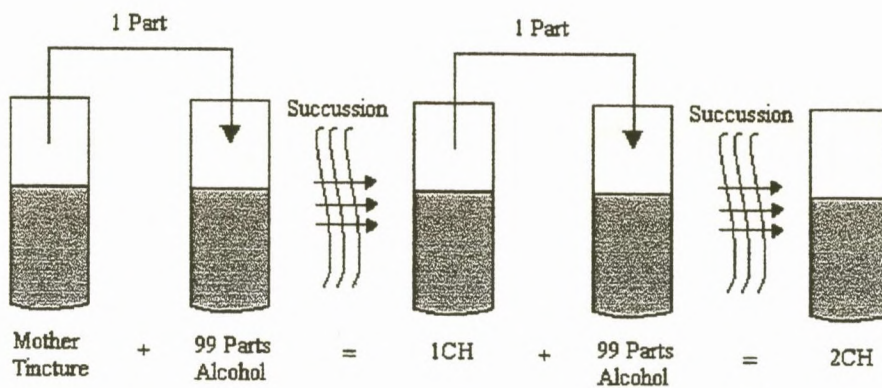


Figure 2.4.1 Hahnemannian method of potentisation

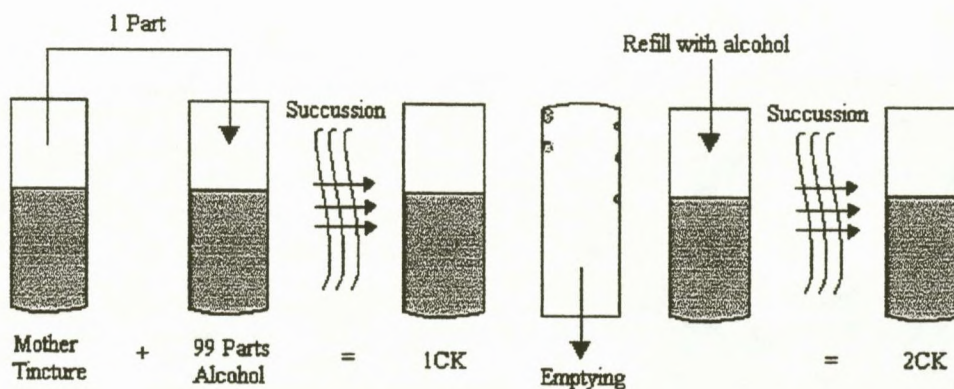


Figure 2.4.2 Korsakovian method of potentisation

Hahnemann had entered into correspondence with Korsakov from around 1829. He did not criticise the method or the use of Korsakov's higher attenuations, but stated that it was best to stay with the 30th attenuation for the sake of uniformity (Winston, 1989). In fact Gaier (1981:457) quotes Hahnemann as saying that 'the eminent von Korsakoff's process might be as sensible as it was useful'. This is extremely surprising when we have already established Hahnemann's inability to accept any difference concerning his ideas (Leary, 1993). Hahnemann obviously could see no difference between the two methods. The centesimal method developed by himself is extremely tedious, while the Korsakovian method is efficient, both from a time and economic point of view. This enables a lending to temptation to experiment with higher potencies. As Schore (1991) points out, Hahnemann did not just improve on his 30CH with the LM's in order to find a more gentle means of cure. He only experimented with the LM's in the years before his death, and he was already advocating the use of the 30CH for a number of remedies in his *Materia Medica Pura*, published in six parts between 1811 and 1821. There were a number of years where Hahnemann would have been experimenting to produce the ideal manufacturing process that would bring about the most rapid and gentle cure possible.

He knew of Korsakov's potencies up to the 60C, 200C, 1000C, and even 1500C (Schore, 1991). He was willing himself to experiment with higher potencies. It can be recalled that Hahnemann and the practitioners of his day imagined that the succussion and trituration process seemed to be the major influence in bringing out the dynamic healing properties lying latent in every medicine. Hahnemann even speaks of the potency level increasing

by continuously shaking the remedy bottle. The number of attenuations reached could therefore be almost infinite. Both the Hahnemannian and Korsakovian method would have undergone the same number of succussions. In 1837 Hahnemann started using ten succussions instead of the two previously used. At this time he was known also to have used low potencies and high potencies up to the 150th and even the 200th. However 100 succussions were used at every level for the 200th (Barthel, 1991). If Hahnemann had no problem concerning Korsakovian potencies and he himself was using high potencies, albeit produced by his own method, why then the controversy surrounding Korsakovian potencies?

2.5 THE CONTROVERSY SURROUNDING KORSAKOVIAN POTENCIES

When Hahnemann declared recognition of the Korsakovian potencies as useful, it was only to be expected that the homoeopathic community would trust and follow the 'old Master'. Thus began the misbelief that the two methods were equivalent, and so Jahr, from 1845, endorses in his Pharmacopoeia, the mixing of the two methods. So continued the wide use of Korsakovian potencies until 1926, when A. Berne conclusively discovered a significant difference in their rates of deconcentration (Gaier 1991:457). It is now accepted from tagged molecular deconcentration studies that the following comparisons can be made:

1000K	————>	9CH
200K	————>	8CH
30K	————>	7CH

12K	—→	6CH
9K	—→	5CH
6K	—→	4CH
4K	—→	3CH

It would seem obvious that any amount of residue remaining in a Korsakovian vial once it has been emptied is of an uncertain volume, and would be transferred to the succeeding potency with far less control than the Hahnemannian method. However, it must not be forgotten that two corresponding potencies have undergone the same number of succussions. The effect that this has on the physical structure of the liquid potency is uncertain. Thus a purely chemical analysis seems rather inadequate. Unfortunately it is the only repeatable quantitative method available presently at these times when chemistry rules the annals of science, and qualitative analysis has been forgotten. A far greater source of evidence comes in the form of clinical experience, however it is difficult to measure quantitatively.

Obviously standardisation is important in any manufacturing process. To standardise the Korsakovian method as is the Hahnemannian method, is almost impossible. Factors that affect the rate of deconcentration are:

- size, shape, and smoothness of the vial
- the type of glass of which the vials are made
- the solubility and variable cohesive properties of the original substance
- the temperature in the laboratory at the time of manufacture

- the method with which the vial is emptied ie. does one drop always remain?

Thus cohesive and adhesive properties between solute and solvent, and solvent and vial bring in a large number of variables, as well many others on which they are dependant, such as temperature. Thus the omission of the Korsakovian method in numerous countries such as Germany and France (as previously mentioned in the introduction in Chapter 1). This is for the exception of a few commercial remedies such as Oscillococcinum, which is prepared in a 200K, with which practitioners experience a large level of success (Pieters, 1992). Practitioners certainly do ascribe to good results when Korsakovian potencies have been used (Toledo, 1996). Korsakov probably only intended to shorten the tedious process of the Hahnemannian method and also economise it. Such is the nature of man to want to go further.

Numerous homoeopharmaceutical companies now produce high potencies through a mixing of the two methods. Boericke and Tafel, as well as Ehrhat and Karl in the USA produce a large portion of their remedies by the Hahnemannian method up to the 30CH. From there they continue up to the 1000C (1M) with the Korsakovian method by hand. This then is continued past the 100 000th potency with continuous fluxion machines. It must be borne in mind that a 10M prepared in the Hahnemannian method by hand, would take about ten weeks of 24 hours per day, non-stop potentisation (Gaier 1991: 459-460). The Korsakovian method takes considerably less time. However it is also a method which more easily lends itself to mechanisation. Helios, the Turnbridge Wells Homoeopathic Pharmacy, unveiled in 1994 a Korsakovian high potency computerised device which

simulates 40 hand succussions at each dilution level. The vial is emptied pneumatically via filtered air, which leaves "one drop" on its walls. It takes only 40 hours for the machine to reach the 10M potency level (High potency power comes to the UK, 1994).

Thus it seems almost inevitable that homoeopathic practitioners would turn to a method of potentisation which was efficient on time and resource constraints. The deciding factor obviously was their clinical efficacy, which without controlled patient studies makes their evaluation difficult.

Perhaps another controversial factor put forward over Korsakovian remedies is the idea of 'multidilutions'. Some practitioners have prescribed remedies consisting of a mixture of potency levels. The reasoning behind this is that some potencies (normally the higher potencies) act on the mental level, while other potencies (normally the lower potencies) act on the physical level. These mixed potencies are said to act independently of each other, affecting the organism on the required level. A blending of the potency levels does not seem to occur. Thus a more rapid cure is established as the remedy can affect the patient on all levels at once.

Finsterbusch (1996) provides a case study in which seventy patients in Chile suffering from mostly chronic ailments were treated with multidilutions of the similimum. He explains that in 100 percent of cases there was an intensification and acceleration of cure. The reason being that all levels are simultaneously stimulated and there is no need to wait for a cure from the mental to the physical level for example. He goes further to say that

Korsakovian dilutions are in fact multidilutions. Since high Korsakovian potencies contain traces of the original solute, this leads to mixing of high and low potencies in the potentisation process. The curative power of which is superior than traditional single Hahnemannian potencies, since the best potency for each level involved is always present.

Thus the validity of Korsakovian potencies remains a personal subject. However until a means of standardising them through an accepted, repeatable method becomes available, they are going to be viewed with some doubt.

2.6 WHAT IS NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY?

2.6.1 PRINCIPLES OF NMR SPECTROSCOPY

Any atomic nucleus with an odd mass or odd atomic number, or both, has a quantised spin angular momentum and a magnetic moment (μ). The number of spin states is quantised and determined by the nuclear spin quantum number (I). There are $2I + 1$ allowed spin states. For a proton such as a hydrogen nucleus with $I = \frac{1}{2}$, there follows two allowed spin states, $-\frac{1}{2}$ and $+\frac{1}{2}$. All spin states of a nucleus are of equivalent energy, and within a collection of atoms, all spin states are almost equally populated. This is provided they are not under the influence of a magnetic field.

However once subjected to a magnetic field, spin states are not of equivalent energy. This occurs because the nucleus, a charged particle, moving in a magnetic field generates its own magnetic field. Thus it has a magnetic moment (μ) generated by its charge and spin, either aligned or opposed to the applied magnetic field, depending on its direction of spin.

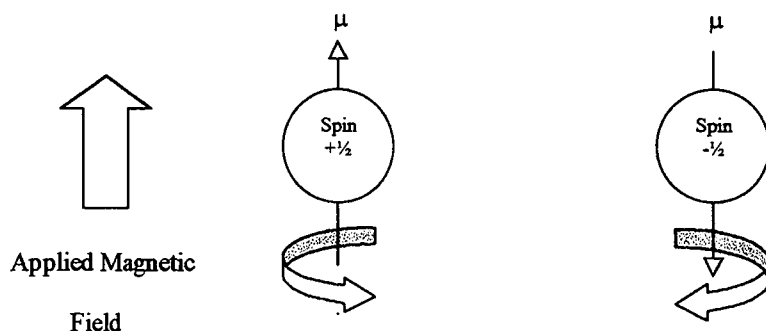


Figure 2.6.1 Alignment of proton spin with applied magnetic field.

Therefore as a magnetic field is applied the spin states split into two states of unequal energy, $+1/2$, aligned with the field (lower energy), or $-1/2$, opposed to the field (higher energy).

The NMR effect occurs when nuclei aligned with the applied field are induced to absorb energy and change their spin orientation with respect to the applied field. The energy absorbed is equal to the difference between the two spin states involved. Protons are able to absorb energy because they precess in an applied magnetic field at a rate directly proportional to the strength of the field, thus creating their own electric field of the same

frequency. When radio (rf) waves of the same frequency are directed at the proton, the two fields couple and energy is transferred to the proton, thus allowing a spin change.

However not every portion of a molecule resonates at the exact same frequency.

Circulating valence electrons create opposing magnetic fields, thus shielding certain protons depending on their electronic environments. Protons in a solution will therefore precess at different rates depending on their molecular positioning. The resonance frequency is measured relative to a standard which maintains a fixed position. This is done in terms of the chemical shift (δ), measured in parts per million (ppm). It maintains the same value for a sample irrespective of the spectrometers field strength, since the chemical shift is determined by the amount which a proton's resonance is shifted from the reference standard (eg. acetone) in hertz over the spectrometers operating frequency (MHz).

If all the protons in a molecule have identical chemical environments, they will all give identical chemical shifts. Thus they will all give rise to one peak. However the area under the peak is proportional to the number of protons generating that peak. These relative values are known as integral values. Working out the ratio of protons at specific chemical shift values can thus reveal very accurately the structure of the sample being tested. Thus the potential for NMR spectroscopy to discover the physical and chemical structure of a sample can easily be realised (Pavia, 1979: 81-92).

2.6.2 PULSED (FOURIER TRANSFORM) NMR

Conventional NMR spectrometers (continuous-wave method) scan the spectrum at a slow rate so that spectral lines, which are quite narrow, are not missed. Most of the time is therefore spent arduously scanning background noise, diminishing the accuracy of recorded spectra. If we think of a spectrum to consist of a large number of small increments, each just large enough to contain a spectral line, and each increment can be examined simultaneously, then we begin to understand the principle of Fourier transform spectrometry. Such a spectrometer is a combination of a continuous-wave circuit, a computer-controllable pulse generator, and a digital computer. Since all frequencies can be simultaneously observed, both time and signal-to-noise ratio is vastly improved.

This is achieved by applying a strong pulse of rf energy (B_1) containing a wide range of frequencies to the sample for a short period of 1-100 μ s. The magnetic moments of the nuclei are tipped at an angle normally less than 90°. Once the pulse is completed, the static field (B_0), 'pushes' the nuclei back into their original position, precessing at the resonant frequency. This free precession of the magnetic moments of the nuclei under the influence of only the static field induces decaying sinusoidal voltages in a coil of wire surrounding the sample. The reason for the decay being firstly, that the nuclear magnetic moments return to their original positions with an exponential time constant, T_1 (spin-lattice relaxation time), thus reducing the signal. Secondly, as they return to their original positions they lose phase coherence and begin precessing at slightly different rates. The

resultant sum of all precessing vectors diminishes, reflecting in T_2 (spin-spin relaxation time).

The signal recorded by the coil is displayed in the following diagram.

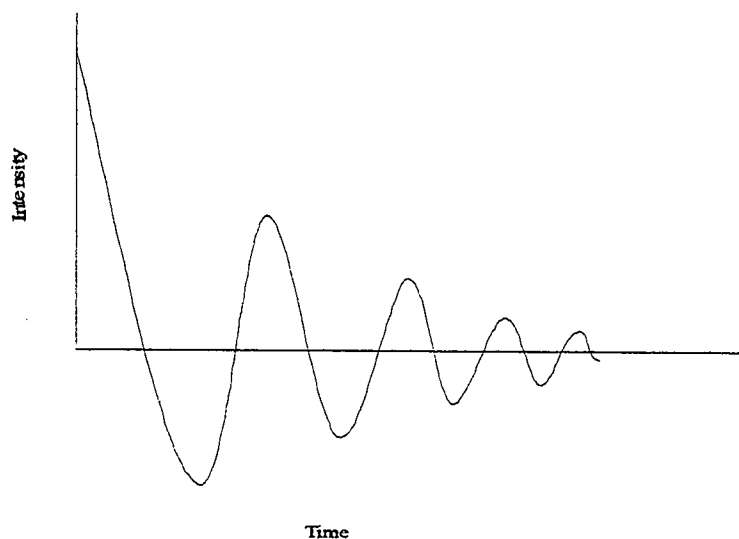


Figure 2.6.2 Representation of signal observed by receiver coil

The FID (Free Induction Decay) signal contains the sine waves of all frequencies of all precessing nuclei 'knocked' by the rf impulse. The FID signal following each transient is digitized by a fast analog-to-digital (ADC) converter, and coherently added in the computer until an adequate signal-to-noise ratio is obtained. The computer then does a Fourier transformation to the frequency domain (obtained from the FID time domain response), and produces a normal spectral representation of the NMR absorption versus frequency in 10-20 seconds. (See appendix B for spectra examples).

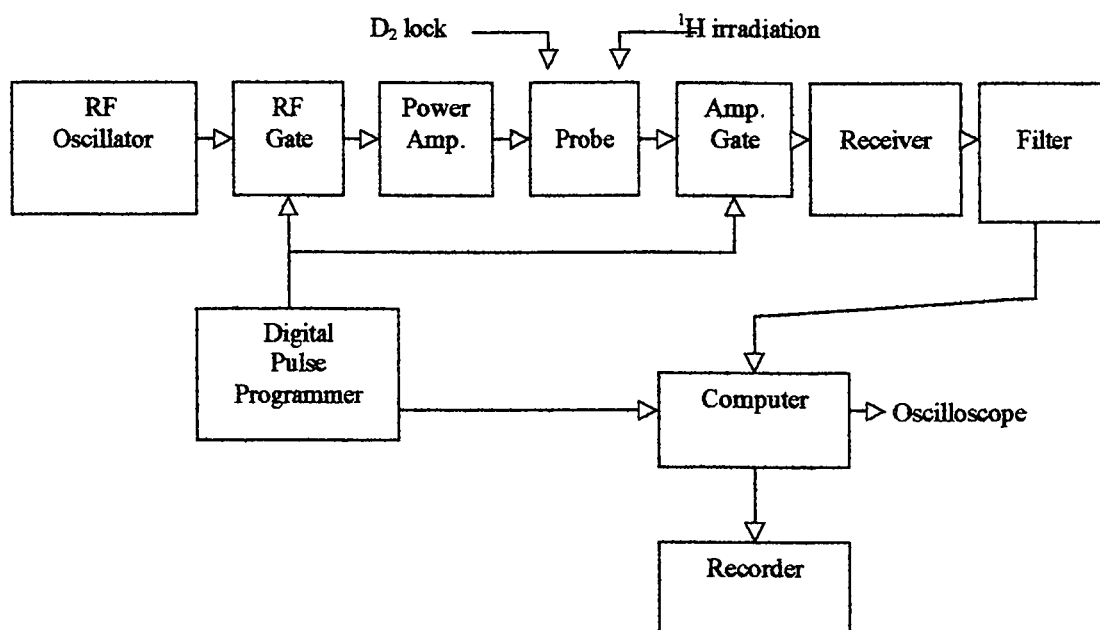


Fig 2.6.3 Diagrammatic representation of a pulsed Fourier transform NMR spectrometer (adapted from Willard *et al* 1988:438).

The oscilloscope serves to adjust the magnetic homogeneity during signal accumulation, monitor the FID signal, and quick display of Fourier transformed signals to ensure an adequate signal-to-noise ratio. The digital data format also allows extremely accurate chemical shift and integral values.

2.7 NMR RESEARCH IN HOMOEOPATHY

Over the last thirty to forty years, evidence has amassed which shows NMR spectroscopy to be a useful tool to indicate structural changes within homoeopathic remedies. Smith and Boericke (1966) were probably the pioneers in the use of NMR spectroscopy to investigate homoeopathic remedies, or ultra high dilutions as the scientific community have termed it in order to avoid ridicule.

They evaluated remedies of Sulphur ranging from tincture to 30X (decimal dilutions) in terms of NMR spectra. Comparison was made between succussed and unsuccussed serial dilutions produced with standard homoeopathic methods. An ultra sonic electrode was used to produce serial dilutions, as was the use of heat to replace the energy of succussion. They were able to show differences in solvent structure in terms of the hydroxyl group of the spectrum, with little or no change in the CH₃ and CH₂ peaks. Differences were noted between undiluted solvent and unsuccussed serial dilutions, which showed further changes in succussed serial dilutions, and these changes became more extreme as the dilution level approached and passed Avagadro's limit. Ultra sonic potencies also showed changes approaching succussed serial dilutions.

Changes were hypothesized to be the result of the structural rearrangement of molecules within the solvent in the form of isotactic, stereospecific, self-replicating polymers. Smith and Boericke (1968) later followed this study with another, examining succussed versus unsuccussed serial dilutions up to 60X, together with bioassays of homoeopathically produced Bradykinin Triacetate up to a 30X. Again an increased area was noted in the

hydroxyl spectrum in succussed versus unsuccussed serial dilutions, and this increased and decreased in cyclic order as the dilution reached 60X. It was theorised that the water polymers had a lower mobility and viscosity than free water molecules, thus increasing the time for exchange of protons with neighbouring alcohol molecules. This would explain changes specifically in the OH portion of the NMR spectrum. The results of the bioassay looked favourable in terms of a correlation to the NMR spectra, however it was considered far too early to draw any definite conclusions.

Another study conducted by Sacks (1983) compared Sulphur in 16 different potencies ranging from tincture, 6X, 12X, and up to 45X, and also centesimal potencies including 30C, 200C, 1M, 50M, and CM. He also compared seven different remedies (*Calcarea carbonica*, *Lycopodium*, *Lachesis*, *Natrum muriaticum*, *Sepia*, *Arnica montana*, and *Nux vomica*) in a 30C potency. An unsuccussed and undiluted ethanol water control showed no variation in terms of spectra throughout the experiment. However the succussed high dilutions showed distinct differences to the control, and to each other. A uniform pattern of peak shape was not discernable in ascending potency order, or within groups. The differences in spectra lay in the hydroxy regions, where merging of the OH and H₂O peaks was evident, perhaps indicating a rapid proton exchange between the two peaks due to a structural rearrangement within the solvent.

Weingärtner (1990) showed that the intensities of the H₂O and the OH signals relative to the CH₂ signals were considerably different in the Sulphur D23 and ethanol control group. Little significance was detected between the lower Sulphur D13 and ethanol group

on statistical evaluation. Parsch (1990:132) criticised the study for not using a potentised solvent in solvent for the control. He also criticised Weingärtner for preparing the sulphur mother tincture and resultant potencies by volume, instead of by weight as indicated in the German Homoeopathic Pharmacopoeia. The resultant ratios of solute to solvent were thus incorrect. However the results did indicate that structural changes do occur in the potentisation process, and that further investigation with the use of NMR spectroscopy was validated (Bol, 1997:13). It is worth noting that problems observed in the preparation process of Weingärtner's research were corrected in this study.

Weingärtner's study was followed by that of Ross (1997). Ross however attempted to show differences between NMR spectra of quinquagenimillesimal (LM) potencies of Hahnemannian produced Sulphur and a lactose based control. Significant differences were noted between individual potencies within the Sulphur group, and within the lactose based control group. Differences also existed between parallel potencies. However most noted differences appeared between LM10 Sulphur potencies and the control. The chemical shifts of all three tested signals compared significantly (CH_2 : $p=0.0352837$; H_2O : $p=0.0480296$; and OH : $p=0.00256373$), and the CH_2 ($p=7.06947 \times 10^{-8}$) and H_2O ($p=0.0166579$) integration values were also significantly different.

This research was followed by Power (1999), who attempted to show differences between quinquagenimillesimal potencies (LM6, LM14, LM22) which exceeded dilution levels used by Ross. He also used two different substances (tin and lead) in order to show differences between substances. Two controls were also used, one which had undergone potentisation as had the test substances, and one which had not. Significant differences

were noted in the MANOVA of the chemical shift values in 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 results in terms of analysis of the integration values were noted 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 ($F < 0.001$). Of the t-test and Mann-Whitney, 139 of 240 tests were found to be significant. This was found in substance vs. control, substance vs. substance, and intra substance. No significant results were found between lactose controls, nor intra substance comparisons of the second lactose control (ie. without potentisation). Both studies conducted by Ross and Power served to further show that structural changes occur in ultra high dilutions, and that high resolution spectroscopy is a valuable tool to indicate these differences.

Perhaps one of the most famous and respected studies was that of Demangeat *et al* (1992). An increased 4 MHz proton relaxation T1 ($p < 0.034$) and a T1/T2 ($p < 0.018$) ratio was observed in saline solutions of a silica/lactose vortexed remedy versus pure saline solvent prepared according to the French Homoeopathic Pharmacopoeia. Dilution levels were measured at levels ranging from 1.66×10^{-5} to 1.66×10^{-29} mol/l. Comparison was made with agitated dilutions of solvent (0.9 % NaCl), and distilled water. T1/T2 values were observed to increase with the addition of a solute in all solvent comparisons.

Extreme precaution was taken in the preparation of the remedies. The effect of atmospheric pressure on dissolved oxygen was carefully monitored during the potentisation process, as it can have an effect especially on T2 molecular relaxation times

due to its paramagnetic nature. Theories given for the observed differences were the interaction of solutes with water molecules through hydrogen bonding, and perhaps also electrostatic forces linked to their dipolar moment. Isotope effects similar to the theories of Berezin (1991) were also considered, as was the structure breaking effect of the solute first introduced by Resch and Guttman (1991). Also discussed was the electromagnetic nature of water acting at long distances on impurities in a solution, provided they are electrically polarisable. Thus it can be seen that a lot of evidence is beginning to amass, however any clear cut theory on the observed results remains elusive.

In a more recent study by Sukul *et al* (2000), Nux vomica in a 30C, 200C, and 1000C (1M) potency was used to observe its effect in reducing alcohol induced sleep time in mice. The NMR spectra of these potencies were then compared in order to try and find a correlation between clinical effect and physical structure of the remedies. The frequency of mice regaining righting reflex (waking and sitting up) was always higher in Nux treated groups as opposed to control groups ($p < 0.01$). Controls were tested with 90% ethanol unsuccussed solvent. NMR spectra were run on Nux vomica 30C, Nux vomica 200C, Nux vomica 1000C, 90% ethanol, ethanol 30C (agitated), and ethanol 30C (unagitated). The T1 values of ^2H nuclei of OH and H_2O peaks showed an increased value in the following order: 90% ethanol, ethanol 30C (agitated), ethanol 30C (unagitated), and Nux vomica 30C showing the highest value. However the Nux vomica 200C gave the lowest values (with the exception of a very low unagitated ethanol 30C OH peak), and then rose again at the Nux vomica 1000C to the highest value, where the

H₂O and OH peaks merged. The CH₂ and CH₃ values showed indecisive variation within sample groups. However the results did show that dilution and agitation result in structural changes of the solvent, which could be responsible for the antihypnotic effect observed in *Nux vomica* potencies on the mice.

2.8 CURRENT SCIENTIFIC THEORIES ON THE MECHANISMS OF HOMOEOPATHIC REMEDIES

Theories on the mechanisms of homoeopathic remedies remain varied, however most endorse the idea of a physical restructuring of the solvent which is able to interact or produce electromagnetic effects within the presence of another electromagnetic field ie. the human organism. Numerous means have been employed to test the hypotheses such as : electric conductivity and dielectricity of aqueous solutions, surface tension, differential (micro)calorimetry, X-ray spectroscopy, UV spectroscopy, Raman spectroscopy, and more commonly NMR spectroscopy (Endler and Schulte, 1994:100-102). Any attempts at an explanation normally centre around complex organised hydrogen bonded molecules in ethanol\water mixtures, or electromagnetic coherence and resonance phenomena.

Anagnostatos *et al* (1991) explain their clathrate model of homoeopathic dilution. In this theory small clusters of the starting substance are created in the initial grinding or dilution stages. These are highly symmetric and stable molecules forming dodecahedral shapes. The surrounding solvent (water) forms a shell around the cluster through hydrogen

bonding, conforming to the shape of the inner cluster. The hydrogen bonded structure is called a clathrate. Hard succussion forces the clusters to break out of the clathrates, leading to new clathrate formation. Some clathrates break in the process, however because of the symmetrical structure, some are able to repair themselves, contracting as they do so. The empty clathrates are now able to act as clusters, producing their own surrounding clathrates from the surrounding solvent, still maintaining the specific symmetry of the initial starting substance even when Avagadro's limit has been passed. Symmetrical hydrogen bonded structures within water are not new, however explaining how these interact with the organism remains difficult. Smith (1994:190-191) suggests that it is possible that dodecahedrons could join together at their pentagonal facets, forming helical conduction paths. This helps explain small dielectric changes measured when water is potentised with a magnetic field.

Perhaps the most recent modification along this structural mechanism of remedy action comes from the discovery of so called *Ie crystals* (I - ice and e - formed through electromagnetic forces) (Ouinn, 1998). Ie crystals were discovered by Shui-Yin Lo, a senior research scientist with the American Technologies Group of Los Angeles. He discovered that water molecules surrounding a dissolved substance solidify at room temperature. This occurs at deconcentration levels of 1×10^{-8} (D8 or C4). These water structures are extremely stable and unique to the substance dissolved in the water.

Succussion actually causes the concentration of these structures to increase, even once the remedy has been diluted past Avagadro's number. These water clusters have been

photographed with an electron microscope, and can aggregate to form even larger clusters, large enough to be seen with a normal microscope. It has also been shown that blood samples stimulated with Ie crystals produce a fifty fold increase in certain immune factors. It is still unknown how Ie crystals within a prescribed remedy might interact with a person, however theories are based on the binding of the crystals to immune factors, or the solvation of antigens by the crystals for excretion by the body.

Antonchenko and Ilyin (1992) also explain the formation of hydration shells around dissolved substances. These in turn form hydrogen bonded chains. Like Smith they suggest that the stability of such structures is maintained by the process of proton transfer along these chains. The succussion process results in the collapse of cavitation microbubbles, resulting in the dissociation of water molecules making available protons required for the stabilisation of the dissipative structures. Since this is related to charge transfer processes, Antonchenko and Ilyin suggest they must have radiation spectral characteristics dependant upon the initial dissolved substance, which can be maintained independent of this solute.

Resch and Gutmann (1991) start their explanation of homoeopathic remedies as a complex system acting as a unity. The fact that a system responds to changes so as to preserve it against external changes, means that all parts are in continuous cooperation, and any change in one part of the system would bring about a response in every other part of the system. Resch and Gutmann suggest that in order to understand any system, it must

be divided into hierarchic levels depending on their qualitative significance in maintaining the system.

The highest hierarchic significance is attributed to molecules at and near the interface ie. between the solute and liquid solvent. Continuous interactions occur between these phases and therefore create high states of tension. Subordinated to this level is that of the inner surfaces around hydrophobic solutes such as gas molecules. These can influence the oscillating pattern of the entire liquid. The oscillating pattern of the gas molecules and the inner surface of water molecules around the gas molecules have the ability to come into harmony with one another. Thus a change in one will effect a change in the other. A change introduced into the water at the interface via a solute will therefore bring about a change in the oscillating pattern of the gas molecules. The gas molecules therefore serve as "synchronisation nodes" in maintaining the oscillating pattern of the liquid.

Below this level are the hydrophilic solutes and the surrounding water molecules or hydration shells. These are able to exert a change on the surrounding interface by inducing for example changes in bond angles and lengths, and as a result causing mechanical changes such as lowering of vapour pressure. Introduction of a solute is therefore able to bring about a change in the entire liquid which is maintained by the gas molecules, even beyond Avagadro's limit. The lowest hierarchic significance belongs to the other water molecules which are required to exercise the structural and thermodynamic properties of the liquid.

A few important facts must be borne in mind. Firstly the different levels are not isolated from one another. Secondly the lower hierarchic levels provide the static boundary conditions for the properties of the dynamic higher hierarchic levels to be maintained and executed.

On dilution of the solute into the water solvent there occurs the integration of a substance with more defined static boundary conditions into the more flexible and dynamic water solvent. As potentisation continues the number of molecules in the higher hierarchic levels increases, while those in the lower hierarchic levels decreases. Thus the original structural information is not lost, but is maintained in a more differentiated system.

Energy is provided by shaking (succussion) as is evident by experiments such as vigorous shaking of a solution before crystallisation. Crystals produced in such a manner show increased thermoluminescence energy as opposed to an unshaken solution before crystallisation.

Another of the physical models is one proposed by Berezin (1991) on isotopic diversity. Berezin proposes a model of homoeopathic action centered on the patterning of stable isotopes in water. The majority of chemical elements consist of two or more stable isotopes. A change of just one neutron in a substance with an atomic mass of 200, causes a variation of 0,5%, which Berezin asserts can cause substantial variations in atomic vibrational frequencies, bond strengths, and changes in chemical activity etc. It would seem almost irrational that Nature would not use such an opportunity to enrich its

bioinformational content. During remedy preparation, strong shaking pushes the system into a non-equilibrium state with an excess of free energy. Such systems are known to be vulnerable to pattern formation. In water there are three isotopic degrees of freedom (H to D and ^{17}O or ^{18}O to ^{16}O). A dissolved molecule is then able to cause ordering or positional arrangement of these isotopes. Since the isotopic combinations provide such an immense information storage capacity, just small fragments could provide the information required to structure the next stage of dilution. An example of such a degenerate system is that of crystallisation where a 'micro-change' in the lattice structure will result in an ordered structure formation conducive to that change throughout the rest of the crystal. It is an idea similar to the clathrate model proposed by Anagnostatos *et al* (1991). A second possibility of maintaining information through dilution stages are polarisation effects. Ionic polarisability is a mass dependant effect and therefore isotopically sensitive. Certain isotopic positions could enhance the polarisability of the solvent.

Berezin also tries to link his isotopic model with theories of consciousness in physical systems. This is because differences in isotope masses result in differences in their gravitational action. Gravitational effects are assumed to lock the brain into a certain mode of thinking. This results in the realisation of a mental image via a route similar to the reduction of a wave function in quantum system from all given possibilities.

An attempt to link consciousness and physics is not a new one. It was one to which the 20th centuries great physicists aspired. Great men such as David Bohm and Wolfgang

Pauli come to mind. Walach (2000) tries to link consciousness and homoeopathy in such a way. He suggests that homoeopathy, which is being constantly tested under the current paradigm of scientific research, tends to show unrepeatable or anomalous results independent of the researcher. The irregularities however show regularities which cannot be dismissed as chance. Thus he proposes a non-local interpretation of homoeopathy based on principles such as Jung's law of synchronicity, and semiotics. Although a substance is extremely diluted in a homoeopathic remedy, Walach asserts that the diluted substance effect is not present in a causal sense (as orthodox explanations follow), but is rather exerted through a system of signs (ie. not causes). In so doing a non-local and acausal means is used to activate connectedness. It is this interconnectedness of all beings which makes homoeopathy possible through consciousness. Extensive discussion between Jung and Pauli throughout their lives brought them to the conclusion that psychological states and physical events could be acausally connected through an element of meaning (Walach, 2000). Thus a homoeopathic remedy is a sign, activating the ritual of homoeopathic case taking, remedy preparation, and study of *Materia Medica*, only activated once the homoeopath has understood the case, thus generating meaning.

Berezin (1994:153-155) supports a similar idea evidenced by experiments on the direct effects of consciousness on physical systems such as electronic random number generators. It would seem that consciousness as a quantum phenomenon and physical reality are linked into an interactive loop (ie. a resonance exists between the two). Thus within homoeopathy, the conscious intention of the doctor forms an interactive loop with

the remedy which has been prepared under the correct protocol. The patient could also be included in the loop.

Returning to a more local and causal interpretation of homoeopathy, Del Guidice (1994:117-119) provides an explanation based on superradiance. It is the phenomenon occurring in a dense set of particles interacting via an electromagnetic radiative field. It consists basically of an oscillation of a large number of water molecules in phase over time and space. He criticises classical physics' explanation of a system configuration based on short range forces under which the electromagnetic field would vanish. It follows the Heisenberg uncertainty principle that this field configuration must fluctuate. Even current solid state physics endorses the idea that the fluctuations are incoherent, and so don't change the classical picture of matter. Del Guidice maintains that this is not true, and that beyond a certain density, the molecules and electromagnetic field couple, and the system sets itself in a coherent configuration, kept in phase by the electromagnetic field.

Del Guidice and Preparata (cited by Bellavite and Signorini, 1995:249-252) propose that the coherent domains are maintained both by the electromagnetic field and a shell of strong hydrogen bonds. Within the coherent phase entropy is zero, therefore making the structure very stable. Since water molecules possess a significant dipole moment, they would be capable of coupling and interacting coherently with another electromagnetic field. According to Del Guidice and Preparata the field need only be very small such as that produced by a dissolved contaminant. Succussion is able to temporarily break and relax the hydrogen bonds of the coherence domains, thus allowing modulation of the

oscillatory field of water by the external electromagnetic field (this allows potentially any source of electromagnetic radiation, not only a dissolved solute). After succussion the shell reforms, protecting the new frequencies from outside disturbances. The existence of phase coherence within a domain serves as the information carrier. Del Guidice *et al* (2000) propose that the homoeopathic remedy containing a number of coherence domains, has a rotation frequency which can neutralise the abnormal magnetic polarisation of cell membranes, thus restoring them to their natural frequency, and bringing health to the organism as a whole.

2.9 SUMMARY

Hahnemannian and Korsakovian potentising techniques are both widely used around the world. This could perhaps be in error, however little concrete evidence exists to explain remedies from a biophysical point of view in terms of the physical restructuring theorised within homoeopathic liquids. The effect that the method of manufacture has in terms of this restructuring leaves another question mark. Differences have been shown to exist between potentised remedies and controls, the most convincing proof seems to have come from NMR spectroscopy. The nature of such an instrument may tell us something about the nature of homoeopathic remedies. In light of this statement, further research to elucidate the physical nature of the remedies is required, and then also to use this information to assess standardisation regulations in homoeopharmaceutic practice.

CHAPTER THREE: MATERIALS AND METHODS

3.1 PRODUCTION OF THE SAMPLE POTENCIES

All potencies were produced by hand according to Method 5a in the German Homoeopathic Pharmacopoeia (1985:20,21). Since the Korsakovian method of dilution has been omitted from the German Homoeopathic Pharmacopoeia (GHP), the methodology was derived from the British Homoeopathic Pharmacopoeia (BhomP), which is based on the GHP (1993:3). Therefore method 5a was followed, however for production of Korsakovian potencies, the emptying of the vial and succeeding dilutions was performed according to Method Br11 in the BhomP (1993:24).

Since the GHP indicates that all dilutions are to be carried out by weight, correct ratios of Natrum muriaticum and 15% ethanol/water had to be used. Therefore for the first centesimal dilution 0.03g of Natrum muriaticum was accurately weighed out on a mass balance accurate to five decimal places. This was then placed in a 5ml screw top bottle to which was added 2.97g of 15% ethanol (S.G. 0.9752). Measurement of the ethanol was achieved by working out the corresponding volume of 3.0455 millilitres. For the second centesimal dilution, 0.03g (0.03076ml) of the 1CH was placed in a 5ml screw top bottle containing 2.97g (3.596 ml) of 87% ethanol. Measurement of the solute containing droplet and the solvent volume was done with a new unused micropipette tip which was discarded after each potency level was reached. Thus a new disposable tip was used for

every potency produced, thereby eliminating any cross contamination. Since all potencies from the 3CH upwards were all produced in 87% ethanol, a volume ratio of 0.03ml : 2.97ml solute to solvent was used as it still maintains a correct weight to weight ratio. For the Korsakovian potencies, preparation was exactly as explained above for the 1CH. However for the 2CK, the vial containing the 1CK was emptied and a corresponding volume of solvent (2.97g) added, assuming that 0.03g remains in the bottle, to produce the 2CK. The corresponding process continued as such up to the 199C.

All remedies were succussed 10 times between potency levels. Two controls were used for the experiment, one for each method of manufacture. In order to subject the controls to the same variables as the test potencies, it was believed that they should also be diluted and succussed in an identical manner. It was impossible to produce a single control and not show bias towards one of the methods. The only difference was that where the test potencies contained a specific weight of solute, an identical weight of solvent was used as solute. Therefore the two controls differed from each other only in terms of their method of manufacture. Any differences between the two would then question the method of dilution as a means of altering solvent structure, and not only the initial starting substance.

It must also be noted that although the GHP indicates 15% ethanol for the first dilution, and succeeding dilutions in 43% ethanol, it was found in previous experimental runs that merging of the OH and H₂O peaks occurred at this concentration, making any speculation difficult. It was therefore decided to use 87% (S.G. 0.826) ethanol for dilutions

succeeding the first centesimal dilution. This also correlated with ethanol/water concentrations used in previously discussed NMR experiments. Ethanol/water concentrations were verified with a hydrometer to conform to standards set out in the GHP. All purified water used for cleaning glassware and preparation of ethanol/water concentrations was obtained from a US Filter in-line water filtration unit. The glassware used was autoclaved at 121°C for 25 minutes and allowed to cool to room temperature before use. All ethanol and water was drawn from the same batch, and the Natrum muriaticum employed was assayed for purity as indicated in the GHP. All potencies were prepared in an overlapping fashion (ie. one potency level of both methods and its control) before moving on to the next potency level. This ensured the same temperature and atmospheric pressure variations across all sample potencies as far as possible. The remedies were prepared in a Labaire laminar flow unit at a constant pressure of 200 Pascals. Fluorescent and ultraviolet lighting were switched off so as not to interfere with the potentisation process.

3.2 PREPARATION OF SAMPLE VOLUMES FOR ANALYSES

Samples had to be produced in a volume large enough to withdraw ten samples of 600µl each. Therefore the volumes produced in the 5ml screw top bottles was not sufficient. A process was required which maintained a proportional dilution process. The sample potencies were produced in 25ml amber glass bottles. In each bottle an actual remedy volume of 16 ml was produced, therefore maintaining $\frac{1}{3}$ of the bottle volume for succussion space.

For all four sample groups the potencies required were a 9C, 30C and 200C. The procedure for all groups was exactly the same. Although it may seem questionable that the desired Korsakovian potencies are being produced in a new bottle, thus overlapping on the Hahnemannian method, the physicochemical deconcentration of the 1 part of the previous potency used is not equivalent. The impact that this has on the solvent structure of the remedy produced for NMR testing is unknown. This is also the only way to produce the remedy in the desired quantity from a stock potency, which is the manner in which practising physicians and homoeopharmaceutical companies would produce a Korsakovian potency. The only way around it would be to produce all potency levels in the 25ml amber glass bottles, which was just not financially viable on a limited budget.

The remedies were produced by placing 15,84 ml of 87% ethanol (S.G. 0.826) into a 25ml amber glass bottle using a 10ml measuring cylinder, 5ml pipette and 1ml pipette (10ml + 5ml + 0.84ml). The 0.16ml was taken from the previous stock potency via a new unused micropipette tip and injected into the amber bottle. The bottle was sealed and succussed ten times, and labeled appropriately. The remedies prepared for testing were wrapped in soft paper toweling and stored in a thick walled cardboard box devoid of as much external stimulus as possible. The remedies were then transported the day following their entire preparation by the researcher via road to the Chemistry Department at University of Natal, Pietermaritzburg campus. Any stimuli such as noise, vibration, temperature, light or any other electromagnetic disturbance was avoided as far as possible. (A complete methodology of remedy preparation can be viewed in appendix A).

3.3 NMR MEASUREMENT OF THE SAMPLES

The number of samples drawn from each respective sample group was set at ten. These were drawn by the NMR laboratory technician (Mr. M. Watson), who then consequently ran the NMR spectra for each group.

The samples were drawn in an overlapping order, that is one sample was drawn from each of the twelve respective groups (four groups each containing three potency levels) before repeating the process again in cyclical order. This was done in order to ensure that if any instrumental or external influence affected the samples, it could be detected as a trend in a linear pattern correlating to the order in which the tests were run. Taking samples in a random order could make discerning this difficult. If there was any correlation within sample groups, they would have been far enough apart to be sure that similarities were a true reflection of specific structural changes within a particular method and potency.

The instrument used was a Varian 500MHz INOVA Spectrometer operating at a frequency of 499.9832268 MHz, utilising the VNMR 6.1C software package by Varian and Associates. In order to make spectra as accurate as possible, they contained 15 770 data points, zero filled to 64K. To this end, the magnet was also shimmed before every run to ensure a homogeneous field around each sample before it was tested. The pulse angle was set at 20.4 degrees, with an acquisition time of 1.9 seconds and four transients per run (4 x 1.9s). A constant temperature of 24°C was maintained during NMR analysis.

Sample volumes of 600 μ l were drawn by micropipette and injected into a coaxial tube. An insert containing an external lock and reference substance were also placed in the tube. An external lock was used so as to completely minimise the effects of a contaminant, which may affect the physical nature of the sample eg. density, viscosity, vapour pressure, dielectric constant etc. Acetone was used both as the external lock and reference substance. This was because it provided firstly a good resonance signal with a chemical shift value outside the range of the other peaks. Secondly the use of deuterated compounds means that the ratio and quantities of external lock to reference compound requires precise measurements to maintain a constant reference signal. This difficulty is managed by using the same compound for both, thus maintaining a fixed accurate signal (Watson, 2000).

A new unused sample tube was used for each of the twelve sample groups, as were the acetone inserts. After each run these were rinsed and cleaned with filtered water and then 87% ethanol. The tubes were then baked in a drying oven until completely dry. The same tube and insert were only used with the same sample, thus preventing any cross contamination.

Data was then recorded in the form of NMR spectra listing the chemical shifts (δ , Hz) and integration values. These were then transferred onto spreadsheets in Microsoft Excel 97©.

3.4 STATISTICAL ANALYSIS

Both the chemical shift and integration values were recorded to a maximum of six decimal places. For the CH₂ and CH₃ chemical shift values where there arose four and three major peaks respectively, these were all averaged to find a single value for each peak. Since the integration values are a ratio of the areas under the peaks relative to one another, all values were derived relative to the CH₃ value which subsequently attained a value of 1. In order to allow for comparison between all integration values, the data was further manipulated to create a relative integration value. This was done by dividing the integration values of each peak by the sum of all integration values for the run.

The data was then transferred from Microsoft Excel 97© into the SPSS© software package for statistical evaluation. For analyses there were two potentiating methods, Hahnemannian and Korsakovian as well as a control for each (groups 1, 2, 3 and 4 respectively). Within each group there were three potency levels (ie. 9C, 30C and 200C). For each potency level there were four independent or unpaired groups (group 1, 2, 3 and 4) of sample size 10 each. Since the sample size per group was small, comparison was made between the four unpaired groups using the non-parametric *Kruskal-Wallis H-test*. If a significant difference existed between any of the groups, individual comparison between each group and another group was made using the *Mann-Whitney U-test*. This was done between group 1 and its control, group 2 and its control, between group 1 and 2, and between the two control groups.

Also, within each group there were three related samples arising from each of the three potency levels. The three related samples within each group were compared using *Friedman's F-test*. If a significant difference existed in any of the groups they were further analysed pairwise using *Wilcoxon's Signed Ranks test*. Wilcoxon's non-parametric test was used again because the sample sizes being used were small. The null hypothesis in each case states that there was no difference between the groups being compared. The alternative hypothesis states that there was a difference. The null hypothesis was rejected if the observed p-value was less than α . Otherwise, the null hypothesis was accepted at the same level of significance. The level of significance (α) of the tests was set at 0.05 (Thomas, 2001). Graphical representation of the p-value comparisons can be seen in appendix C.

3.4.1 THE KRUSKAL - WALLIS H - TEST.

The object of the Kruskal-Wallis rank sum test is to test if k random samples could have come from k populations with the same mean/median (ie. testing the null hypothesis that several samples have been drawn from the same or identical populations, and therefore show no difference). It was therefore used to compare all methods with each other including the controls.

Therefore the hypotheses are stated as follows:

- H_0 : The k population distributions are identical
- H_1 : The k population distributions are not identical

The hypotheses can be accepted or rejected according to the following decision rules:

- Reject H_0 if $p < \alpha$

- Accept H_0 if $p \geq \alpha$

The results of the tests and p-values were determined by SPSS statistical software package. Significant differences led to an evaluation using the Mann-Whitney U-test.

3.4.2 THE MANN – WHITNEY U – TEST

The purpose of the Mann-Whitney test is to see if two independent random samples could have come from two populations with the same median. It was therefore used to compare methods to find out where the differences actually lay.

The hypotheses therefore are stated as :

- H_0 : The two independent population groups have identical medians

- H_1 : The two independent population groups have different medians

The two samples are combined and ranked from smallest to largest. If there are two identical observations, the mean of the two are found and they are given the same rank.

The rank sums of the two samples can then be found. We then compute the U-statistic and compare it with the p-value.

The decision rule therefore reads accordingly:

- Reject H_0 if $p < \alpha$.
- Accept H_0 if $p \geq \alpha$.

Once again the results of the tests and p-values were determined with SPSS.

3.4.3 FRIEDMAN'S F FOR K-RELATED SAMPLES.

The Friedman test is a procedure that compares data from three or more related samples.

It was therefore used to compare all potency levels within the same method.

The hypotheses can then be stated as following:

- H_0 : There is no difference amongst the potency levels
- H_1 : There is a difference amongst the potency levels

The hypotheses are once again evaluated according to the following decision rule:

- Reject H_0 at α level of significance if $p < \alpha$
- Accept H_0 at α level of significance if $p \geq \alpha$

SPSS statistical package was used for the above analysis. Rejection of the null hypothesis will lead to an evaluation using the Wilcoxon Signed Rank Test.

3.4.4 WILCOXON MATCHED – PAIRS SIGNED RANK TEST.

Once a significant difference was elucidated amongst potency levels, it was necessary to find out where the differences lay (ie. between the 9C and 30C, or the 30C and 200C, or 9C and 200C). The Wilcoxon Signed Rank Test allows determination of whether a pair of observations (X_i and Y_i) differ, and also the magnitude of the differences, which can then be ranked.

The hypotheses therefore appear as follows:

- H_0 : There is no difference between the two potency levels.
- H_1 : There is a difference between the two potency levels.

The decision rule follows accordingly:

- Reject H_0 at the α level of significance if $p < \alpha$.
- Accept H_0 at the α level of significance if $p \geq \alpha$.

SPSS was used for data entry and analysis.

CHAPTER FOUR : STATISTICAL ANALYSIS OF THE RESULTS

4.1 CRITERIA GOVERNING THE ADMISSIBILITY OF DATA

When considering the nature of homoeopathic remedies to be operating on an electromagnetic level, one must constantly be aware of the effects that disturbances of a similar nature may have on the samples. This is especially true when considering Heisenberg's Uncertainty principle, and then submitting these remedies to a pulse of electromagnetic radiation. The effect it has on the remedy and on any other within a relatively large radius, even within the next room, is really uncertain. The results observed on NMR spectroscopy show extremely small changes, most of which appear only from the second and third decimal places. Although the spectrometer used was extremely sensitive, a researcher is still left wanting for an even more sensitive and conclusive means of testing homoeopathic remedies. The changes we are looking for are evidently extremely subtle, yet remarkably they do appear to exist.

Bearing this in mind it was extremely important to prepare the remedies with utmost caution as previously explained in sections 3.1 to 3.3. This was to prevent any variability in the results, and therefore attempt to make the results as accurate as possible. During preparation of the remedies and while taking samples for NMR analysis, all bottles and samples containing ethanol were exposed to the atmosphere for as short a period of time as possible. Pipetting equipment was not used across samples, and respective samples to be measured were only taken from a single bottle, and all bottles containing samples were constantly maintained under the same conditions at all times.

The raw data containing chemical shift (δ) values of the CH₃, CH₂, H₂O, and OH values, and resultant relative integration values, were treated according to the statistical methods explained in 3.4.

4.2 COMPARISON BETWEEN POTENCY LEVELS FOR EACH METHOD OF POTENTISATION USING FRIEDMAN'S F-TEST.

Below is a table showing the p-values for comparison of potency levels for each method of potentisation ie. Hahnemannian, Hahnemannian control, Korsakovian, and Korsakovian control.

	Chemical Shift (δ)				Relative Integration Values			
	CH ₃	CH ₂	H ₂ O	OH	CH ₃	CH ₂	H ₂ O	OH
Hahnemannian	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hahnemannian Control	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001
Korsakovian	0.000	0.006	0.006	0.000	0.000	0.000	0.000	0.000
Korsakovian control	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 4.1 Comparison of all potency levels within methods using Friedman's F-Test.

Results of the Friedman Test show very significant differences between all potencies levels within all methods of potentisation. Very little doubt exists as to whether or not there are differences between all of the potency levels. In order to isolate these differences, further analysis had to be conducted using the Wilcoxon Signed Ranks Test.

4.3 PAIRWISE COMPARISON OF POTENCY LEVELS FOR EACH METHOD USING WILCOXON'S SIGNED RANKS TEST

4.3.1 COMPARISON OF HAHNEMANNIAN POTENCY LEVELS

Below is a table representing data used in the comparison of chemical shifts and relative integration values relating to homoeopathically potentised Natrum muriaticum in the classical Hahnemannian method. Before continuing the pairwise comparison of individual potency levels, it is worth noting the observation of a number of trends. The most obvious point is that in most potency comparisons the 30C value decreases below the 9C, and then rises again at the 200C to a value exceeding the 9C. This occurs with remarkable consistency for the mean, minimum, maximum and median values for all peaks. The only notable exception to this rule are the relative integration values pertaining to the CH₂ peaks, which show a consistent rise in value as the potencies ascend for all descriptions previously mentioned. A few other less notable exceptions are:

- the chemical shift value of the CH₃ peak where the 30C slightly exceeds the 9C.

- the relative integration values of the H₂O peak where the 30C values exceed the 9C (except for the minimum value). However the 200C values drop below the 9C again.
- the relative integration maximum value for the 9C - CH₃ peak is less than the 30C value.

Peak type	Potency	N	Mean	Std. Deviation	Minimum	Maximum	Median
Chemical shift values							
OH	9C	10	4.810756	0.0004687	4.80984	4.81137	4.81073
OH	30C	10	4.803895	0.003429	4.79942	4.80705	4.806155
OH	200C	10	4.8258209	0.0003265	4.82534	4.8261	4.8259749
H ₂ O	9C	10	4.037583	0.0004807	4.03672	4.03824	4.0374799
H ₂ O	30C	10	4.031513	0.003413	4.02707	4.03469	4.033675
H ₂ O	200C	10	4.0443939	0.0003954	4.04383	4.04485	4.0446
CH ₂	9C	10	3.077078	0.0002244	3.0768	3.07737	3.07705
CH ₂	30C	10	3.070321	0.003544	3.06599	3.07343	3.072515
CH ₂	200C	10	3.091052	0.0001759	3.09077	3.09122	3.09106
CH ₃	9C	10	0.637243	0.004077	0.62567	0.63891	0.63847
CH ₃	30C	10	0.631804	0.003535	0.6275	0.63495	0.63406
CH ₃	200C	10	0.653696	0.0002689	0.65325	0.65409	0.65367
Relative Integration Values							
OH	9C	10	0.1455377	0.0005179	0.144801	0.146158	0.1455875
OH	30C	10	0.1451373	0.0007126	0.143365	0.145836	0.1453005
OH	200C	10	0.1484721	0.0007068	0.146827	0.149306	0.14858349
H ₂ O	9C	10	0.1319928	0.0004182	0.130904	0.132339	0.1321
H ₂ O	30C	10	0.1327208	0.0009137	0.130192	0.133219	0.133064
H ₂ O	200C	10	0.112793	0.0009583	0.110102	0.113306	0.1131095

CH ₂	9C	10	0.288249	0.0004963	0.287683	0.289192	0.2881555
CH ₂	30C	10	0.2886521	0.0007185	0.287908	0.290341	0.28858699
CH ₂	200C	10	0.2950616	0.0007132	0.294093	0.296724	0.29485701
CH ₃	9C	10	0.4342205	0.0004673	0.433672	0.43508	0.434194
CH ₃	30C	10	0.4334895	0.0009784	0.432704	0.436102	0.433143
CH ₃	200C	10	0.4436733	0.000971	0.442978	0.446347	0.443352

Table 4.2 Comparisons of Means, Medians, Standard Deviations, Minimum and Maximum values for all potencies and peak types for the Hahnemannian method.

4.3.1.1 RESULTS OF TESTS FOR POTENCY COMPARISON

		30C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.028

Table 4.3.1 Resultant p-values for chemical shift comparison of 9C and 30C.

		30C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.028			
	H ₂ O		0.009		
	CH ₂			0.017	
	CH ₃				0.037

Table 4.3.2 Resultant p-values for relative integration comparison of 9C and 30C

Comparison of chemical shift values for 30C and 9C potency levels show a significant difference for all peaks at the α level of significance. The same observation is made of the relative integration values. Thus in all cases of Hahnemannian comparison for the 9C and 30C potencies we reject the null hypothesis, and conclude a difference exists between the two potency levels.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
30C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.3.3 Resultant p-values for chemical shift comparison of 30C and 200C.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
30C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.3.4 Resultant p-values for relative integration comparison of 30C and 200C.

For all peak comparisons of the 30C and 200C potency level, the p-values = 0.005.

Therefore resulting in rejection of the null hypothesis, and acceptance of the alternative hypothesis. This holds true both for the chemical shift comparisons and relative integration values. This means that in all above comparisons, there is a significant difference between these two potency levels.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.3.5 Resultant p-values for chemical shift comparison of 9C and 200C.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.3.6 Resultant p-values for relative integration comparison of 9C and 200C.

The outcome of the 9C and 200C potency level comparison again yields very significant differences for all respective peaks, both for the chemical shift and relative integration values. A p-value = 0.005 in all comparisons results in rejection of the null hypothesis stating that there is no significant difference between potency levels, therefore accepting the alternative hypothesis.

4.3.2 COMPARISON OF HAHNEMANNIAN CONTROL POTENCY LEVELS

Comparison of the table values below again show the same trends as the Hahnemannian potency levels. There is the very consistent decrease in value from the 9C to the 30C, and then a decided increase again above the 9C value for the 200C potency level.

Variations occur for the chemical shift values related to the following parameters for the H₂O peak:

- the 30C mean and minimum value is barely greater than that of the 9C.
- the maximum value almost follows the same trend, with the 30C and 9C having exactly the same value.

Also related to the H₂O peak are the following variations for the relative integration values:

- for the mean, minimum, maximum, and median values, the 30C is significantly greater than the 9C.
- the 200C is lower than both these values.

The relative integration values also show the following deviations:

- the mean, maximum, and median values for the OH peak show the 200C to be greater than the 30C, and the 30C greater than the 9C.
- the minimum and maximum values for the CH₂ peak reveals that the 200C is greater than the 30C, and the 30C is greater than the 9C.

Peak type	Potency	N	Mean	Std. Deviation	Minimum	Maximum	Median
Chemical Shift							
OH	9C	10	4.8113911	0.0004545	4.81035	4.81187	4.8114951
OH	30C	10	4.7409879	0.2204068	4.1137	4.81111	4.8105998
OH	200C	10	4.826228	0.0003999	4.82585	4.82686	4.8260999
H ₂ O	9C	10	4.038296	0.000519	4.03723	4.03901	4.0383749
H ₂ O	30C	10	4.0382961	0.000444	4.03774	4.03901	4.038245
H ₂ O	200C	10	4.044851	0.0003958	4.04434	4.04561	4.0447249
CH ₂	9C	10	3.077631	0.0001765	3.07731	3.07788	3.077685
CH ₂	30C	10	3.077169	0.0003075	3.07674	3.07756	3.0769899
CH ₂	200C	10	3.091274	0.0003756	3.09058	3.09179	3.0912199
CH ₃	9C	10	0.639094	0.0003015	0.63843	0.63936	0.63919
CH ₃	30C	10	0.638561	0.0003947	0.63792	0.63902	0.63851
CH ₃	200C	10	0.653793	0.0004907	0.65291	0.65443	0.6538
Relative Integration Values							
OH	9C	10	0.1453826	0.0006827	0.14416	0.146178	0.1455425
OH	30C	10	0.1454262	0.0007379	0.143687	0.146195	0.145641
OH	200C	10	0.1484611	0.000555	0.14768	0.149306	0.1485875
H ₂ O	9C	10	0.1319699	0.0006895	0.130124	0.132481	0.13216349
H ₂ O	30C	10	0.1330036	0.000766	0.130898	0.133609	0.133252
H ₂ O	200C	10	0.1132431	0.0001532	0.112988	0.113477	0.1132015
CH ₂	9C	10	0.2883386	0.0005638	0.287623	0.289516	0.28824949
CH ₂	30C	10	0.2882953	0.0005786	0.287794	0.289662	0.288085
CH ₂	200C	10	0.2947997	0.0004302	0.294232	0.295407	0.2947125

CH ₃	9C	10	0.4343091	0.0008138	0.433432	0.4362	0.434039
CH ₃	30C	10	0.4332747	0.0009395	0.432591	0.435753	0.43294799
CH ₃	200C	10	0.4434959	0.000344	0.442978	0.444003	0.4435

Table 4.4 Comparisons of Means, Medians, Standard Deviations, Minimum and Maximum values for all potencies and peak types for the Hahnemannian Control method.

4.3.2.1 RESULTS OF TESTS FOR POTENCY COMPARISON

		30C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.007			
	H ₂ O		0.953		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.5.1 Resultant p-values for chemical shift comparison of 9C and 30C.

		30C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.646			
	H ₂ O		0.005		
	CH ₂			0.646	
	CH ₃				0.005

Table 4.5.2 Resultant p-values for relative integration comparison of 9C and 30C.

The p-values for the chemical shift comparison show significant differences for the OH, CH₂, and CH₃ peak. This therefore leads to a rejection of the null hypothesis and acceptance of the alternative hypothesis for these respective peaks. However the large p-value = 0.953, forces us to accept the null hypothesis for the H₂O peak, concluding that no difference exists for this value.

Comparison of relative integration values supports an acceptance of the null hypothesis for the OH and CH₂ peaks. However a rejection of the null hypothesis exists for both the H₂O and CH₃ peaks.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
30C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.5.3 Resultant p-values for chemical shift comparison of 30C and 200C.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
30C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.5.4 Resultant p-values for relative integration comparison of 30C and 200C.

The 30C and 200C potency comparisons yield again very small p-values for both the chemical shifts and relative integration values. This results in a rejection of the null hypothesis in all the above tabulated values, forcing us to accept the alternative hypothesis stating that a significant difference exists between the 30C and 200C potency levels for the Hahnemannian control method.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.5.5 Resultant p-values for chemical shift comparison of 9C and 200C.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.5.6 Resultant p-values for relative integration comparison of 9C and 200C.

Results again yield very small p-values for all peak comparisons, both for chemical shift and relative integration values. Once again comparison of the 9C or 30C with the 200C, leads to a rejection of the null hypothesis for all values, leading us to accept the alternative hypothesis stating that a significant difference exists between the two potency levels.

4.3.3 COMPARISON OF KORSAKOVIAN POTENCY LEVELS

In the table below are the mean, median, standard deviation, minimum, and maximum values for all the Korsakovian test potencies. It is clear that the number of discrepancies^{*} observed from the trend seen with regards to the Hahnemannian potencies is far greater, although the basic trend is still there. This can be observed in the following chemical shift values:

- for the OH minimum value, the CH₂ minimum value, and the CH₃ mean and minimum value, the 9C value is greater than 30C and 200C. However the 200C value remains higher than the 30C.
- for the H₂O minimum value the 200C value is greater than the 30C, which is also greater than the 9C.

For the relative integration values, the following observations can be made:

- For the maximum, median, and mean value of the H₂O peak, the 30C is greater than the 9C value. However the 9C is greater than the 200C value.
- With regards to the minimum value for the same peak, the 200C is less than the 30C and the 9C.

- For the maximum value of the CH₂ and CH₃ peak, the 200C is greater than the 30C, and the 30C is greater than the 9C.

Therefore although there seem to be more variations in the data aside from the pattern mentioned earlier, there still remains a consistent pattern within these variations.

Peak type	Potency	N	Mean	Std. Deviation	Minimum	Maximum	Median
Chemical Shift							
OH	9C	10	4.8172851	0.0002099	4.81695	4.81772	4.8172102
OH	30C	10	4.8144651	0.0003334	4.81391	4.81492	4.8145401
OH	200C	10	4.826431	0.005938	4.81492	4.82966	4.8291502
H ₂ O	9C	10	4.044189	0.0002467	4.04383	4.0446	4.044215
H ₂ O	30C	10	4.041931	0.0003013	4.04129	4.04231	4.0420599
H ₂ O	200C	10	4.045078	0.005817	4.03367	4.04815	4.047775
CH ₂	9C	10	3.083468	0.0002349	3.08289	3.08372	3.083565
CH ₂	30C	10	3.0805911	0.0003332	3.07978	3.0808	3.08077
CH ₂	200C	10	3.091491	0.005956	3.08004	3.09452	3.0943
CH ₃	9C	10	0.645087	0.0001943	0.64469	0.64542	0.64503
CH ₃	30C	10	0.641993	0.0003861	0.64114	0.64232	0.64224
CH ₃	200C	10	0.654301	0.005296	0.643	0.65706	0.65676
Relative Integration Values							
OH	9C	10	0.1454879	0.0005218	0.14449	0.146288	0.1455345
OH	30C	10	0.1452105	0.0006851	0.143637	0.14615	0.145309
OH	200C	10	0.1482671	0.0004202	0.147745	0.148966	0.1482745
H ₂ O	9C	10	0.1320678	0.000545	0.130589	0.13239	0.13225099
H ₂ O	30C	10	0.1327666	0.0008066	0.130514	0.133215	0.1330565
H ₂ O	200C	10	0.11336299	0.0006401	0.112275	0.114237	0.11326665

CH ₂	9C	10	0.2884145	0.0004749	0.287837	0.289485	0.28836051
CH ₂	30C	10	0.2882674	0.0005856	0.287556	0.289651	0.28820099
CH ₂	200C	10	0.2948272	0.0005006	0.29407	0.295534	0.2948465
CH ₃	9C	10	0.43403	0.0005697	0.433566	0.435437	0.433786
CH ₃	30C	10	0.4337554	0.0008846	0.433179	0.436198	0.433439
CH ₃	200C	10	0.44344154	0.0004981	0.442873	0.444328	0.443261

Table 4.6 Comparisons of Means, Medians, Standard Deviations, Minimum and Maximum values for all potencies and peak types for Korsakovian method.

4.3.3.1 RESULTS OF TESTS FOR POTENCY COMPARISON

		30C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.7.1 Resultant p-values for chemical shift comparison of 9C and 30C

		30C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.059			
	H ₂ O		0.007		
	CH ₂			0.169	
	CH ₃				0.059

Table 4.7.2 Resultant p-values for relative integration comparison of 9C and 30C

With regards to the chemical shift comparison of all the peaks, $p = 0.005$. This means that the null hypothesis is rejected, and we must accept the alternative hypothesis. Therefore with regards to chemical shift values for the 9C and 30C comparison of Korsakovian potencies, there is a significant difference. The relative integration values for the OH, CH₂, and CH₃ ($p = 0.059$, $p = 0.169$, and $p = 0.059$ respectively) peaks result in an acceptance of the null hypothesis, and therefore indicating no significant difference between these potency levels with regards to these peaks.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
30C	OH	0.005			
	H ₂ O		0.386		
	CH ₂			0.012	
	CH ₃				0.005

Table 4.7.3 Resultant p-values for chemical shift comparison of 30C and 200C.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
30C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.7.4 Resultant p-values for relative integration comparison of 30C and 200C.

The only p-value greater than the level of significance for the test, is the chemical shift comparison of the H₂O peak ($p = 0.386$). This forces us to accept the null hypothesis, therefore concluding that no difference exists with regards to the chemical shift of the H₂O peak between the 30C and 200C. However all other peak types show a significant difference between the two potency levels at the 5% level of significance, for both the chemical shift and relative integration values.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.012			
	H ₂ O		0.386		
	CH ₂			0.012	
	CH ₃				0.009

Table 4.7.5 Resultant p-values for chemical shift comparison of 9C and 200C.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.7.6 Resultant p-values for relative integration comparison of 9C and 200C.

Comparison of the 200C and 9C potency levels show very similar p-values as the 200C and 30C comparison. The only difference is that the p-values for the OH and CH₃ chemical shift signals are slightly higher. The H₂O chemical shift value ($p = 0.386$) is

considerably greater than the level of significance for the test. This means that we must accept the null hypothesis (since $p \geq \alpha$), and there is no difference between the two potency levels for this peak. However all other values both for the relative integration and the chemical shift values, are lower than the level of significance of the test. This again means that the null hypothesis is rejected, and the alternative hypothesis stating that there is a difference for these peaks between the two potency levels, must be accepted.

4.3.4 COMPARISON OF KORSAKOVIAN CONTROL POTENCY LEVELS

The Korsakovian control perhaps shows the highest consistency amongst potency levels.

The following observations can be made concerning the integration values:

- the H₂O mean, median, and maximum values show the 30C to be greater than the 9C, however the 200C remains lower than both these potencies. The minimum values reveal that the 200C is greater than the 30C, which is itself greater than the 9C.
- the CH₂ and CH₃ maximum values show a similar trend where the 30C is greater than the 9C. However the 200C is greater than the 30C and 9C.

Peak type	Potency	N	Mean	Std. Deviation	Minimum	Maximum	Median
Chemical Shift							
OH	9C	10	4.8107279	0.0002747	4.81035	4.81111	4.8105998
OH	30C	10	4.809892	0.0003747	4.80933	4.81035	4.8098402
OH	200C	10	4.829963	0.0003354	4.8294	4.83042	4.8299098
H ₂ O	9C	10	4.0376861	0.0003336	4.03723	4.03824	4.0377402
H ₂ O	30C	10	4.0373302	0.0003668	4.03697	4.03774	4.03723
H ₂ O	200C	10	4.048406	0.0002926	4.04815	4.04891	4.0484099
CH ₂	9C	10	3.076934	0.00024	3.07642	3.07731	3.0769899
CH ₂	30C	10	3.076138	0.0002882	3.07572	3.07648	3.0760701
CH ₂	200C	10	3.094825	0.0002781	3.09433	3.09522	3.09487
CH ₃	9C	10	0.638359	0.0002396	0.63792	0.63877	0.638385
CH ₃	30C	10	0.637537	0.00041	0.6369	0.6381	0.637495
CH ₃	200C	10	0.657291	0.0003649	0.65672	0.65774	0.657355
Relative Integration Values							
OH	9C	10	0.1457207	0.0003543	0.145265	0.146335	0.14577951
OH	30C	10	0.1453458	0.0005386	0.144284	0.146067	0.145488
OH	200C	10	0.1485493	0.0004041	0.147932	0.149169	0.148618
H ₂ O	9C	10	0.1321622	0.0002479	0.131727	0.132449	0.132242
H ₂ O	30C	10	0.1330713	0.0006005	0.131475	0.133469	0.1332965
H ₂ O	200C	10	0.11303097	0.0004535	0.112327	0.114038	0.1130095
CH ₂	9C	10	0.2880909	0.0003182	0.287595	0.288476	0.2880605
CH ₂	30C	10	0.2878365	0.0003826	0.287484	0.288589	0.28778751
CH ₂	200C	10	0.2947393	0.0003922	0.294065	0.295246	0.29480951

CH ₃	9C	10	0.4340264	0.0003313	0.433713	0.434755	0.43391649
CH ₃	30C	10	0.4337469	0.0007932	0.433088	0.435652	0.43350799
CH ₃	200C	10	0.4436804	0.0003856	0.442885	0.444161	0.443673

Table 4.8 Comparisons of Means, Medians, Standard Deviations, Minimum and Maximum values for all potencies and peak types for the Korsakovian Control method.

4.3.4.1 RESULTS OF TESTS FOR POTENCY COMPARISONS

		30C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.005			
	H ₂ O		0.007		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.9.1 Resultant p-values for chemical shift comparison of 9C and 30C.

		30C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.013			
	H ₂ O		0.007		
	CH ₂			0.013	
	CH ₃				0.074

Table 4.9.2 Resultant p-values for relative integration comparison of 9C and 30C.

Comparison of the 30C and 9C Korsakovian Control method show a significant difference between all peak types for the chemical shift comparison. All p-values are well lower than the level of significance for the test, the highest p-value being 0.007 for the H₂O peak. The alternative hypothesis is therefore accepted for all chemical shift values.

The relative integration values show slightly higher p-values. The OH and CH₂ peaks reveal p-values = 0.013, and for the H₂O peak p = 0.007. All these values suggest that we accept the alternative hypothesis, thus a significant difference exists between these potency levels for these values. However for the CH₃ peak, p = 0.074. This means that we

must accept the null hypothesis and no difference exists between the 9C and 30C relative integration values for this peak comparison.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
30C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.9.3 Resultant p-values for chemical shift comparison of 30C and 200C.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
30C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.9.4 Resultant p-values for relative integration comparison of 30C and 200C.

All peak comparisons, both for chemical shift and relative integration values, give p-values = 0.005. This means that the alternative hypothesis is accepted in all cases and a significant difference must exist between the 200C and 30C potency levels for all peak types.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.9.5 Resultant p-values for chemical shift comparison of 9C and 200C.

		200C			
		OH	H ₂ O	CH ₂	CH ₃
9C	OH	0.005			
	H ₂ O		0.005		
	CH ₂			0.005	
	CH ₃				0.005

Table 4.9.6 Resultant p-values for relative integration comparison of 9C and 200C.

As with the previous 200C and 30C comparisons, all potency comparisons reveal a p -value = 0.005. Once again comparison with the 200C potency level shows significant results. The alternative hypothesis is again accepted in all peak comparisons.

4.4 KRUSKAL – WALLIS COMPARISON OF POTENTISATION METHODS

The table below represents all the p -value results for all potentisation method comparisons at the three respective potency levels. The values show a peculiar result in that all chemical shift comparisons for all peaks and potency levels, are conclusively different from one another ($p = 0.000$). Therefore with regards to comparison of the methods of potentisation, there is no doubt as to whether a difference exists somewhere when looking at chemical shift values. However, the relative integration values conclude that there is statistically no difference between any of the methods and their controls as most values exceed the level of significance of the test quite considerably, forcing us to accept the null hypothesis.

The only exceptions lie in the 30C potency with regards to the H_2O peak ($p = 0.007$), the CH_3 peak ($p = 0.041$), and the CH_2 peak ($p = 0.011$) which all reveal a significant difference between the methods of potentisation. Although we have not yet isolated between which methods the differences exist, it does strike one as a peculiar coincidence that the only significant relative integration values all occur at the 30C potency level on molecules with more than one hydrogen bond.

The reason why the chemical shift values yield such results while the relative integration values don't, could be a result of the normalising procedure. The relative values produced give a value relative to the original integration value, in the same proportions, however the figure produced is smaller and differences are only picked up between methods in later decimal places. It can be reasoned however that the procedure could smooth out irregularities within the data, and show where the real differences are hidden. From the table below it would appear that the H₂O peak could give some clues.

These anomalies had to be further investigated to find out exactly where the differences lay.

	Chemical Shift (δ)				Relative Integration Values			
	CH ₃	CH ₂	H ₂ O	OH	CH ₃	CH ₂	H ₂ O	OH
9C	0.000	0.000	0.000	0.000	0.456	0.518	0.449	0.682
30C	0.000	0.000	0.000	0.000	0.041	0.011	0.007	0.549
200C	0.000	0.000	0.000	0.000	0.433	0.738	0.100	0.424

Table 4.10 Comparison of all potentiation methods using the Kruskal – Wallis H-Test.

4.5 MANN-WHITNEY COMPARISON OF METHODS AND CONTROLS

4.5.1 MANN-WHITNEY COMPARISON OF THE HAHNEMANNIAN METHOD AND THE HAHNEMANNIAN CONTROL

	Chemical Shift (δ)				Relative Integration Values			
	CH ₃	CH ₂	H ₂ O	OH	CH ₃	CH ₂	H ₂ O	OH
9C	0.002	0.000	0.009	0.008	0.940	0.705	0.473	0.821
30C	0.000	0.000	0.000	0.002	0.257	0.199	0.016	0.226
200C	0.449	0.124	0.041	0.061	0.623	0.427	0.059	0.791

Table 4.11 Mann -Whitney U-Test comparison of the Hahnemannian potentiising method and its control.

When one looks at the above table, the most striking figures come from the 9C and 30C chemical shift values. All p-values are well below 0.05 ($p < \alpha$). The alternative hypothesis is therefore accepted at these values, and one can conclude that for these parameters at the 9C and 30C potency levels, there must be a difference between the Hahnemannian method and its control. The 200C potency comparison however yields

less positive results. All peak types, excepting the H₂O peak, show a p-value greater than 0.05, forcing an acceptance of the null hypothesis stating that no difference exists between the Hahnemannian method and its control at the 200CH potency level for these respective peaks, with regards to the chemical shift values.

The relative integration values give rise to only one significant result which is represented in the H₂O peak for the 30CH potency level ($p = 0.016$). All other relative integration values resulted in acceptance of the null hypothesis.

4.5.2 MANN-WHITNEY COMPARISON OF THE KORSAKOVIAN METHOD AND THE KORSAKOVIAN CONTROL

	Chemical Shift (δ)				Relative Integration Values			
	CH ₃	CH ₂	H ₂ O	OH	CH ₃	CH ₂	H ₂ O	OH
9C	0.000	0.000	0.000	0.000	0.226	0.130	0.880	0.173
30C	0.000	0.000	0.000	0.000	0.940	0.041	0.019	0.496
200C	0.004	0.001	0.000	0.000	0.257	0.545	0.174	0.151

Table 4.12 Mann -Whitney U-Test comparison of the Korsakovian potentising method and its control.

Results of the Korsakovian comparison give rise to a very similar picture to that of the Hahnemannian comparison. However where the Hahnemannian comparison showed no statistical significance for most 200CH chemical shift values, the Korsakovian method and its control are undoubtedly significant for all peak types. Therefore all chemical shift values for all peak types and potency levels lead to an acceptance of the alternative hypothesis, and a significant difference exists between the method and its control with respect to chemical shift values.

The relative integration values also yield very similar results to the previous comparison. The only significant p-values are again at the 30C potency level. The H₂O peak ($p = 0.019$) and CH₂ peak ($p = 0.041$) yield significant results. However for all other relative integration values, we must once again accept the null hypothesis and conclude that no difference exists when considering the relative integration values for these values.

4.5.3 MANN-WHITNEY COMPARISON OF THE HAHNEMANNIAN AND KORSAKOVIAN METHODS

	Chemical Shift (δ)				Relative Integration Values			
	CH ₃	CH ₂	H ₂ O	OH	CH ₃	CH ₂	H ₂ O	OH
9C	0.000	0.000	0.000	0.000	0.257	0.406	0.173	1.000
30C	0.000	0.000	0.000	0.000	0.082	0.096	0.850	0.880
200C	0.023	0.022	0.022	0.022	0.496	0.545	0.112	0.151

Table 4.13 Mann -Whitney U-Test comparison of the Hahnemannian and Korsakovian potentiising methods.

When one looks at the p-values for the chemical shift results above, one cannot but be surprised by the uniformity of the values. All chemical shift comparisons show a rejection of the null hypothesis, and therefore an acceptance of the alternative hypothesis. A significant difference is therefore observed between the Hahnemannian and Korsakovian methods of potentisation for the chemical shift comparisons, for all potency levels and all peak types.

The relative integration values are somewhat less positive. Even where the 30C potency gave a few significant values in method and control comparisons, it is now also insignificant ($p = 0.850$). All relative integration values force us to accept the null hypothesis. Therefore no significant difference is observed between the two methods of potentiation at any of the potency levels for any of the peaks with regards to relative integration values.

4.5.4 MANN-WHITNEY COMPARISON OF THE HAHNEMANNIAN CONTROL AND KORSAKOVIAN CONTROL

	Chemical Shift (δ)				Relative Integration Values			
	CH ₃	CH ₂	H ₂ O	OH	CH ₃	CH ₂	H ₂ O	OH
9C	0.001	0.000	0.007	0.004	0.326	0.364	0.473	0.364
30C	0.000	0.000	0.000	0.006	0.028	0.028	0.427	0.450
200C	0.000	0.000	0.000	0.000	0.273	0.880	0.034	0.705

Table 4.14 Mann -Whitney U-Test comparison of the Hahnemannian and Korsakovian controls.

All chemical shift results show p-values less 0.05. We therefore accept the alternative hypothesis stating that a difference exists between the two controls at the respective potency levels for all peak types regarding chemical shift values.

The relative integration values once again indicate an acceptance of the null hypothesis for most peaks since all p-values exceed 0.05. However significant differences are experienced once again at the H₂O peak ($p = 0.034$), albeit this time at the 200C level. The 30C potency level also shows significant differences, again for the CH₂ peak ($p = 0.028$), and also for the CH₃ peak ($p = 0.028$) thus rejecting the null hypothesis.

CHAPTER FIVE: DISCUSSION

The results of this study suggest that significant differences exist between Hahnemannian and Korsakovian potencies. This also holds true for intra-potency comparisons for each respective method and its control.

Significant differences were found to exist between the 9C, 30C, and 200C potency comparisons for almost all peaks, both for the chemical shift and relative integration values (A summary of significant values can be observed in appendix D). This suggests that for each respective method (Hahnemannian and Korsakovian) there are distinct physicochemical identities occurring, and evolving as potency level increases.

It is interesting to note that the Hahnemannian test method was the only method to provide significant differences for all peaks and potency levels. The Korsakovian test method however showed the greatest number of insignificant results. The significance of such observations is unclear especially when compared to the control methods. Perhaps the introduction of a solute allows the solvent to explore a vast number of configurations. The precision of such an act is dependent upon the degrees of freedom possessed by the solvent to support all the possible variations of structure. Conceivably a more precise and organised dilution method allows greater variation in structure. Such an observation may also require the addition of a specific structure-determining solute.

The general trend observed with regards to the chemical shift values was a decrease in value from the 9C to the 30C, and then an increase again at the 200C. This suggests that there is a shielding of protons as potency levels increases towards the 30C, and then a deshielding as the potency rises again to the 200C. This reverse in direction of chemical shift values past the 30C makes any explanation difficult. Differences as low as around 0.2 Hertz up to 10 Hz can be found between potency levels, with the greatest variations observed between the 30C and 200C, and the 9C and 200C.

Comparison of parallel Hahnemannian and Korsakovian test potencies certainly yield significant differences with regard to chemical shift values for all peak types and potency levels. Relative integration levels however show no significant differences for any of the peaks or potency levels. Differences in chemical shift values are dependent on a proton's resonant frequency which is subject to a number of factors such as the strength of an applied magnetic field and shielding or deshielding by valence electrons. It very simply indicates differences in energy between precessing protons. The relative integration values were derived from the integral values. This value is proportional to the number of protons generating a peak at a specific chemical shift value.

Chemical shift comparisons between methods show very uniform energy differences between peaks. A difference in resonant frequencies between the Hahnemannian and Korsakovian potentiising methods shows that for all peaks, the 9C provides differences of around 3.2 to 3.9 Hz, the 30C at around 5.1 to 5.2 Hz, and the 200C at 0.2 to 0.35Hz. Comparison of the two controls for all peaks reveals a difference of 0.3 to 0.37 Hz for the

9C, 0.48 to 0.52 Hz for the 30C, and a shift of around 1.8 Hz in the opposite direction for the 200C (as opposed to the 9C and 30C which are both shifted in the same direction).

Comparison of the Hahnemannian method with its control gave differences of 0.27 to 0.93Hz for the 9C, around 3.4 Hz for the 30C, and 0.05 to 0.2 Hz for the 200CH.

Comparison of the Korsakovian method and its control produced differences of 3.25 to 3.36 Hz for the 9C, 2.2 to 2.3 Hz for the 30C, and 1.5 to 1.8 Hz for the 200C in the opposite direction.

It should be pointed out that the use of NMR to find differences within homoeopathic remedies, and the results suggest the existence of such differences, leaves us to hypothesize that electric fields are set up within water or ethanol\water solutions. The strength of these fields must be expectedly small, nonetheless, protons within the solution must precess at a rate proportional to the field. Using a 500 MHz spectrometer with a magnetic field of 11.7 Tesla leaves little space for a proton which was initially precessing at approximately 50Hz to show itself. Thus our point of reference can only be each of the methods relative to one another, which is not an absolute value. The comparison values are by no means negligible, and may indicate differences in spin coupling (interactions involving nuclei and the bonding electrons), and thus also differences in bond angles relative to one another (Shaw, 1976:215-223, 238-240).

It has so far been observed that comparison of the ascending potency levels yield significant differences both for chemical shift and relative integration values for all methods and controls. Parallel potency comparisons of different methods however tend to

show no significant differences for the relative integration values, and yet chemical shift comparisons do show significant values. These observations suggest that the potentiation process lays down some sort of structure, independent of the starting substance or solute. This is evident from the fact that both controls provide differences between the three potency levels, and that these changes are different from each other in parallel comparisons, and different to their test methods prepared with a solute. Thus it would seem that the potentiation process lays down a specific structure which is reflected in the significant differences observed in the relative integration values as potency level increases, and a lack of significance in parallel potency comparisons between methods. Chemical shift values however remain significant in nearly all comparisons, including parallel potency comparisons.

If we assume that energy is equivalent with information storage, then it seems reasonable that if there is any difference in the information storage of potentiation methods, it would be revealed mainly in the chemical shift values, although one might expect minor perturbations within the relative integration values. Thus although the initial hypotheses expected differences in both the chemical shift and relative integration values, these may perhaps be adapted as explained above.

Significant results do not become apparent at high potencies as was observed by Ross (1997:58-59), although it must be noted that his scale of deconcentration was far greater. However the generality of observed results leads one to assume that potentiation, irrespective of method, lays down some sort of a structure, or alternatively, 'formats' the

liquid in a manner for specific information storage. The specific information can then be stored simultaneously as the potentisation process continues. Perhaps the quality of the 'format' is dependent upon the precision of the method employed. Smith (1994 : 193-200) discusses the possibility of succussion (or an additional magnetic field was found to produce similar results) to 'format' water, thus readying it for bioinformation storage by a magnetic vector potential. This suggests that an unpotentised control may serve as a superior means of hypothesis testing.

Thus a holistic view of all peak comparisons for each potency suggests that very specific information storing occurs within homoeopathic remedies. This is apparent firstly from the significant differences noted between the methods and also the differences noted between the controls. Thus, the method of dilution is somehow stored within the information content. Secondly, a significant difference between the methods and their controls suggests that the introduction of a solute into the solvent is also somehow stored within the information content. Differences between potency levels indicate a third factor that is part of the remedy's information content.

The spectra do not provide enough evidence to comment on any of the current theories of remedy mechanisms in too much depth. The clathrate model provided by Anagnostatos *et al* (1991) describes a large amount of hydrogen bonding in the forming of complex structures within water. One would perhaps expect larger increases in chemical shift values which does not seem to occur. It must be remembered that we can only compare

the methods relative to each other, and the act of potentisation obviously induces certain changes within a remedy, even in the controls used. However if there are clathrate structures which solidify in solution as proposed by Shui-Yin Lo (Quinn, 1998), they would probably not be picked up either, unless solid state spectroscopic methods could be used. Similarly the theory provided by Resch and Guttman (1987:301-335) suggests that a solute causes shortening of hydrogen bonds, and modifies the overall structure and density gradients, while 'structure makers' (gases) then maintain these changes via the effect of their oscillating pattern at interfaces within the solution. One would also expect these changes to be observable on NMR spectroscopy. The difference in chemical shift values does not reject such a hypothesis. However to pin point the reasons for such differences are difficult. It must be remembered that any specific information that may be stored within a remedy is represented as a single value. Thus the superposition of all possible states of information is reduced to one value, making a comparison that is quite coarse.

Much scientific evidence as carried out by Endler *et al* (1997) on the effect of thyroxine-controlled metamorphosis of frogs, has revealed that information from molecular thyroxine can be transmitted through homeopathic dilutions, electronic circuitry, stored on compact disks, and produce an effect through sealed glass vials. The obvious conclusion is that bio-information is electromagnetic in nature. The responses observed on NMR spectroscopy lead one to believe that small electric fields are responsible for the differences observed. Smith (1994:189) points out that chemical analysis by

spectroscopic methods demonstrates that there are specific frequency patterns corresponding to specific chemical bonds.

The theoretical mechanisms of setting up coherent electric fields within a polar substance such as water are variable, yet all possible, and perhaps even synergistic. Smith (1994:191) illustrates the fact that collapsed clathrates would form dodecahedron structures and could bind to each other at their pentagonal facets. A reversal of bonding between one hydrogen and two oxygen atoms would create a hydroxyl ion dipole and a strong electric field. The theory of superradiance proposed by Del Guidice (1994:117-119) could however provide greater insight into the small differences observed in the spectra.

Water and ethanol molecules, being both polar substances, have permanent electric dipoles. In classical physics and chemistry one would assume that the continuous interaction of molecules within a liquid would result in the overall electric field produced by the oscillating electric dipoles at equilibrium to reach zero. However because of the Heisenberg uncertainty principle, the electric field must fluctuate. Del Guidice maintains that beyond a certain density the oscillations of the electric field and the solvent molecules couple to form a coherent configuration, the size of which depends on the electromagnetic field (approximately 100 μm). The coherent oscillation of the electric field and molecules condenses the coherent domains by an amount proportional to the gained energy. The system will attempt to increase its density as much as possible, which theoretically may result in the Ic crystals discovered by Shui-Yin Lo.

Since the solvent has a strong dipole moment and is interacting collectively making it more easily polarisable, even a small electric fluctuation on the surface of a solute could modulate the coherent field. The field could then also be modulated by an externally applied electric field. Thus it provides a theoretical basis for very low frequency polarisation fields set up in a polar solvent in the order of a few hundred micrometres. Such very low frequency fields are probably more in line with the observed NMR results. These small differences in chemical shift values must also indicate that resonant frequencies within a homoeopathically potentised remedy are extremely or very low frequency.

Much experimental work with extremely low frequency radiation has been accomplished. It has been found that even tapping organic molecules at ranges from 1-1000 Hz can stimulate them to produce narrow-band coherent or partially coherent far-infrared radiation. Cellular activity (binding of muscle enzymes) was also shown to be modified by an oscillating magnetic field equal in strength to the earth's magnetic field (0.02 to 0.07mT) (Towsey and Hasan, 1995:219). A large amount of relevant studies pertaining to the effects of electromagnetic fields has accumulated over the last few decades (Bellavite and Signorini, 1995:265-275).

The aforementioned discussion may suggest an adaption of the coherent domains theory provided by Del Guidice based on observations of the NMR spectroscopy resonance phenomena. It would seem inevitable that a coherent electric field set up by the collective

motion of oscillating dipoles would cause the protons in the solution to precess at a rate which is dependant on the strength of the field. Since the protons have a charge, they will generate an oscillating electric field of the same frequency, and such is the state of the remedy until taken by a patient. A diseased state or any particular state of a living being must produce an oscillating electric field of a certain frequency specific to that state. If the remedy and a diseased person producing a certain excitation frequency come into contact causing their fields to couple, the protons in solution will absorb the energy, causing a spin change. The amount of energy required to cause a spin change at such low fields is extremely small and obeys the equation (a random small field strength of 1 mT is assumed):

$$\Delta E = \frac{h\gamma B_0}{2\pi}$$

where: h is Planck's constant = 6.626×10^{-34} J.s

γ is the magnetogyric ratio = 26.75×10^7 rad T⁻¹s⁻¹

B_0 is the applied magnetic field = 1×10^{-3} T

Therefore the energy required for one proton in the system to change its spin orientation from the ground to excited state is in the order of 10^{-29} joules, very small indeed! The idea of using proton spins to store information in ordinary liquids (at room temperature) using NMR spectroscopy, has recently become the goal of physicists to construct quantum computers (Gershenfeld and Chuang, 1998:50-55). Rudimentary operations have been performed, showing that molecules have the ability to store and compute

information. The only problem is that once a computation is performed, protons lose their coherence and fall back to the ground state.

However in terms of a homoeopathic remedy, decoherence could provide a means of proton relaxation (via dissolved oxygen obtained during the potentisation process) required to produce a radiofrequency signal to transmit the message required for healing. If this wasn't so the system would become saturated, and a signal would not be produced. The state of a quantum system before a measurement is undefined, having only the potentiality of certain values with certain probabilities ie. the Copenhagen Interpretation (CHI) (Mc Evoy and Zarate, 1996:161), in other words the wave function for a system is represented by an infinite number of wave functions. A measurement, which could constitute an atom colliding with another atom or a stray photon, results in the collapse of the superposition of quantum states into a single definite state, which is detected by an observer. This phenomenon results in decoherence. Thus the potential for antidoting of a remedy by strong electromagnetic sources.

Finally, the use of NMR spectroscopy has served to confirm the hypothesis that physicochemical processes are evolving within homoeopathic remedies. The use of such a small study to attempt some form of molecular standardisation of remedies through an ordered pattern of observations is practically not possible. Further study requiring comparison of a large number of different substances and potencies is required. This would also require standardisation of the potentisation process so that all researchers may

compare results. Only once this huge monolith has been erected can more convincing hypotheses be put forward concerning the nature of homoeopathic remedies.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The results obtained serve to confirm the hypotheses that distinct physicochemical structures are developed within homoeopathic remedies, and it is highly probable that they are responsible for the homoeopathic results observed in clinical practice. The Wilcoxon's Signed Ranks Test showed significant differences in almost all intra-potency comparisons for each method and its respective control. This served to confirm the first and second hypotheses stating that changes are occurring and are specific to each method.

The Mann-Whitney U-test provided significant differences for nearly all chemical shift comparisons of parallel potencies, however almost all relative integration values showed no significant difference. This led to the hypothesis that a standard process occurs in homoeopathic remedies during potentisation irrespective of method, which allows information storage. This is reflected in the changes observed in relative integration values as potency increases, but no significant differences were observed in parallel potency comparisons. This led to a slight adaptation of the third hypothesis in that differences were no longer expected between parallel relative integration comparisons.

The final conclusion drawn from the results is that Hahnemannian and Korsakovian potencies are not equivalent in homoeopathic practice. This is clear both in a parallel comparison of *Natrum muriaticum* prepared according to both protocols, and a parallel

comparison of a potentised control for each method utilising the solvent as the initial solute. This suggests that the method of dilution is part of the remedy's information content, as is the initial solute represented by the significant results obtained from substance versus control comparisons. It is not possible to say if one method is superior to another, as the quantitative comparisons obtained from spectroscopy are not able to give us a qualitative feel for such an understanding. This understanding needs to come with a correlated clinical study where patients could reveal a qualitative measure of the efficacy achieved by each method.

Nonetheless, this study has put a big question mark above the homoeopathic community's and homoeopharmaceutical industry's equivalent use of the two methods. They are not the same according to NMR spectroscopic methods, and perhaps should not be used together or even interchanged from higher dilution levels. A strict standardisation is required around the world from all manufacturers regarding the potentising process. This would go a long way to reduce the mystery surrounding homoeopathy by reducing the number of questions that are aroused through anomalous results observed in practice. Results could then be more easily traced to their cause. Since the Korsakovian method makes standardisation so difficult, perhaps it would be best to omit it in order to endorse the scientific validity of homoeopathy.

6.2 RECOMMENDATIONS

The large amount of research now being conducted into a working, scientific, hypothesis of homoeopathic remedies and their mechanisms, is proof that a multi-disciplinary scientific community believes that a plausible explanation of homoeopathy is possible. In order to make results comparable, it would seem obvious that all remedies be prepared according to a precise standard, endorsed by current chemical and physical authorities. The Hahnemannian method indicates exact precision, and as such should be the only method employed in scientific research, followed according to a reputable homoeopathic pharmacopoeia such as the GHP. General practitioners should not neglect quality either in an attempt to cure patients in public practice!

Further aspects which need to be taken into account when using NMR spectroscopy in remedy study are as follows:

1. Strength of the magnetic field

The current thrust of the mechanisms of remedy action involves the production of electromagnetic fields. Electromagnetic fields are produced by charged atomic particles moving in a magnetic field. As such the effect of very strong magnetic fields used in high resolution NMR spectroscopy may have an uncertain effect on the remedy. It may prove useful to conduct research on homoeopathic remedies using spectrometers of different field strengths, ranging from very low to very high. This is the topic of research which

will be conducted by Cason (2001) in the near future. The results of this study should prove rather exciting.

2. Use of an unpotentised versus potentised control

The results suggest that the potentisation process causes some form of physicochemical change within the remedy solvent. Power (1999:39) used both a potentised and unpotentised lactose control. Unlike the current study no differences were found to exist between the controls, although differences were observed in intra-substance potency comparisons, which did correspond to the current study. Power therefore proposed the idea that the process of dilution plays a role in the production of homoeopathic potencies. The solvent only attains its unique characteristics with the addition of a specific solute. The addition of lactose to the solvent may have produced certain unknown results. He therefore proposes the use of pure solvent as a control to better assess the changes brought about by the LM potencies. Similarly two pure solvent controls, both potentised and unpotentised, may provide a better milestone in terms of assessing the observed changes due to the potentisation process.

3. Control of external factors

Perhaps the biggest worry using NMR spectroscopy was whether or not the observed changes were due to the absorption of moisture during the potentisation process, even though careful consideration had been taken into account. If this was the case, one would

expect the largest changes to occur at the OH peak. However all peaks show a uniform shift across the spectrum specific to the substance and potency level. The change in direction of chemical shifts from the 30C up to the 200C, also suggests that moisture absorption was negligible, and was not responsible for the observed results. Although the control of external factors such as pressure and temperature are scientifically validated from a chemist's viewpoint in order to maintain a uniform solvent free from variations in for example atmospheric oxygen, one must question excessive control as unnatural to the potentisation process. Perhaps dissolved oxygen is necessary in certain amounts to allow for relaxation to occur more readily. One must therefore attempt to replicate the potentisation process as is done in practice as closely as possible, with as few variations (variables) as possible. Thus standards for temperature and pressure variation need to be set in scientific research.

4. Use of a wider variety of substances

The results of a wide variety of substances prepared according to standardised methods, would allow an in depth comparison of values for trends that should arise. If a large archive or results all yield anomalous comparisons, instead of definite trends, then NMR spectroscopy may need to be re-evaluated as a tool for homoeopathic remedy study.

5. Standardisation of the pharmaceutical process

As already mentioned, strict standardisation of the potentiation process is required for worthwhile scientific evaluation between researchers. Human error is an unavoidable fact of remedy preparation. Succussion force may therefore require control with calibrated machines. This current study may receive criticism for its apparent lack of blinding measures. Such measures serve only to question the integrity of the researcher. Nonetheless it is part of scientific research, and helps avoid experimental bias. If the research budget permits, these measures should be undertaken.

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APPENDIX A : METHODOLOGY OF REMEDY PREPARATION

Method 1:

Aim: To prepare Hahnemannian 9CH, 30CH, and 200CH potencies.

Apparatus: Crushed rock salt (Sodium chloride)

5ml screw top bottles

Purified water

15% ethanol

87% ethanol

Paper toweling

25ml amber bottles.

Labels and pens

Chemical balance (accurate to 3 decimal places)

Spatula

5ml and 2ml pipettes, and 10ml measuring cylinder

Micropipettes

Paper

- Method:
1. Rinse and autoclave equipment, allowing to cool.
 2. Place single sheet of paper on chemical balance and tare.
 3. Weigh out 0.03g of Sodium chloride using mass balance and place into first 5ml screw top bottle.

4. Place 2.97g (3.0455 ml) 15 % ethanol into first 5ml screw top bottle using 5ml pipette.
5. Succuss ten times and label "Natrum muriaticum 1CH".
6. Place 2.97g (3.595 ml) 87% ethanol into second new 5ml screw top bottle.
7. Add 0.03g (0.0307 ml) of 1CH into second screw top bottle using a clean micropipette.
8. Succuss ten times and label 2CH.
9. Repeat the above procedure 6-8 up to 8CH, excepting that a volumetric ratio of 1 : 99 (0.03ml : 2.97ml) may now be used as ethanol concentrations are the same.
10. Place 15.84ml 87% ethanol into 25ml amber dropper bottle using 5ml pipette, 2ml, and 10ml measuring cylinder.
11. Place 0,16ml of 8CH into amber 25ml bottle using 2ml pipette.
12. Succuss ten times and label 9CH.
13. For 30CH and 200CH repeat procedures 10-12.
14. All intervening potencies ie. 10CH – 29CH
31CH – 199CH
must be prepared as described in steps 6-8.
15. Label all required potencies for NMR spectroscopy appropriately, and store in cool environment free from any electromagnetic disturbance.

Method 2 :

Aim: Preparation of Korsakovian 9CK, 30CK and 200CK potencies.

Apparatus: Crushed rock salt (Sodium chloride)

Purified water

87% ethanol

15% ethanol

Paper toweling

5ml screw top bottles

25ml amber bottles

Chemical balance

Labels and pens

Micropipette

5ml and 2ml pipettes, and 10ml measuring cylinder

Spatula

Paper

- Method:
1. Rinse and clean equipment and allow to cool.
 2. Place single sheet of paper on chemical balance and tare.
 3. Weigh out 0.03g of Sodium chloride using mass balance and place into first 5ml screw top bottle.

4. Place 2.97g (3.0455ml) 15 % ethanol into first 5ml screw top bottle using 5ml pipette.
5. Succuss ten times and label "Natrum muriaticum 1CK".
6. Empty the 1CK potency container by turning it upside down.

The process employed thus removing 99 percent of the liquid.

The remaining one percent staying fixed to the container walls.
7. Add 99 parts ie. 2.97g (3.595ml) 87% ethanol to the one part of the first centesimal dilution remaining in the glass container.
8. Seal the container and succuss thoroughly ten times.
9. The resultant solution thus yields a 2CK.
10. Empty the container again, and add 99 parts (ie. 2.97ml) 87% ethanol to the emptied 2CK container.
11. Succuss ten times and label resultant solution 3CK.
12. Repeat as indicated in steps 10-11 up to the 8CK level.
13. Place 0.16ml of the 8CK potency into a 25ml amber glass bottle.

Then add 15.84ml of 87% ethanol into the bottle.
14. Cap, seal, and succuss bottle ten times, and label

"Natrum muriaticum 9CK".
15. Continue potentising with the emptied 5ml screw top bottle labelled

"Natrum muriaticum 8CK" as indicated in steps 10-11, up to the 29CK potency level.
16. Production of the 30CK and 200CK potency level must be achieved as described in steps 13-14.

17. All intervening potencies are continued as in steps 10-11 and 15.
18. Label all required potencies for NMR spectroscopy appropriately,
and store in cool environment free from any electromagnetic
disturbance.

NB – all batch numbers must be recorded.

All control potencies are carried out exactly as described in the respective methodologies, excepting that an exact same mass of solvent in the required percentage of ethanol, will replace the solute, Sodium chloride, for the first centesimal potency.

APPENDIX B : SPECIMEN NMR SPECTRA

⁹CH

Pulse Sequence: s2pul

INDEX	FREQUENCY	PPM	HEIGHT
1	2405.343	4.811	26.9
2	2018.796	4.038	36.2
3	1549.046	3.098	19.6
4	1542.313	3.085	43.3
5	1535.073	3.070	41.2
6	1528.086	3.056	18.9
7	326.400	0.653	125.7
8	319.541	0.639	155.0
9	312.300	0.625	106.9

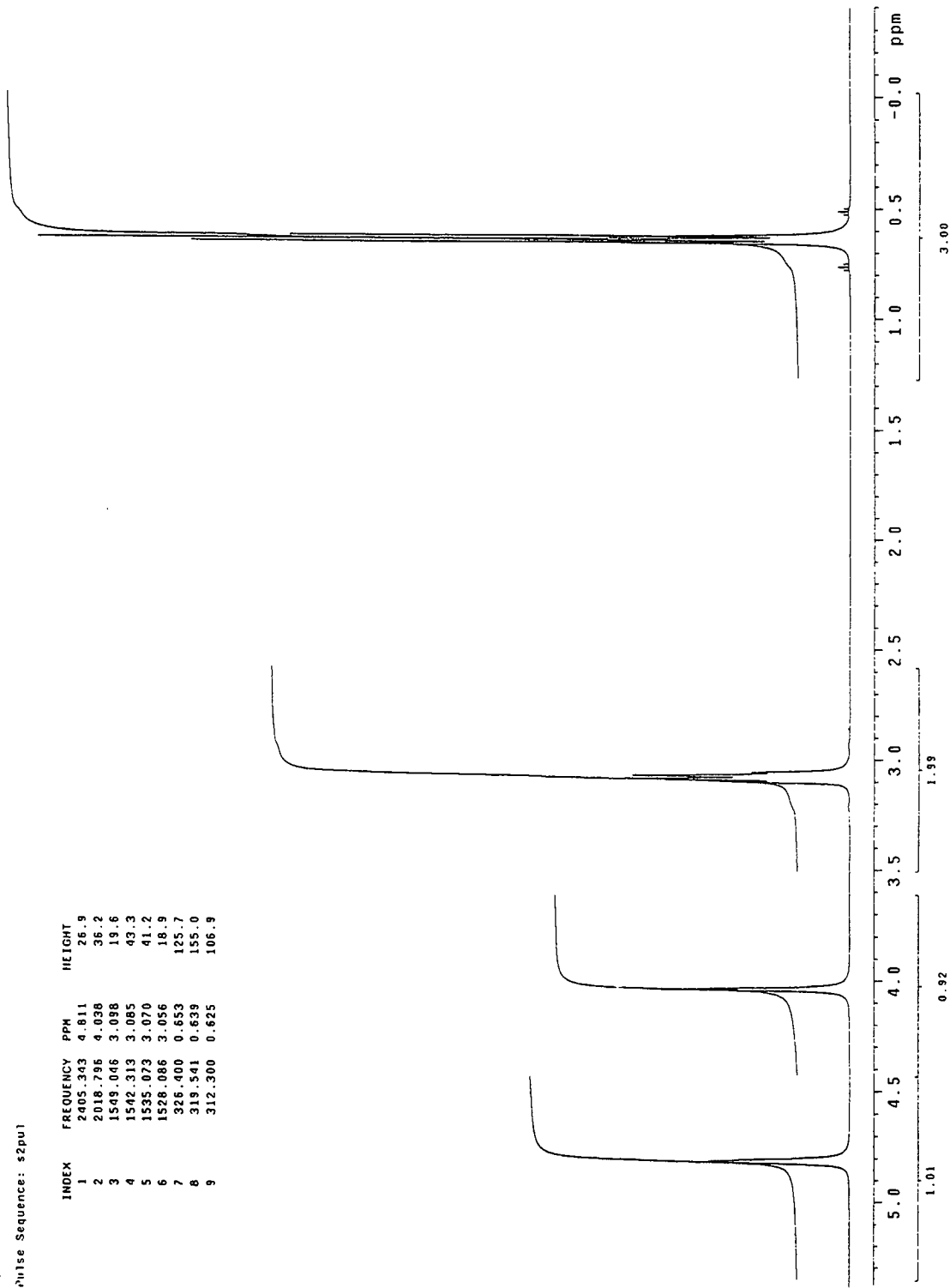


Figure 1 : Specimen NMR spectrum of the Hahnemannian 9CH

30CH

Pulse Sequence: s2pul

INDEX	FREQUENCY	PPM	HEIGHT
1	2399.626	4.799	20.3
2	2013.461	4.027	20.2
3	1543.457	3.067	32.1
4	1536.597	3.073	69.9
5	1529.484	3.059	65.6
6	1522.243	3.045	28.6
7	320.811	0.642	127.0
8	313.824	0.628	156.9
9	306.584	0.613	105.0

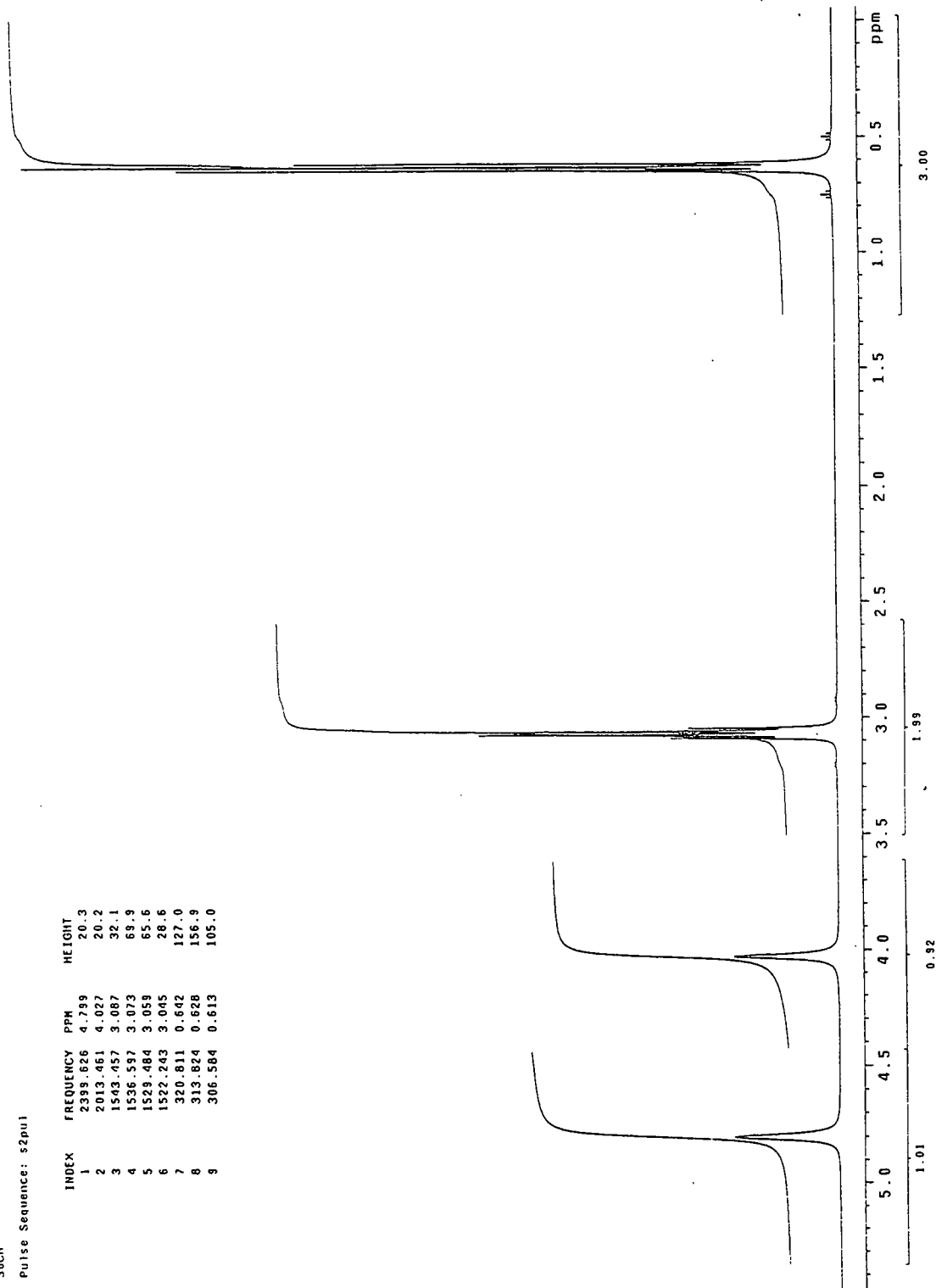


Figure 2 : Specimen NMR spectrum of the Hahnemannian 30CH

200CH

Pulse Sequence: s2pul

INDEX	FREQUENCY PPM	HEIGHT
1	2412.964	4.826
2	2022.353	4.045
3	1556.159	3.112
4	1549.173	3.098
5	1542.059	3.084
6	1534.819	3.070
7	334.022	0.668
8	327.035	0.654
9	319.668	0.639

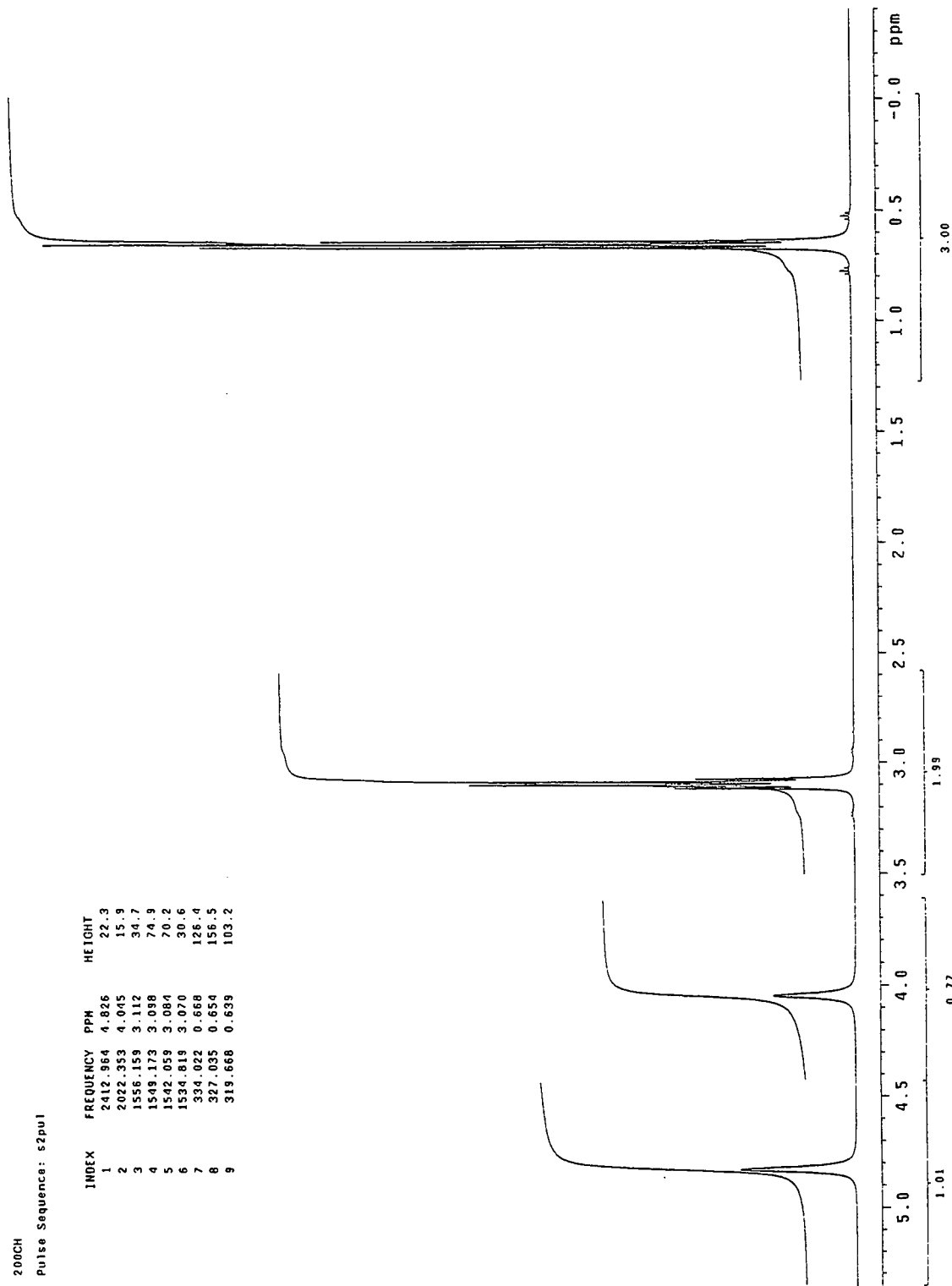


Figure 3 : Specimen NMR spectrum of the Hahnemannian 200CH

SCHcontrol
Pulse Sequence: s2pul

INDEX	FREQUENCY	PPM	HEIGHT
1	2405.724	4.812	24.1
2	2019.177	4.038	27.4
3	1548.427	3.093	25.8
4	1542.567	3.085	57.0
5	1535.327	3.071	53.7
6	1528.213	3.057	23.8
7	326.781	0.654	129.7
8	319.795	0.640	159.2
9	314.968	0.630	16.5
10	312.427	0.625	109.4

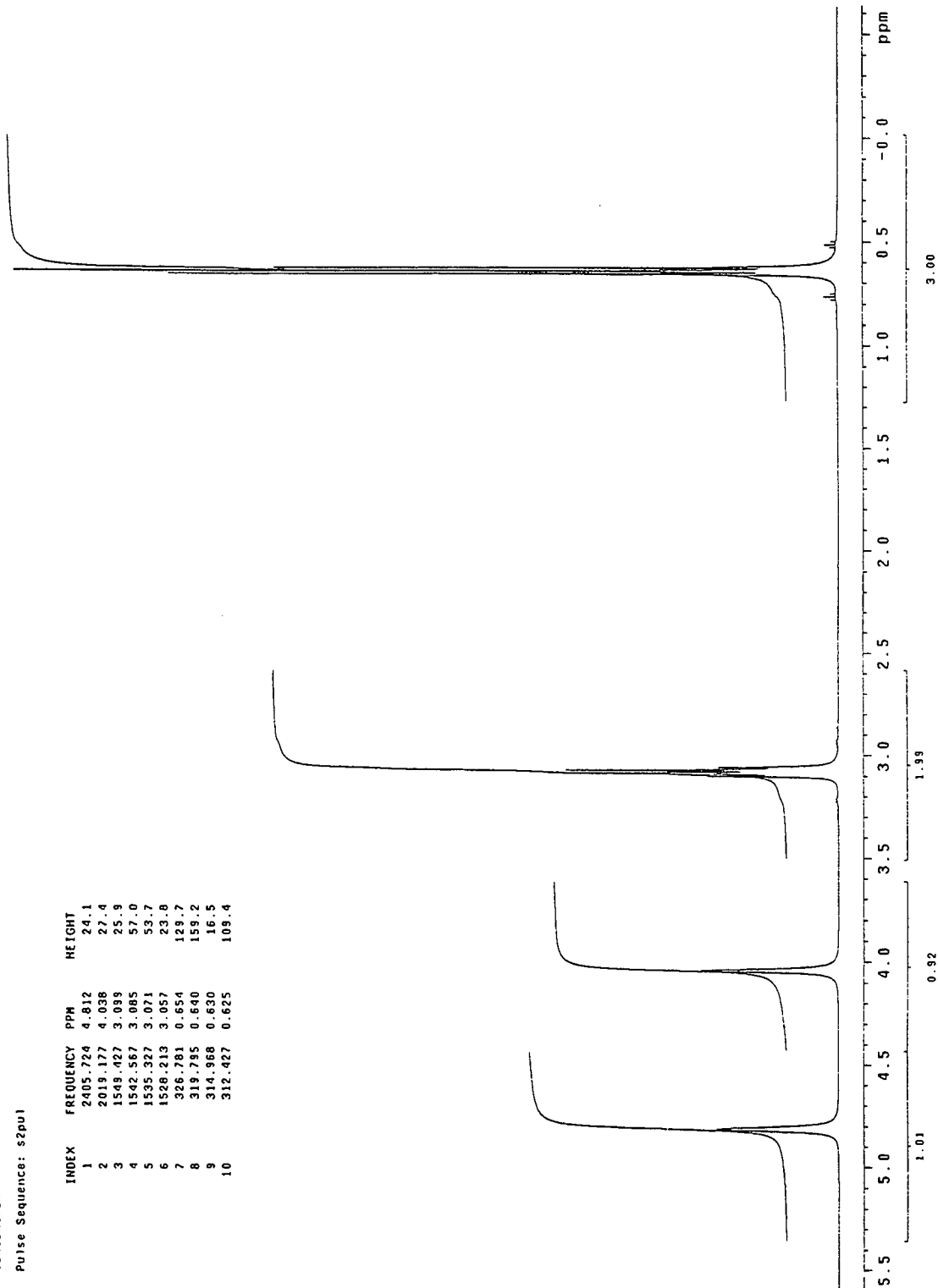


Figure 4 : Specimen NMR spectrum of the Hahnemannian Control 9CH

30CHcontrol

Pulse Sequence: s2pul

INDEX	FREQUENCY	PPM	HEIGHT
1	2405.470	4.811	24.8
2	2013.177	4.036	26.0
3	1549.300	3.099	31.8
4	1542.440	3.085	69.3
5	1535.200	3.071	64.8
6	1527.959	3.056	28.0
7	326.400	0.653	128.0
8	318.795	0.640	157.6
9	312.173	0.624	108.9

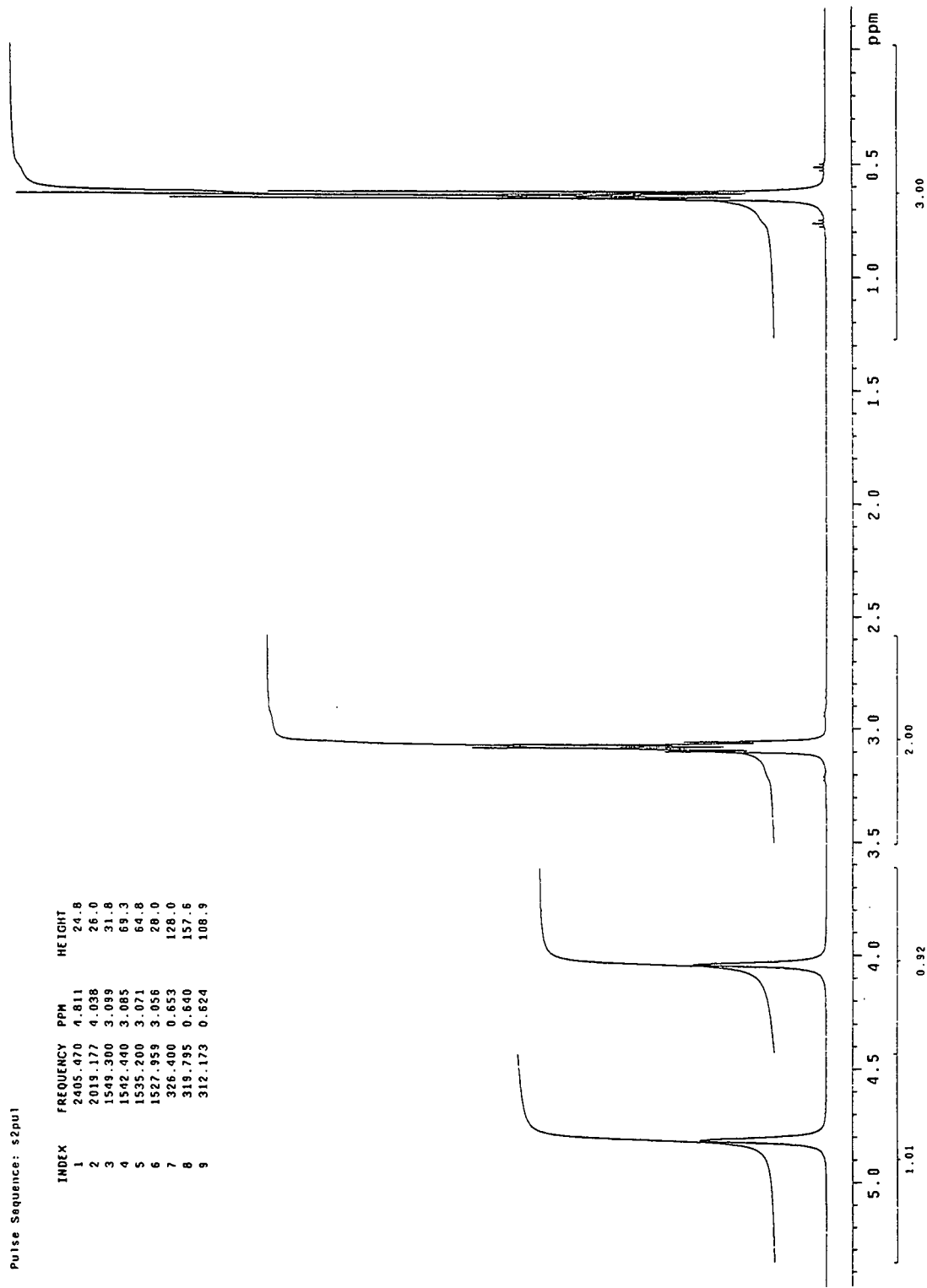


Figure 5 : Specimen NMR spectrum of the Hahnemannian Control 30CH

Pulse Sequence: s2pu1

INDEX	FREQUENCY	PPM	HEIGHT
1	2412.364	4.826	22.5
2	2022.353	4.045	15.1
3	1556.159	3.112	35.0
4	1549.173	3.098	75.6
5	1542.059	3.084	70.8
6	1534.019	3.070	30.9
7	334.022	0.668	127.4
8	327.035	0.654	157.7
9	313.668	0.639	104.1

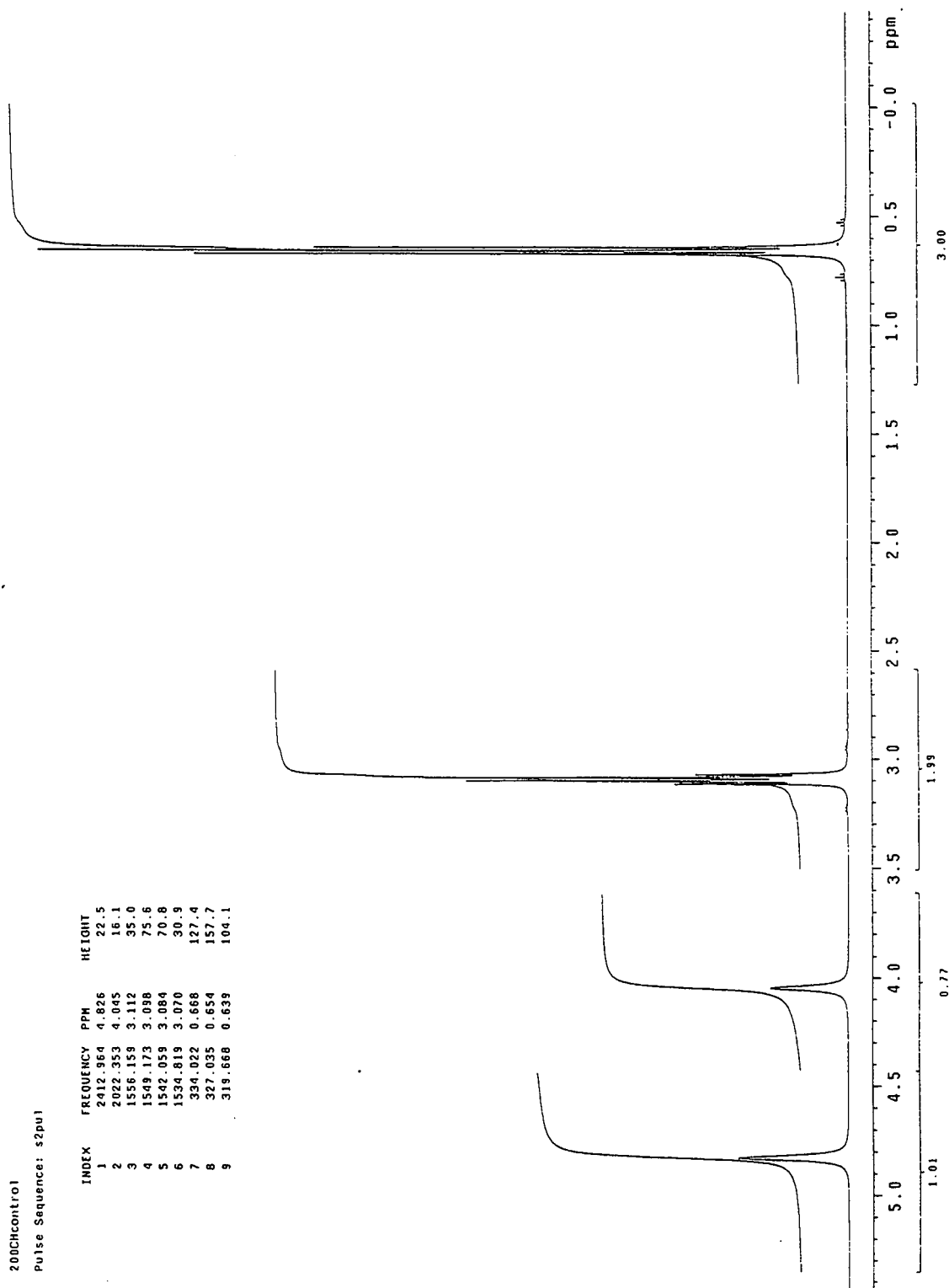


Figure 6 : Specimen NMR spectrum of the Hahnemannian Control 200CHI

9CK

Pulse Sequence: szpul

INDEX	FREQUENCY	PPM	HEIGHT
1	2408.518	4.817	26.0
2	2021.972	4.044	30.2
3	1552.349	3.105	26.5
4	1545.362	3.091	58.7
5	1538.249	3.077	55.5
6	1531.008	3.062	24.6
7	329.576	0.659	128.1
8	322.716	0.645	161.0
9	315.222	0.630	110.1

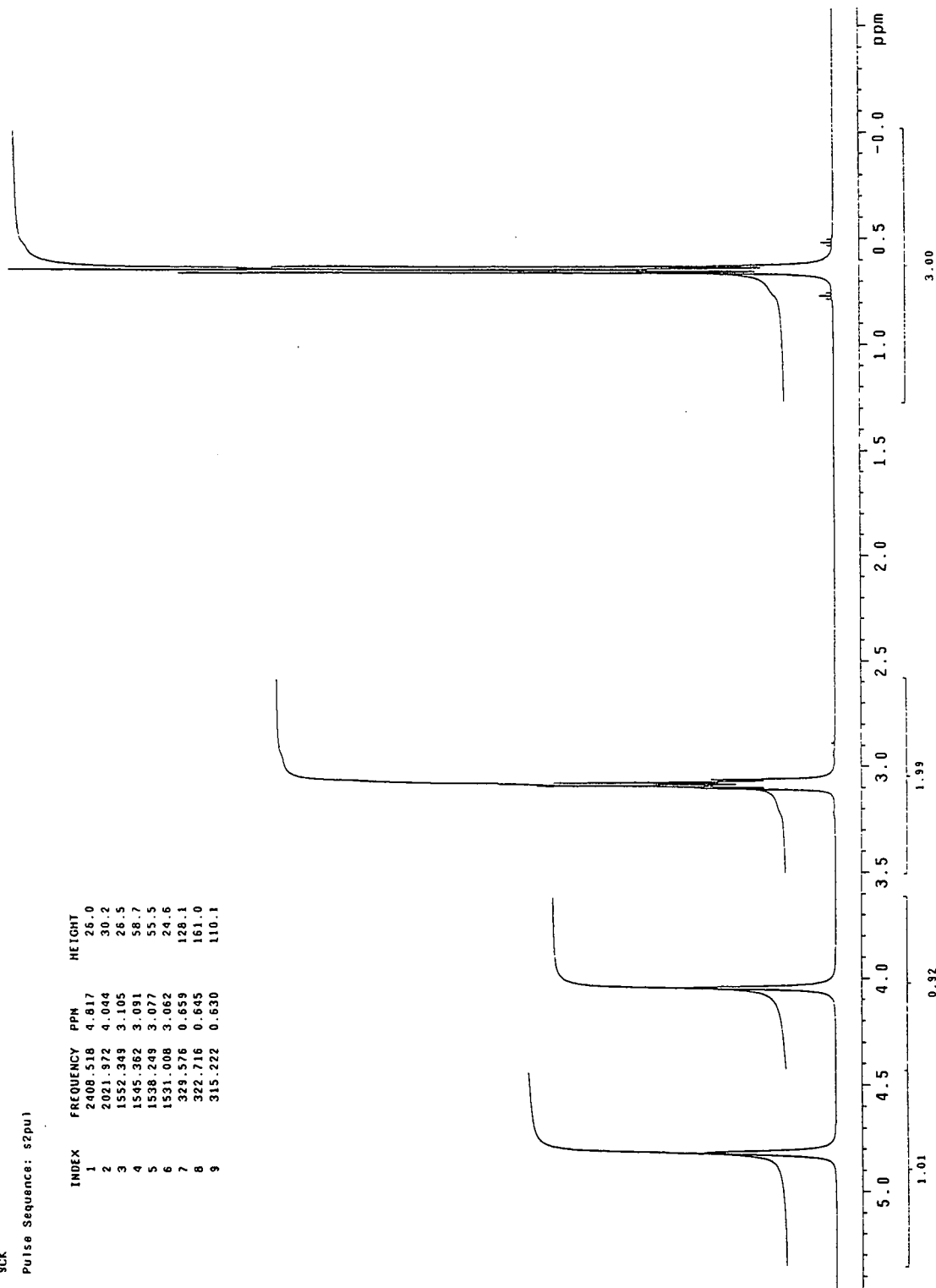


Figure 7 : Specimen NMR spectrum of the Korsakovian 9CK

30CK

Pulse Sequence: s2pu1

INDEX	FREQUENCY	PPM	HEIGHT
1	2407.121	4.814	22.0
2	2020.955	4.042	23.5
3	1550.951	3.102	30.1
4	1543.965	3.088	65.4
5	1536.851	3.074	61.3
6	1529.611	3.059	26.6
7	328.178	0.656	128.2
8	325.003	0.650	13.2
9	321.319	0.643	155.8
10	313.824	0.628	108.3

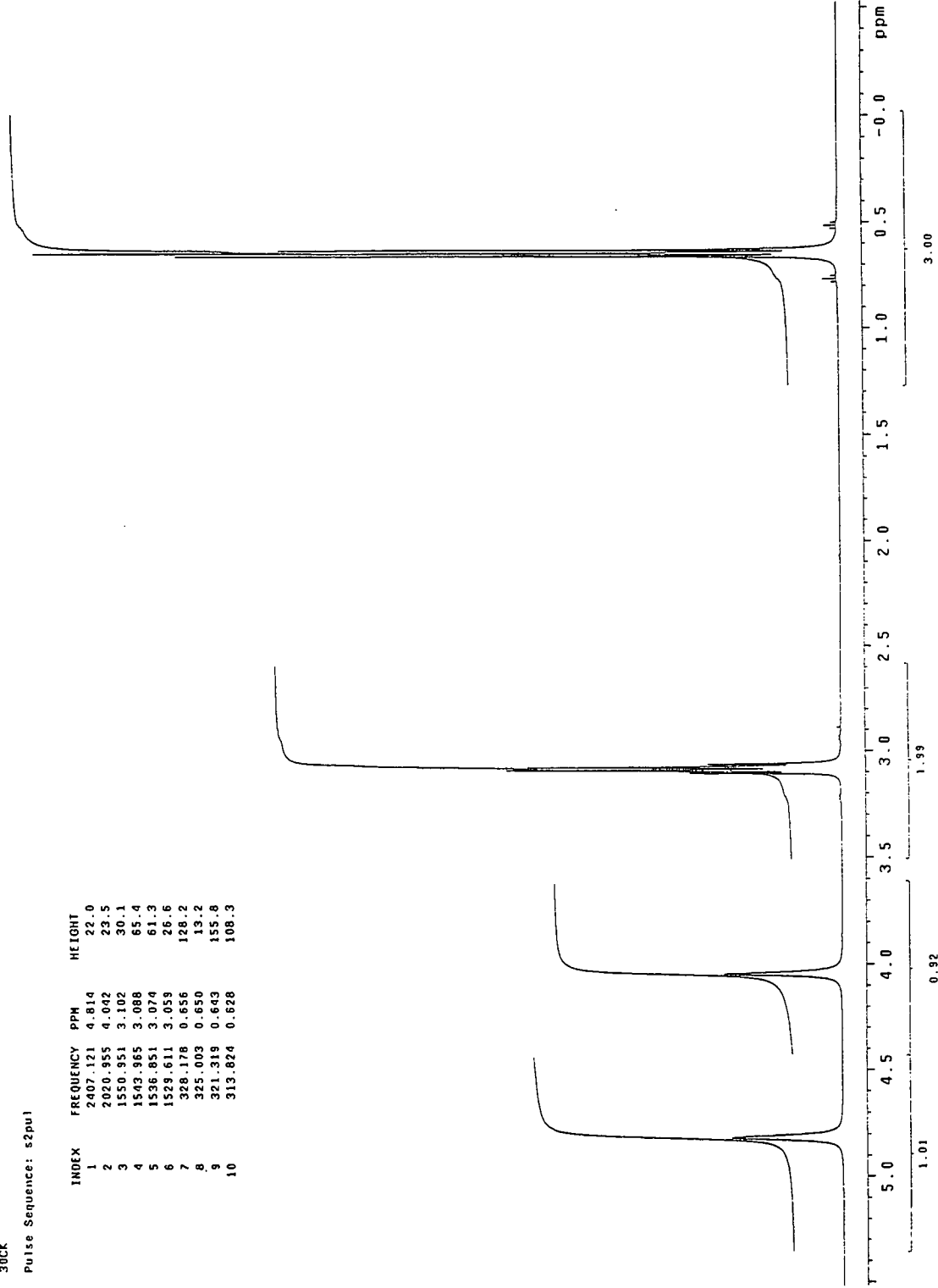


Figure 8 : Specimen NMR spectrum of the Korsakovian 30CK

200CK

Pulse Sequence: s2pul

INDEX	FREQUENCY PPM	HEIGHT
1	2414.362	4.829
2	2023.750	4.048
3	1557.430	3.115
4	1550.570	3.101
5	1543.390	3.087
6	1536.216	3.073
7	335.292	0.671
8	332.624	0.665
9	332.116	0.664
10	328.433	0.657
11	321.065	0.642

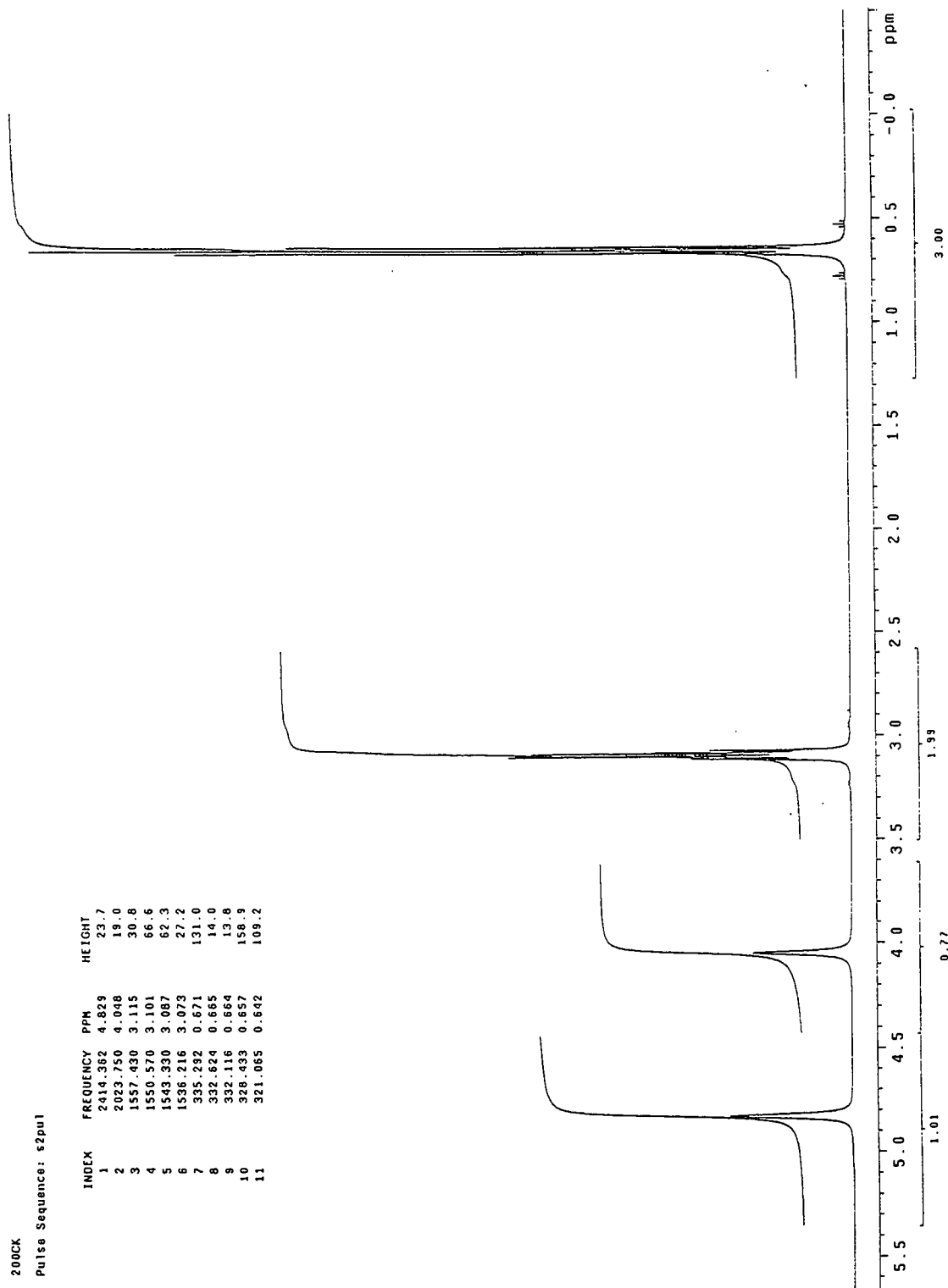


Figure 9 : Specimen NMR spectrum of the Korsakovian 200CK

9CKcontrol

Pulse Sequence: s2pul

INDEX	FREQUENCY	PPM	HEIGHT
1	2405.470	4.811	26.3
2	2018.923	4.038	34.7
3	1549.046	3.098	20.0
4	1542.313	3.085	45.0
5	1535.073	3.070	42.7
6	1527.959	3.056	19.4
7	326.400	0.653	122.4
8	319.541	0.638	151.6
9	312.173	0.624	105.3

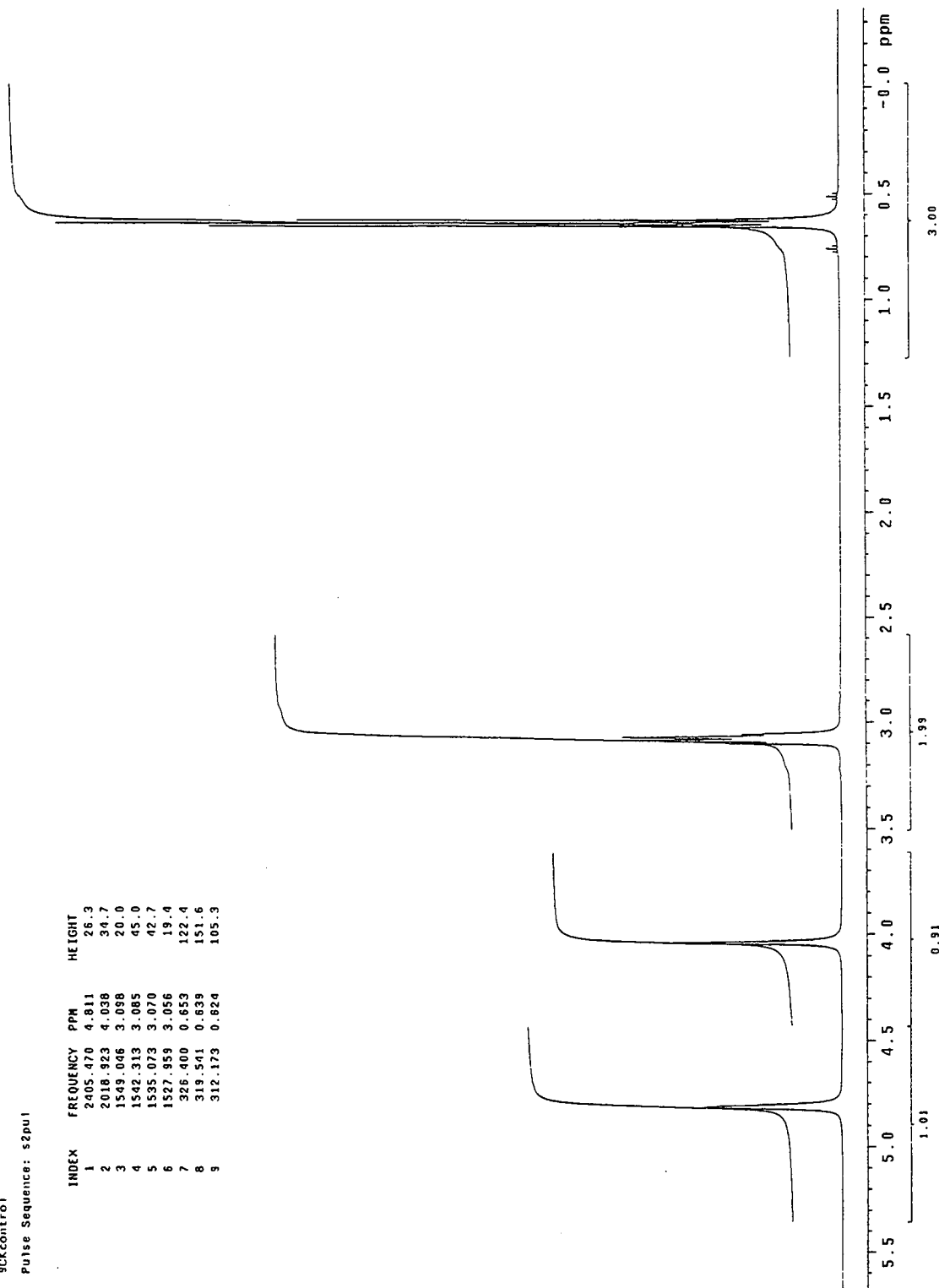


Figure 10 : Specimen NMR spectrum of the Korsakovian Control 9CK

30CKControl

Pulse Sequence: s2pul

INDEX	FREQUENCY	PPM	HEIGHT
1	2405.089	4.810	26.3
2	2018.796	4.038	32.2
3	1548.782	3.098	25.6
4	1541.805	3.084	56.0
5	1534.692	3.069	52.4
6	1527.451	3.055	22.7
7	326.019	0.652	131.0
8	322.843	0.646	14.3
9	319.159	0.638	160.3
10	311.665	0.623	111.6

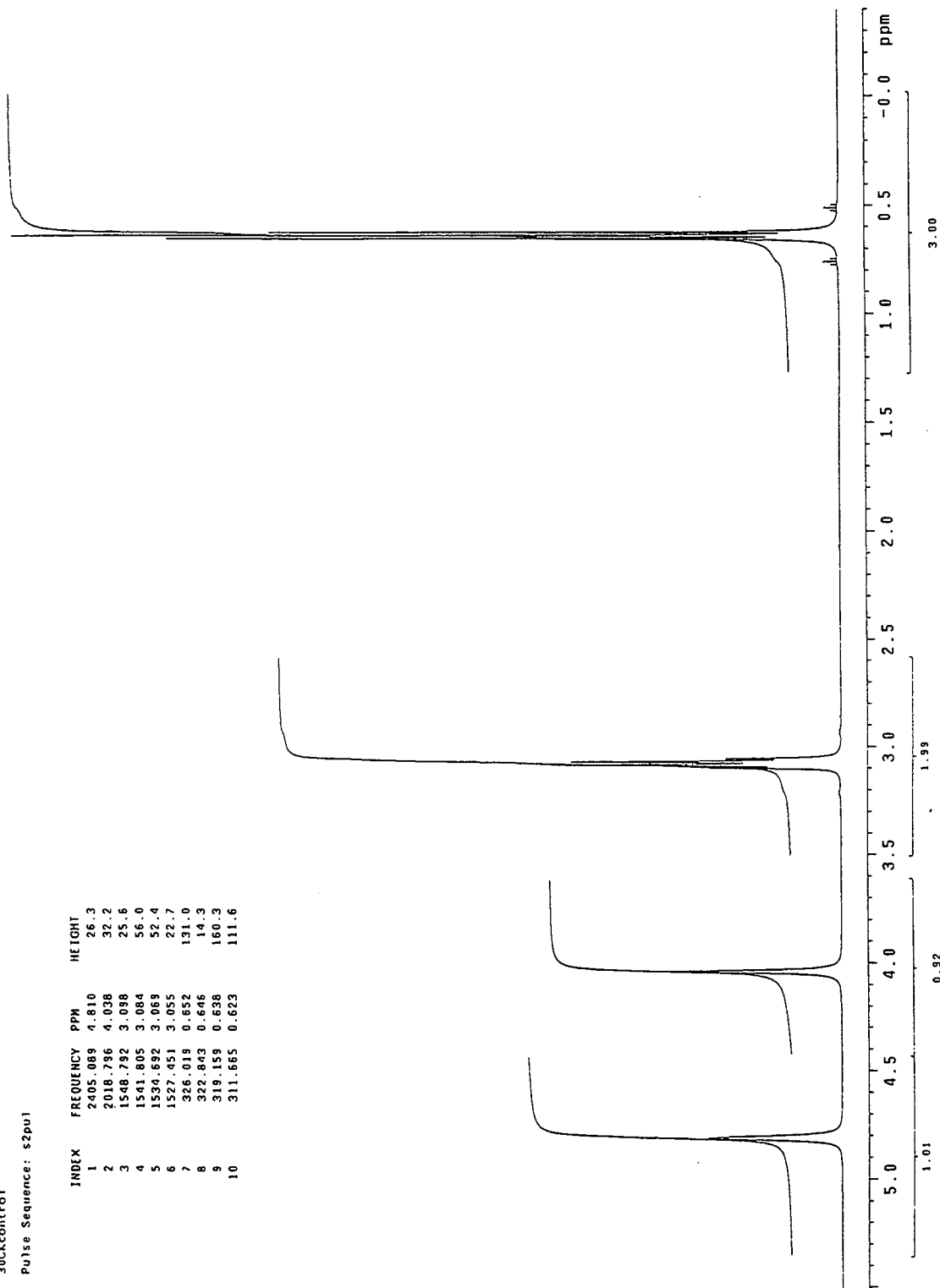


Figure 11 : Specimen NMR spectrum of the Korsakovian Control 30CK

200CKControl

Pulse Sequence: s2pul

INDEX	FREQUENCY	PPM	HEIGHT
1	2415.124	4.830	21.4
2	2024.385	4.049	16.1
3	1558.065	3.116	30.6
4	1551.205	3.103	66.0
5	1544.092	3.088	61.8
6	1536.851	3.074	27.1
7	935.927	0.672	120.2
8	329.068	0.858	147.5
9	321.573	0.643	102.0

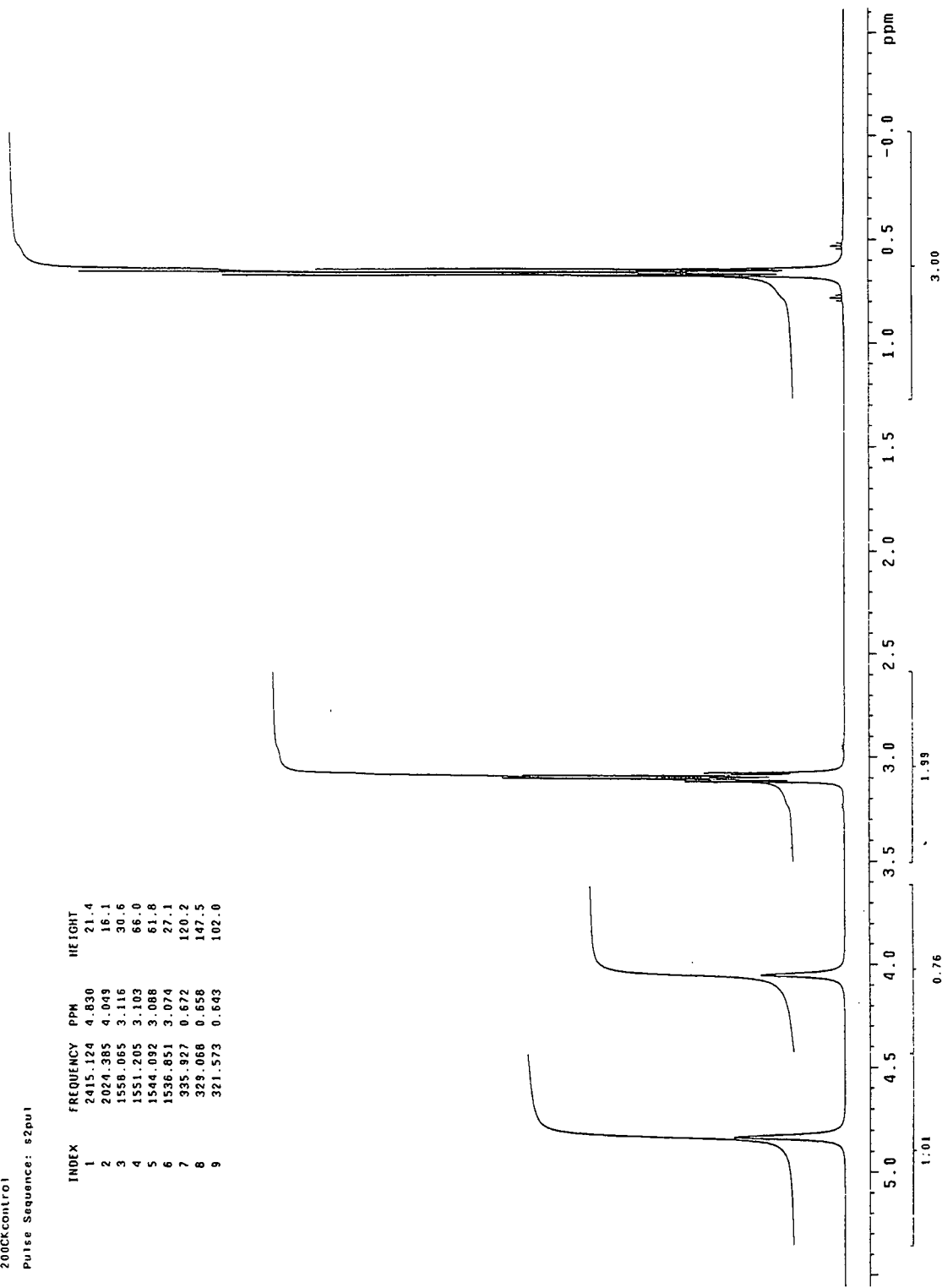
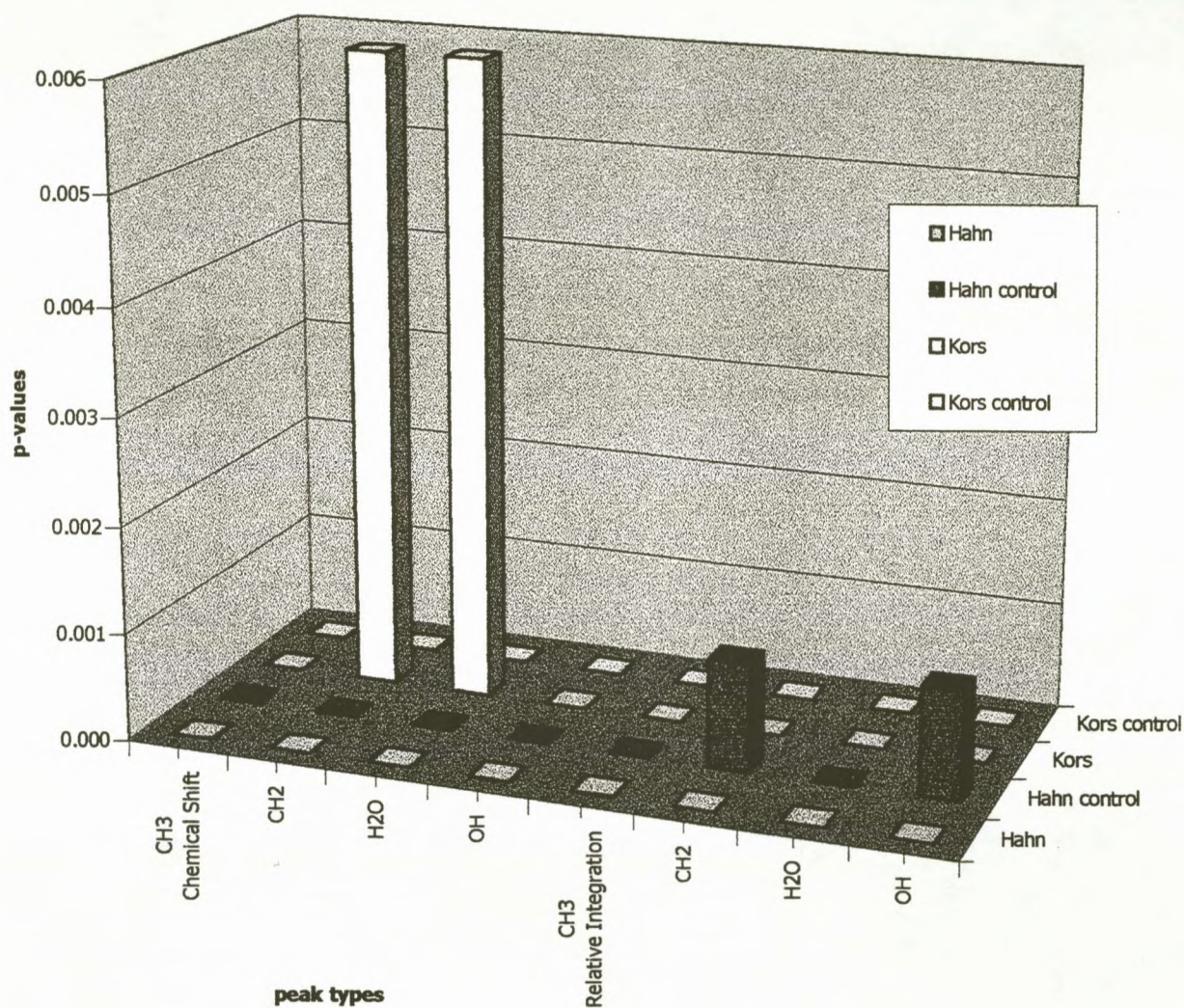


Figure 12 : Specimen NMR spectrum of the Korsakovian Control 200CK

APPENDIX C : GRAPHICAL REPRESENTATION OF P-VALUES

Chart 4.1 Friedman's comparison of all potencies within each method



**Wilcoxon's chemical shift comparison of potency levels for all methods of
potentisation**

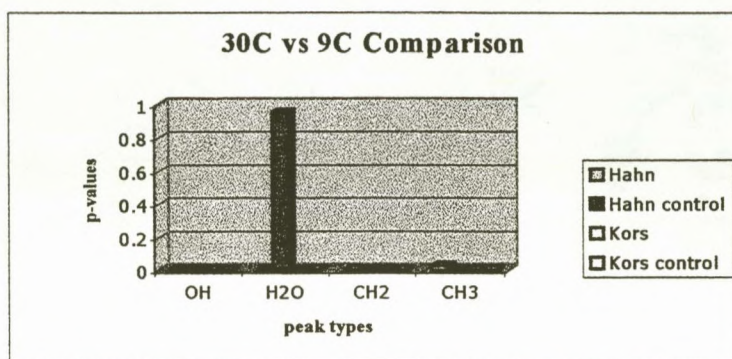


Chart 4.2 30C vs 9C comparison showing all potentisation methods.

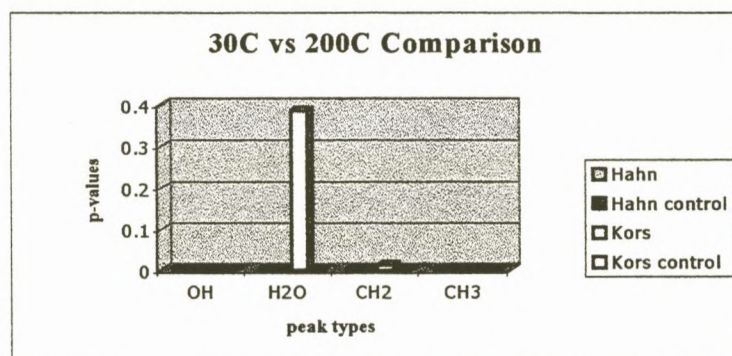


Chart 4.3 30C vs 200C comparison showing all potentisation methods.

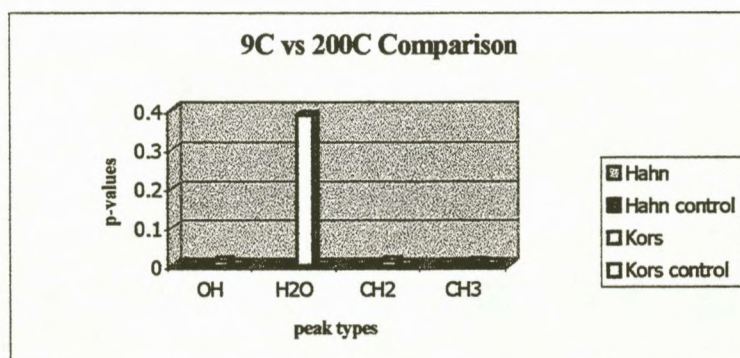


Chart 4.4 9C vs 200C comparison showing all potentisation methods.

Wilcoxon's relative integration comparison of potency levels for all methods of potentisation

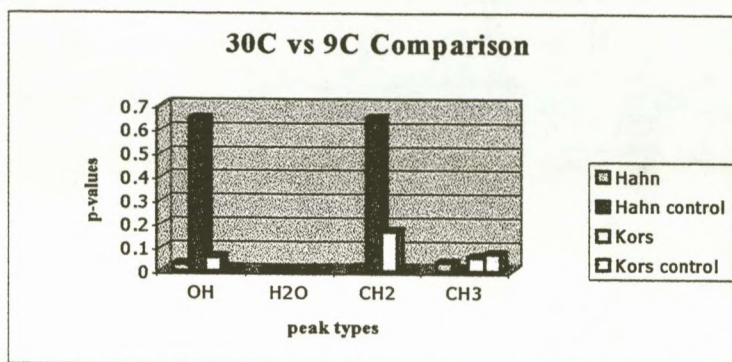


Chart 4.5 30C vs 9C comparison showing all potentiising methods.

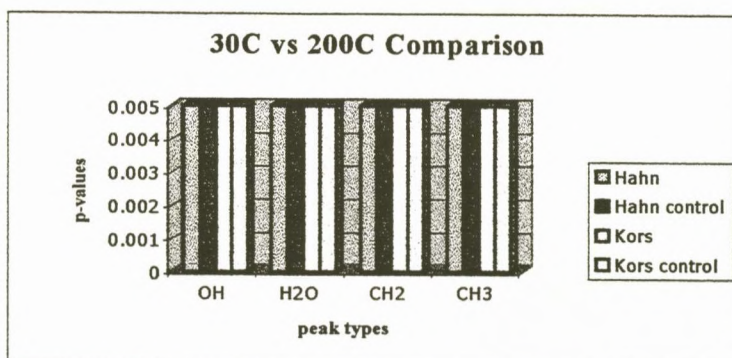


Chart 4.6 30C vs 200C comparison showing all potentiising methods.

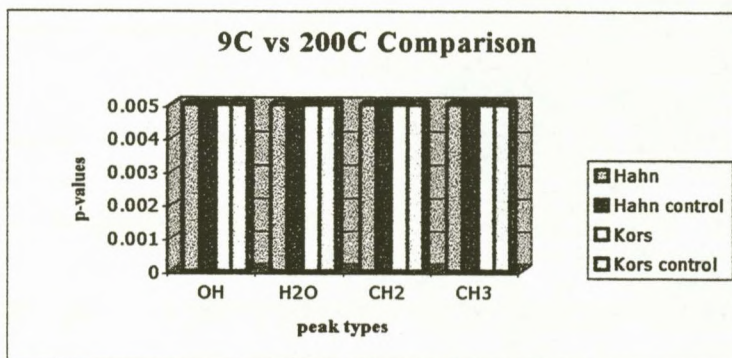
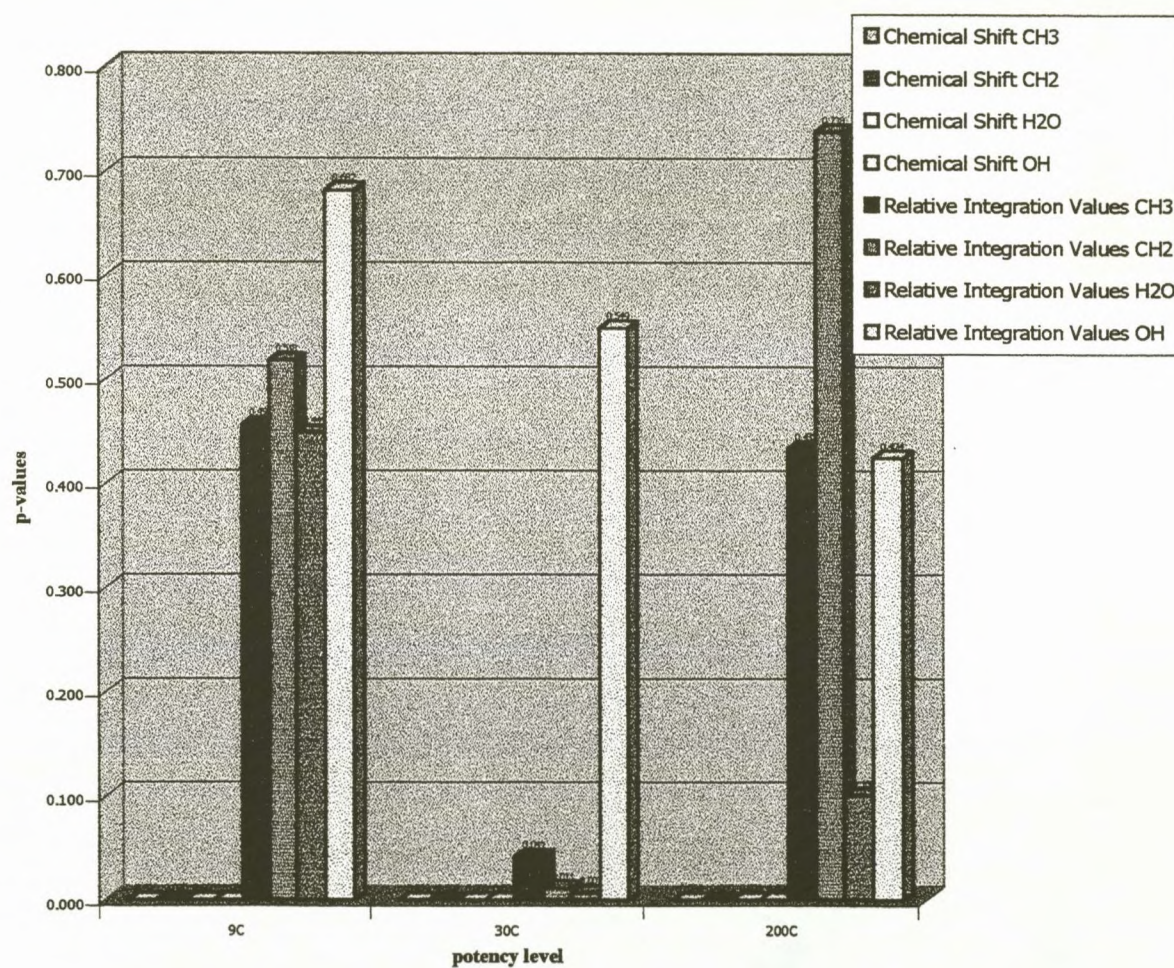


Chart 4.7 9C vs 200C comparison showing all potentiising methods.

Chart 4.8 Kruskal -Wallis parallel comparison of potentisation methods



Mann-Whitney comparison of chemical shift values for all potentisation methods

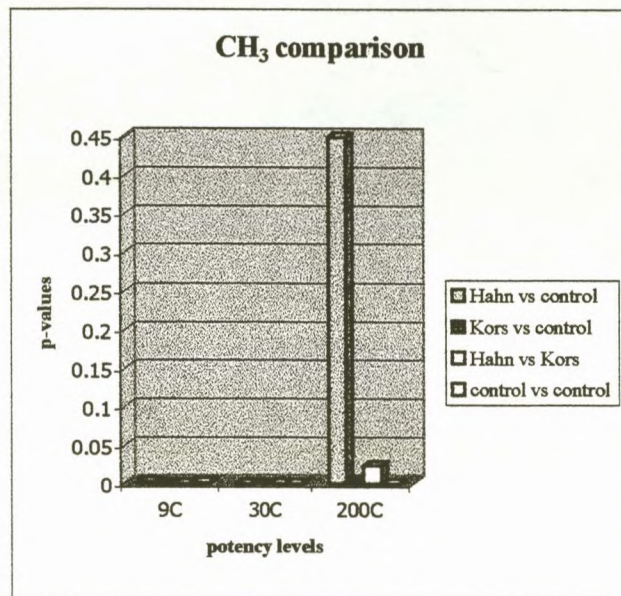


Chart 4.9 CH₃ comparison showing all potentiating methods.

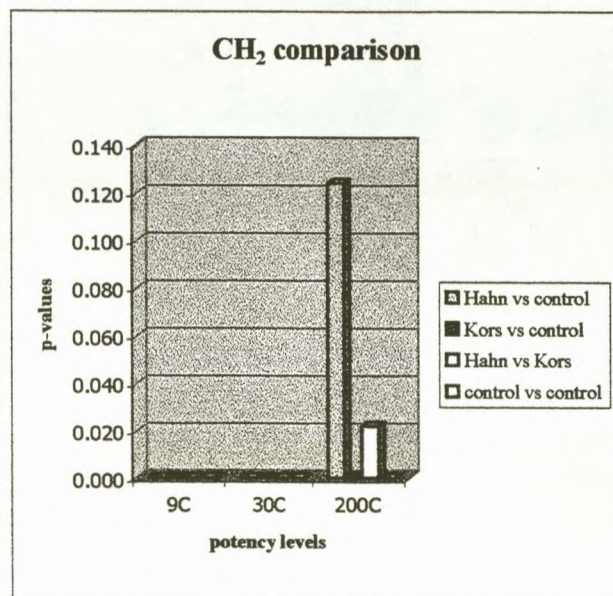


Chart 4.10 CH₂ comparison showing all potentiating methods.

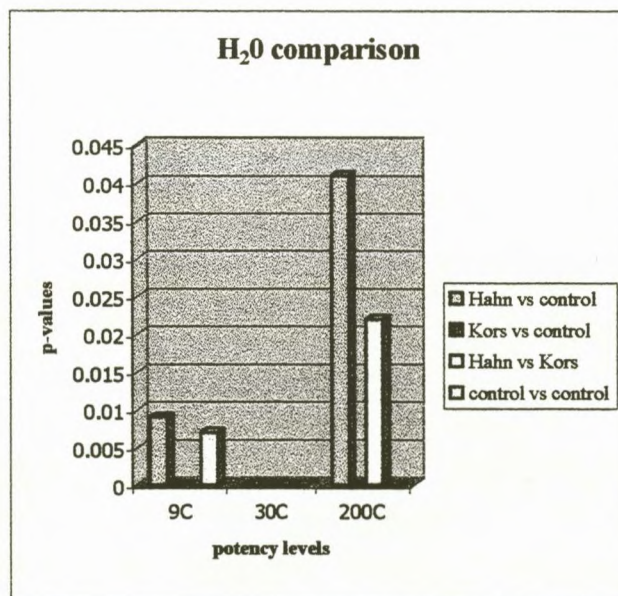


Chart 4.11 H₂O comparison showing all potentiating methods.

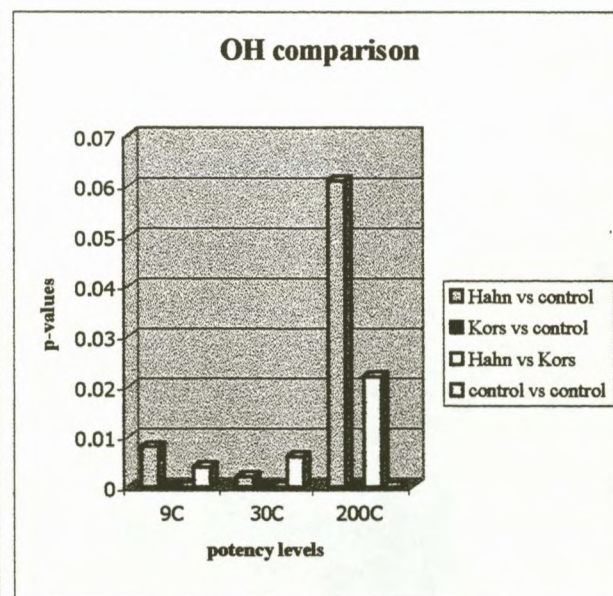


Chart 4.12 OH comparison showing potentiating methods.

Mann-Whitney comparison of relative integration values for all potentisation methods

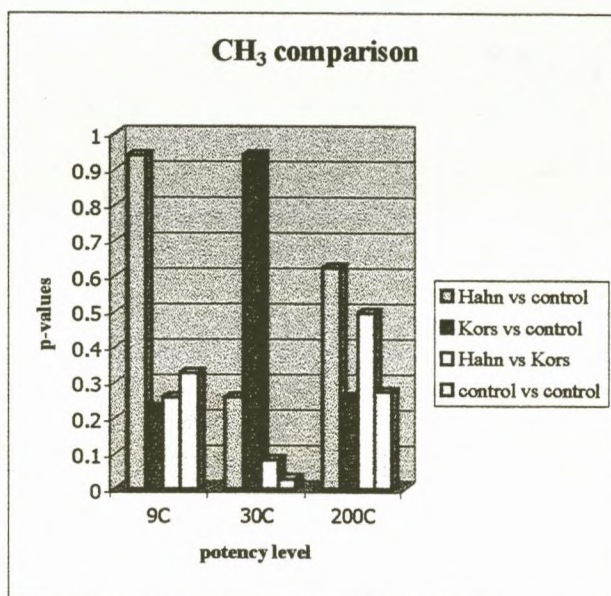


Chart 4.13 CH₃ comparison showing all all potentising methods.

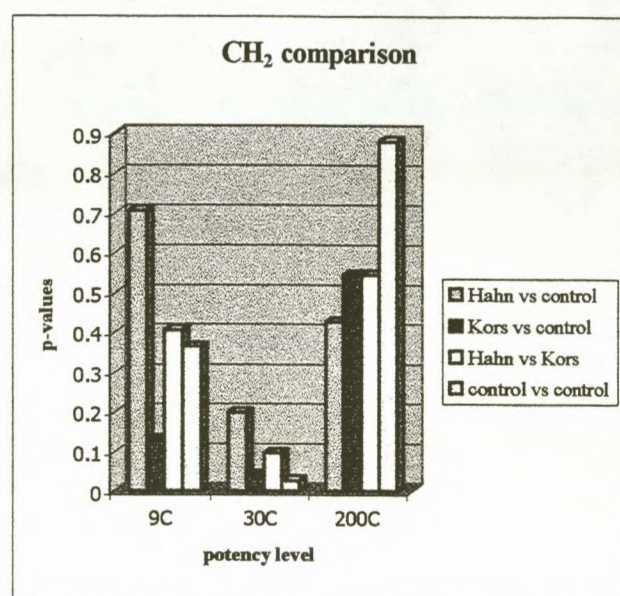


Chart 4.14 CH₂ comparison showing potentising methods.

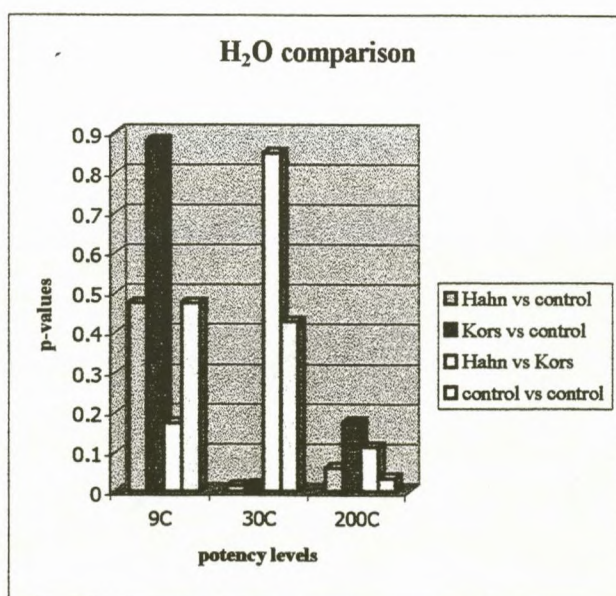


Chart 4.15 H₂O comparison showing all all potentising methods.

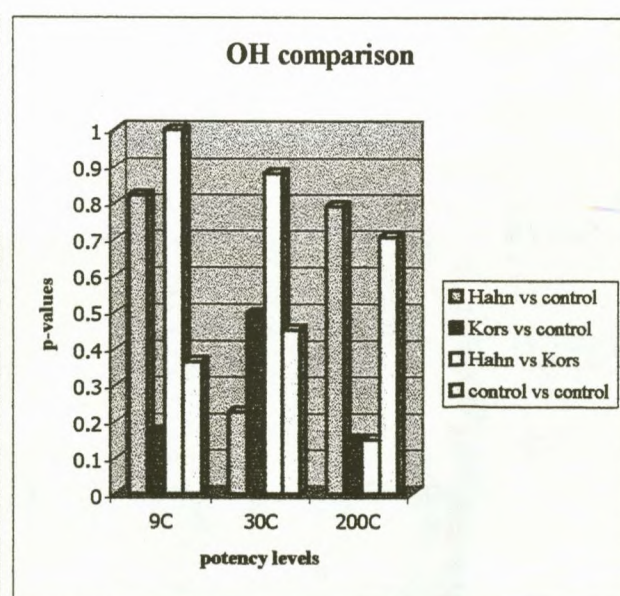


Chart 4.16 OH comparison showing potentising methods.

APPENDIX D : SUMMARIES OF SIGNIFICANT VALUES FOR THE MANN-WHITNEY AND WILCOXON'S SIGNED RANKS TESTS

Wilcoxon's Signed Ranks test summary for intra-potency comparisons showing tests as significant (✓) or not significant (✗).

		Hahnemannian		Hahnemannian Control		Korsakovian		Korsakovian Control	
		δ	Relative integrat	δ	Relative Integrat	δ	Relative Integrat	δ	Relative Integrat
9C vs 30C	OH	✓	✓	✓	✗	✓	✗	✓	✓
	H ₂ O	✓	✓	✗	✓	✓	✓	✓	✓
	CH ₂	✓	✓	✓	✗	✓	✗	✓	✓
	CH ₃	✓	✓	✓	✓	✓	✗	✓	✗
200C vs 30C	OH	✓	✓	✓	✓	✓	✓	✓	✓
	H ₂ O	✓	✓	✓	✓	✗	✓	✓	✓
	CH ₂	✓	✓	✓	✓	✓	✓	✓	✓
	CH ₃	✓	✓	✓	✓	✓	✓	✓	✓
200C vs 9C	OH	✓	✓	✓	✓	✓	✓	✓	✓
	H ₂ O	✓	✓	✓	✓	✗	✓	✓	✓
	CH ₂	✓	✓	✓	✓	✓	✓	✓	✓
	CH ₃	✓	✓	✓	✓	✓	✓	✓	✓

Mann-Whitney U-test summary for parallel potency comparisons showing tests as significant (✓) or not significant (✗).

		Hahn test vs Hahn control		Kors test vs Kors control		Hahn test vs Kors test		Hahn control vs Kors control	
		δ	Relative integrat	δ	Relative integrat	δ	Relative integrat	δ	Relative integrat
9C	OH	✓	✗	✓	✗	✓	✗	✓	✗
	H ₂ O	✓	✗	✓	✗	✓	✗	✓	✗
	CH ₂	✓	✗	✓	✗	✓	✗	✓	✗
	CH ₃	✓	✗	✓	✗	✓	✗	✓	✗
30C	OH	✓	✗	✓	✗	✓	✗	✓	✗
	H ₂ O	✓	✓	✓	✓	✓	✗	✓	✗
	CH ₂	✓	✗	✓	✓	✓	✗	✓	✓
	CH ₃	✓	✗	✓	✗	✓	✗	✓	✓
200C	OH	✗	✗	✓	✗	✓	✗	✓	✗
	H ₂ O	✓	✗	✓	✗	✓	✗	✓	✓
	CH ₂	✗	✗	✓	✗	✓	✗	✓	✗
	CH ₃	✗	✗	✓	✗	✓	✗	✓	✗