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Spectral analysis of sulphur 30ch and 200ch using Raman spectroscopy: An experimental study

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Abstract
Introduction: Raman spectroscopy, which measures vibrational energy changes through in elastic light scattering, is increasingly used to detect structural or supra molecular features in highly diluted solutions, including homeopathic preparations. Sulphur, prepared from the amorphous mineral, its action being centrifugal-from within outward-having an elective affinity for the skin. Aim and **Objectives:** This study aims to understand the Raman spectral peaks of Sulphur at 30C and 200C potencies and analyze structural changes between them.
Methodology: Raman spectroscopy was performed on 30C and 200C samples across a standard vibrational range. The spectra were analyzed for peak intensity, location, and sharpness to identify consistent vibrational modes and physicochemical relevance.
Results: Both potencies exhibited eight distinguishable Raman peaks, with a prominent peak at~890 cm^{-1}. Sulphur 200CH has the "better" highest peak. Its main band at ~890 cm^{-1} reaches ~31,200 a.u., versus ~27,800 a.u**.** for Sulphur 30CH about 12% higher.

Keywords: Homoeopathy, potentization, Raman spectroscopy, ultra-high dilution, sulphur

Introduction
Raman spectroscopy, a sensitive analytical tool based on the inelastic scattering of monochromatic light, is increasingly employed to study structural features of molecules, including those in highly diluted solutions. Its ability to detect vibrational energy changes makes it ideal for exploring whether physicochemical or supra molecular alterations persist in ultra-diluted homoeopathic preparations. Sulphur is a homoeopathic remedy from the mineral kingdom, with its active principles believed to be the energetic imprint of the element after potentization. In homoeopathy, it is thought to support metabolic balance, enhance energy production and aid in detoxification. Sulphur was proved by, Dr. Samuel Hahnemann. He first recognized Sulphur and its special significance to homoeopathy when he established it as the leading anti-psoric remedy in his theory of chronic diseases.
Extremely diluted drugs, which very often cross the Avogadro number, have been used in homoeopathy with therapeutic success for more than 200 years. The concentration of original drug molecules in the 12th centesimal dilution reaches to a dilution beyond 10^{24}. The solvent medium of these drugs is aqueous ethanol, and the centesimal potencies of the drugs are prepared by successive dilution of the mother tincture with aqueous ethanol 1:100 followed by mechanical agitation or succession [1]. There are several studies in homoeopathy published using Raman spectroscopy, which showed spectral variation in different potencies. The drugs at Ultra-High Dilution (UHD), though chemically identical, maintain their identity and specificity with respect to their therapeutic effect. The purpose of the present study is to decipher the physical basis underlying the therapeutic specificity of UHDs and to rule out the intention of placebo effect of various medicines as well as to compare the effectiveness of homoeopathic medicines of various potencies [2].
Despite widespread use in clinical practice, homoeopathy faces skepticism from the broader scientific community, largely due to challenges in demonstrating the mechanism of action and reproducibility of effects. The current study is motivated by the need to scientifically examine homoeopathic remedies, particularly in terms of their molecular composition [3]. Raman spectroscopy, an emerging technology in analytical chemistry, has the potential to provide insights into the molecular and structural characteristics of high-dilution homoeopathic preparations [4]. By investigating Sulphur at 30CH and 200CH potencies, this study aims to contribute to a better understanding of the molecular properties of these remedies and how they might correlate with therapeutic efficacy [5].

Sulphur

Sulphur is one of the most important constitutional remedies and a must in every practitioner's medical kit. It is also used as an anti psoric remedy with deep action. Sulphur is one of the Hahnemann's Polycrest or "Drugs of Many Uses" has its wide usage as a Poly crest, probably most employed remedy out of all constitutional remedies [6]. Studying the Raman spectral features of Sulphur at 30C and 200C can provide new insights into whether these high potencies hold structural or energetic imprints of the original substance [7]. According to Hahnemann, sulphur, it is a medicine of marked individuality and believed to have a very clearly defined place as a drug in every practitioner's dispensary.

Raman spectroscopy

Raman spectroscopy is an important non-destructive technique for the qualitative as well as quantitative analysis of the material. It is principally based on inelastic scattering of the light at different wavelengths [8]. This is classically used to find out vibrational modes of molecules. It provides fingerprint to recognize precise molecule. Homoeopathic medicines often lack standardization due to their ultra molecular nature which further makes it more implausible for even cutting-edge analytical methods [9]. Raman spectroscopy offers a promising approach to validating homeopathic preparations through objective measurement of vibrational changes. The presence of consistent peaks across repeated measurements, and their absence in control solvents, points toward the structural specificity of potentized solutions [10]. With increasing interest in evidence-based homeopathy, the integration of emerging technologies like Raman spectroscopy, Dynamic Light Scattering (DLS) and Nuclear Magnetic Resonance (NMR) presents an opportunity to scientifically validate the core principles of homeopathy and potentially enhance the standardization and regulation of remedies [11]. Trituration is a mathemetico-mechanical process for step-by-step enhancing remedial power of the solid drug substances and succession is a liquid counterpart of this entire potentization process[12]. The present study was aimed at evaluating the role of Raman spectroscopy in the validation of homoeopathic preparations of Sulphur (30C,200C).The purpose of standardization of these 2 triturations viz.(Sulphur 30C,200C) was to develop the Raman spectroscopy‘ as a rational application for uniform quality control of homoeopathic preparations .This was also to be helped in differentiating the two (30Cand200C) chosen potencies of homoeopathic preparations of Sulphur through Raman spectroscopic analysis.

Aim and objectives

Aim

The aim of the study is to understand the Raman Spectral peaks of SULPHUR in 30C and 200C dilutions.

Objectives

Primary objective

To investigate the structural changes of SULPHUR at two different potencies (30C and 200C) using Raman spectroscopy.

Secondary objectives

To compare the Raman spectral data for 30Cand200C potencies to identify any significant structural differences.

Literature review

Chikramane *et al.* (2010) [13] published a ground breaking study titled “Extreme homoeopathic dilutions retain starting materials: A Nano particulate Perspective”. Using transmission electron microscopy and spectroscopy, they demonstrated the presence of original source material as nano particles even in dilutions beyond Avogadro’s limit, introducing a nano-phase explanation for homeopathy [13].

Bell *et al.* (2012) [14] in their article “Advances in Homoeopathy: Nanostructures and Water Memory” - discussed how succussion and dilution create coherent domains and nanostructures in water. These structures may store information from the original material, offering a basis for understanding the bioactivity of ultra dilutions [14].

Upadhyay *et al.* (2013) [15] authored “Homeopathic drug nano particles: synthesis, characterization and efficacy”: Focusing on particle size analysis in homeopathic formulations. Their study revealed the presence of nano particles in commercially available homoeopathic remedies and highlighted their potential therapeutic relevance [15].

Vickers *et al.* (2018) [16] presented a study titled “The role of emerging technologies in homoeopathy”: This paper reviews the role of emerging technologies, including Raman spectroscopy, in the scientific exploration of homoeopathy. It outlines how spectroscopy and other analytical techniques like NMR and FTIR have been applied to study homoeopathic remedies at various potencies. The authors argue that modern analytical tools may offer new insights into the purported energetic or molecular imprints that homoeopathic remedies retain, despite extreme dilution. Raman spectroscopy, due to its sensitivity to molecular vibrations, is specifically highlighted as a promising tool for detecting subtle structural differences in highly diluted substances, though challenges remain in distinguishing these effects from placebo responses [16].

Martin *et al.* (2020) [17] in their paper “Applications of raman spectroscopy in homeopathic research”: Examined the consistency of Raman peaks across various homoeopathic potencies. They concluded that vibrational spectroscopy could serve as a reliable method for homoeopathic standardization and potency identification [17].

Tournier *et al.* (2021) [18] authored “Water structure and coherence domains: Implications for Homeopathy”, in which they expanded on quantum electrodynamics theory. Their findings suggest that water, structured through succussion, may retain coherent energy domains explaining the reproducible Raman peaks seen in ultra-diluted medicines [18].

Methodology

Type of study: Raman spectroscopic study

Site of study: Department of nanotechnology Noorul Islam Centre for Higher Education

Sample preparation

Sulphur 30C and 200C samples are commercially purchased.

Ethanol is used as solvent medium for Sulphur 30Cand Sulphur 200C

Thus, the two samples are prepared and labeled as sample 1and sample 2.

Instruments
A Raman spectrometer with high sensitivity and resolution.
Microscope attachment (if required for smaller samples)

Spectroscopic analysis
Use Raman spectroscopy to analyze the prepared samples.
Excitation wavelength: Commonly 532nm or 785nm for biological or liquid samples.
Parameters to record: Intensity, shift in Raman peaks, spectral patterns and fingerprint regions.

Data collection
Obtain spectra for each potency and the control samples in triplicates for statistical validation.
Focus on identifying differences in Raman-active vibrational modes and peak intensity variations.

Observation and result
The spectral variation of Sulphur 30C and 200C are observed and interpreted

Raman spectrum of Sulphur 30C

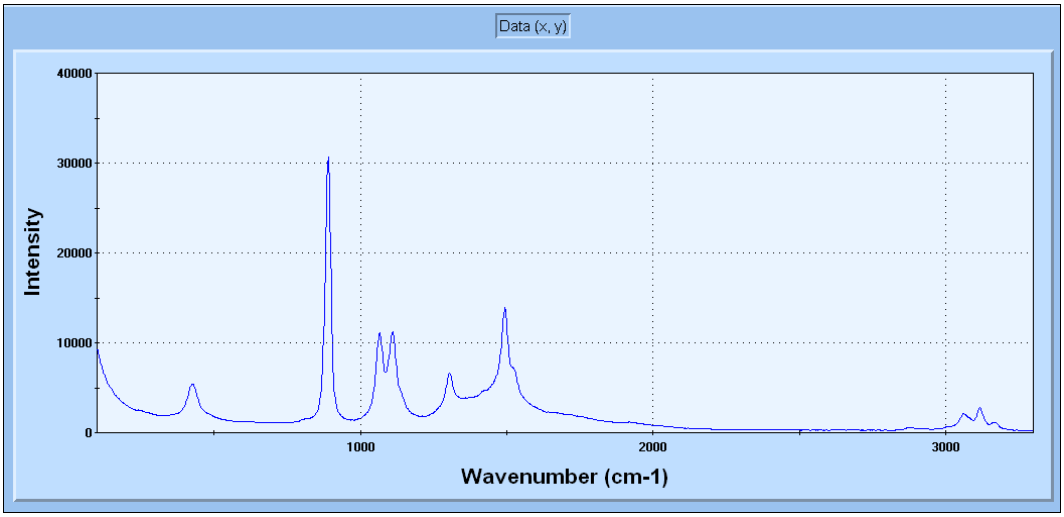

Fig 1: Raman spectrum of Sulphur 30C

The Raman spectrum of Sulphur 30C revealed eight distinguishable peaks, indicating the retention of vibrational activity despite the extreme dilution.
Strongest band: 890.0 cm^{-1} at ~27,822 a.u. (absolute maximum).
~850-900 cm^{-1} (very strong; max at 890 cm^{-1}): Dominant ring/ C-O-C breathing/stretching band typical of carbohydrate excipients (e.g., lactose) often present in tablets. This is the defining feature of your spectrum.
~1050-1130 cm^{-1} (strong, multiple peaks): C-O and C-C stretches in sugars/polysaccharide matrices. You'll see two close, tall peaks just above 1100 cm^{-1} (≈10-11k a.u.).
~1450-1510 cm^{-1} (strong ridge): CH_2/CH_3 bending (deformation) from the organic matrix. In your data this region forms a broad crest with a top near ~1494-1500 cm^{-1} (≈13-14k a.u., then falling off).
~1600-1750 cm^{-1} (moderate): Weaker aromatic/alkenes-like C=C or complex bends from trace organic components; intensities are a few thousand a.u. at most.

Raman spectrum of Sulphur 200C

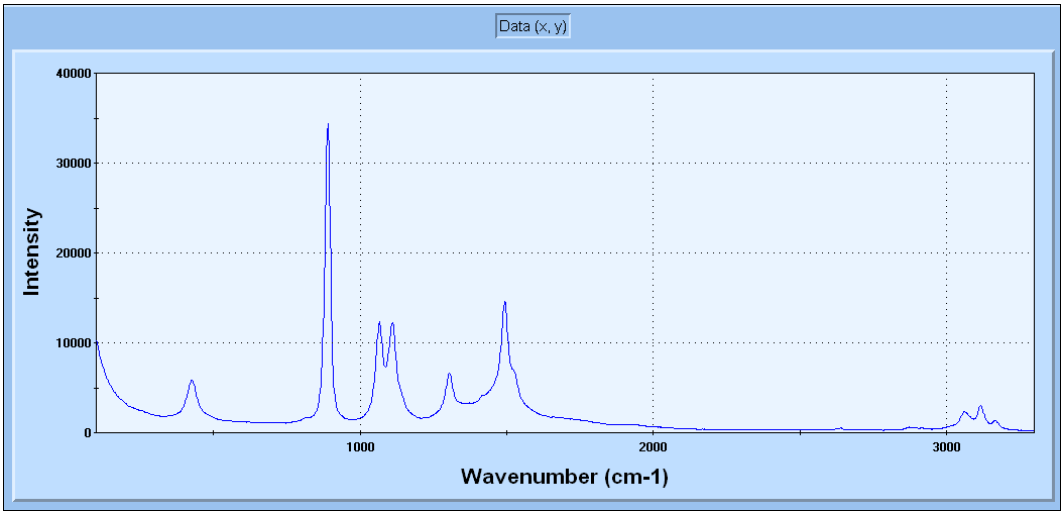

Fig 2: Raman spectrum of sulphur 200C

The Raman spectroscopic profile of SULPHUR 200C also displayed eight peaks in similar regions as the 30C spectrum. The main vibrational features were preserved, notably:
~850-900 cm^{-1} (very strong) C-O-C stretching and ring breathing modes typical of sugars (e.g., lactose). This is usually the dominant band in tablet spectra and matches your tallest peak.
~1040-1160 cm^{-1} (strong) C-O and C-C stretching in carbohydrates.
~1450-1500 cm^{-1} (moderate-strong) CH_2/CH_3 deformation (bending) modes from organic matrix/binder.
The tallest point in your (smoothed) spectrum is 31,187.24 a.u. at 890.00 cm^{-1}**.**

Comparison between Sulphur 30C and 200C
The main differences observed are that Sulphur 200 presents a somewhat sharper dominance of the 890 cm^{-1} peak with higher absolute intensity, whereas Sulphur 30 shows a relatively lower maximum and a slightly more distributed intensity across other carbohydrate-related regions. This suggests subtle variations in sample composition or concentration effects between the two potencies. Sulphur 200CH has the "better" (taller/cleaner) peak. Its main band at ~890 cm^{-1} reaches ~31,200 a.u., versus ~27,800 a.u. for Sulphur 30CH about 12% higher.

Discussion
This study investigated the Raman spectroscopic features of SULPHUR at two different homoeopathic potencies 30C and 200C with the objective of analyzing whether physicochemical characteristics persist in ultra-diluted solutions. Raman spectroscopy, a sensitive technique for detecting vibrational and structural changes in substances, was employed to explore the spectral behaviour of these dilutions. Despite being prepared beyond Avogadro's limit, both potencies exhibited reproducible and distinct Raman peaks, suggesting that structural or energetic imprints of the original material may be retained. This aligns with the central premise of homoeopathy that the process of potentization does not simply dilute the material substance but enhances its dynamic or energetic potential.
In the current analysis, eight distinct peaks were consistently observed in both 30C and 200C samples. Between the two potencies, Sulphur 200CH displays the stronger and more dominant Raman response compared with Sulphur 30CH. In the 200CH sample, the principal band at ~890 cm^{-1} reaches about 31,200 a.u., which is higher than the corresponding peak in 30CH at ~27,800 a.u. This makes the 200CH spectrum appear sharper and more clearly defined, with the 890 cm^{-1} band standing out strongly above the rest of the fingerprint region. By contrast, the Sulphur 30CH spectrum shows a similar set of bands, but the main peak is slightly lower in intensity and the neighboring carbohydrate-related bands around 1050-1130 cm^{-1} and 1450-1500 cm^{-1} contribute more visibly, giving a somewhat more balanced profile. These results indicate that even though both samples are derived from the same raw substance, the degree of dilution and succussion significantly affects their physicochemical expression. This is consistent with the findings of Chikramane *et al*. (2010) [13], who reported the persistence of nano particles in high-dilution remedies, and Martin *et al*. (2020) [17], who noted spectral variation across potencies in their Raman-based homoeopathic studies.

In summary, both spectra are dominated by the excipient matrix, but Sulphur 200 CH produces the stronger, more prominent peak profile, while Sulphur 30CH appears slightly flatter and less intense overall**.** This shows the difference between them.

Conclusion
This study investigated the Raman spectroscopic features of SULPHUR in two ultra-diluted homoeopathic potencies 30C and 200C to determine whether any structural or vibrational characteristics persist following potentization. Raman spectroscopy, which measures molecular vibrations and bond-specific interactions, was employed to capture subtle physicochemical signatures within these highly diluted remedies.
The main 890 cm^{-1} peak in 200CH is about 12% higher in absolute intensity than in 30CH, and its relative dominance over other peaks in the spectrum is more pronounced. This suggests subtle differences in the structural organisation of the excipient molecules, potentially influenced by the different levels of trituration and succussion during the potentization process.
Raman spectroscopy not only offers a scientific means of comparing different homeopathic potencies but also serves as an aid in validating the efficacy of homeopathic remedies, by showing that even in the absence of bulk material, potentization can induce detectable changes in the medium that may be linked to therapeutic activity.

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