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APPLICATION OF SCANNING ELECTRON MICROSCOPE TO ANALYSE CURCUMA LONGA PRIMARY TINCTURE AND HIGHER DILUTION

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ABSTRACT

Background: Curcuma Longa,the turmeric is used as a medicine and antiseptic from the ancient time. Here we have tried to recognise curcuma longa in higher dilutions as a nano particle by SEM. Whereas it is neglected and beyond the knowledge of new researcher that in higher dilutions also, we can identify the nano particles of Curcuma Longa. For these we can go through FTIR, SEM , UV Spectroscopy etc. **Objective**: Through this research work synthesizing the Nanoparticles of Curcuma Longa Primary tincture and 2x potency with the help of Chemical method, Dynamisation is done. **Method:** Potassium ferricyanide used as a Biocatalyst. The t Primary incture and 2x is analysed by Scanning electron microscope. **Result**: The Nano particles of Curcuma Longa is identified in Scanning electron Microscope, Primary Tincture as well as 2x. **Conclusion**: We can conclude that in higher dilution we can identify the particles of Curcuma Longa.

INTRODUCTION

Turmeric (Curcuma longa L.) is a fascinating perennial herbaceous plant belonging to the Zingiberaceae family, closely related to ginger. This vibrant yellow-orange spice has its origins in the humid regions of South Asia but has since found a home in tropical and subtropical areas around the world due to its culinary and medicinal properties. The deep orange-yellow powder we recognize as turmeric is derived from the boiled and dried rhizomes of the plant, which have been an integral part of Asian cuisine and traditional medicine for centuries. In Ayurveda & Homoeopathy, turmeric is renowned for its anti-inflammatory properties and is often employed in treatments for various ailments. Its versatility extends beyond the kitchen, making it a staple in traditional Chinese medicine as well, where it serves as a stimulant and a natural remedy for inflammatory conditions. Turmeric's rich history and ongoing applications underscore its significance in both dietary practices and holistic health approaches As a stimulant, aspirant, cordeal, emenagogue, astringent, detergent, diuretic, and martirnet, it is used in medicine. Wild turmeric, scientifically known as Curcuma aromatic Salisb., serves a multitude of purposes in traditional medicine, acting as a stimulant, aspirant, cordeal, emmenagogue, astringent, detergent, diuretic, and even martirnet. In regions like India and China, this versatile plant is highly valued not only for its medicinal attributes but also as an alternative source for turmeric production. It is often referred to by names such as Kasthuri manjal in India and yujin in China. Furthermore, the species is identified as C. wenyujin Y.H. Chen et C. Ling in Chinese herbal texts. Notably, it has been recognized that the rhizome of wild turmeric can occasionally replace other species traditionally used in herbal formulations. The significance of this plant has been acknowledged in the Pharmacopoeia of the People's Republic of China since its 2005 version, where it was formally separated from Longae varieties.1

Although it is actually acknowledged as an equivalent for C. longa, curcumin is referred to by its scientific name, C. domestica Val., some countries. Over the past fifty years, many studies have been done on turmeric and its extracts, which can be made with water, ethyl acetate, ethanol, and methanol. These studies often focus on "pure" curcumin, which is a mixture of three main curcuminoids.(1,2).Curcumin is one of the most studied compounds when it comes to preventing diseases, especially cancer. Researchers have found that curcumin has strong anti-inflammatory properties and may help reduce the risk of cancer. This interest in turmeric and curcumin shows just how important these natural substances are for health and wellness. Overall, the research highlights the potential benefits of turmeric and curcumin in our diets and medicine.

In the Zingiberaceae family and numerous other groupings, more than 300 diarylheptanoids have been connected. Curcuminoids are members of the diaryl-heptanoids composite group. It belongs to the diphenyl-heptanoids (or species) family and has an aryl-C7-aryl shell. The primary active ingredients in curcumin are these unheroic hues, which are typically employed as complementary food coloring.

These types of polyphenols are continuously connected in turmeric rhizomes, where curcumin is the primary component (1). Known by several names, including 1,6-heptadiene (4-hydroxy-3-methoxyphenyl)-(1E, 6E) or diferuloyl methane, curcumin ($C_{21}H_{20}O_5$)(1) was first identified in 1815, and its molecular composition was connected in 1910.(3)

Curcumin, a compound found in turmeric, shows promise as a treatment for various health issues, including inflammatory bowel disease, pancreatitis, arthritis, and chronic anterior uveitis. Research from cell cultures, animal studies, and clinical trials suggests that it may help reduce inflammation and manage these conditions. Additionally, curcumin has been studied for its potential anti-cancer effects, especially in preventing colon and pancreatic cancers, as well as treating cervical neoplasia and Barrett's metaplasia. It works by targeting several important pathways in the body. For instance, it can inhibit certain proteins and enzymes that are linked to inflammation and cancer development. Curcumin also influences various cytokines and genes, helping to promote cell death in harmful cells. Because of these actions, it may not only reduce tumor growth but also prevent the formation of new blood vessels that feed tumors. All things considered, curcumin has a lot of promise for promoting health and curing illness.(4,5)

Turmeric extracts, particularly the active compounds called curcuminoids, have shown many health benefits. They are known to protect the liver and heart, help lower blood sugar levels, and fight against harmful fungi and parasites. Curcumin also acts as a strong antioxidant, which means it helps protect the body from damage caused by harmful substances. Additionally, it may help improve the effectiveness of chemotherapy and radiotherapy. Recent studies in China and the USA have found that curcumin could be a promising treatment for Alzheimer's disease, a condition that affects memory. (6)Moreover, there is growing evidence that curcumin can help control how the body processes fats, which is important for preventing obesity and related health issues. Overall, curcumin from turmeric appears to hold great potential for improving health and supporting the treatment of various diseases.

Scanning Electron Mictroscope:

Nanoparticles are fundamental to the field of nanotechnology, comprising materials such as metals, metal oxides, organic compounds, and carbon, with sizes ranging from 1 to 100 nanometres. These particles exhibit variations in size, shape, and structural dimensions, which influence their properties and applications. Scanning Electron Microscopy (SEM) employs electron beams to analyse samples by scanning them in raster patterns. When electrons interact with the atoms in a sample, they generate signals that offer valuable information about the sample's surface structure and its composition, helping us understand its characteristics better .SEM typically utilizes secondary electron detectors (SEDs) and backscattered electron detectors (BSDs) to capture these signals effectively. The human eye can resolve two distinct points that are 0.2 mm apart under optimal lighting conditions, a measure known as the eye's resolving power. To observe objects closer than this threshold, optical instruments like microscopes are employed to magnify images. Modern light microscopes can achieve magnifications of up to 1000 times, but their resolving power is influenced by both the quality of the lenses and the wavelength of the illuminating light. The Rayleigh criterion is commonly used to define a microscope's resolution, which can be quantitatively expressed through Abbe's equation: $d = 0.612 \lambda / n \sin \alpha$. In this equation, *d* represents resolution, *λ* is the wavelength of the imaging radiation, *n* denotes the refractive index of the medium between the point source and the lens, and *α* is half the angle of the light cone accepted by the objective. The term *n sin α* is referred to as the numerical aperture (NA), which plays a crucial role in determining the optical system's resolution.(7)

Review of Literature:

The first transmission electron microscope (TEM) developed in the year 1930 thanks to technological developments that substituted an electron beam and coils of electromagnetic radiation for traditional light sources and condensing lenses. This novel device uses an electromagnetic condensing lens for concentrating the beam of electrons onto the object being studied.(8)

Conversely, a scanning electron microscope (SEM) employs a focused electron beam that systematically scans the surface of the specimen, generating various signals that will be elaborated upon later. These electron signals are ultimately transformed into a visual representation displayed on a cathode-ray tube (C R T). Bragg defines his approach as a Huygens' structure for a wave that Reflects in his most important publication.(9)

He posits that when a plane wave strikes a series of lattice planes, spaced apart at a specific angle, points A and C reside on one plane With positions ABCC', B generates a quadrilateral shape on an inferior plane. The ray emitted along AB before its reflection along BC and the beam reflected via AC' have different paths.(10) The beam that passes along AB before its reflection through BC and the beam of light that reflects via AC' have different path lengths.In order for constructive interference to take place at a distant point, this path difference must correspond to an integer multiple of the wavelength of the incoming wave.

Bragg's Law:

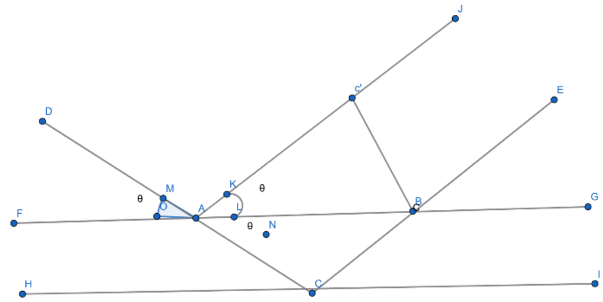
As a result, mathematical connections produce a formula that captures the scattering parameters and reduces to Bragg's law.(10)

Smooth maxima at the Bragg angles could arise from a gradual shift from proactive to negative interference if just the two planes of atoms were involved in diffraction, as shown in the picture. However, in most real materials, the involvement of numerous atomic planes leads to the observation of sharp peaks. A detailed derivation based on the more comprehensive Laue equations can be found on the corresponding page.(11)

A sample's atomic particles and electrons react to generate a variety of signals that provide information about its chemical structure and topography of the surface.(12)

By utilizing a raster scan pattern, the position of the electron beam is linked to the intensity of the detected signals, facilitating image creation.(13,14) A secondary electron detector, specifically the Everhart–Thornley detection system, is used in the main technique of SEM (scanning electron microscopy) to capture secondary electrons, which are generated from molecules excited by the beam of electrons. The material's topography is one of many variables which influence the intensity of the recorded signal strength, indicating the amount of secondary electrons.Certain SEMs are capable of resolutions under one nanometer.(13,15)

Conventional SEMs operate under high vacuum conditions, while variable pressure or environmental SEMs allow for low vacuum or wet observations, and specialized instruments can accommodate a broad range of cryogenic or elevated temperatures.(12)



Bragg’s Law with horizontal x vertical y axis Figure 1

Methodology:

Type of study: Nanotechnology

Duration: 1 Month

Site of study: Jawaharlal Nehru Homoeopathic Medical College, Micro-nano R & D Center, Parul University, Vadodara, Gujarat

Medical Substance: Curcuma Longa Primary Tincture & Higher Dilution

Instrument specifications: The Hitachi SU3800 SEM delivers precise nanoscale surface data through high-resolution characterization and analysis. It has sophisticated optics and detection systems, including as STEM, UVD, BSE, and SE detectors. Utilizing an EDS system for elemental composition assessment, the SEM provides comprehensive information about the morphology of the specimen's surface.

Preparations of Curcuma Primary Tincture:

The *C.* longa plant rhizomes were harvested in the Jaysudha Garden of Parul University, Vadodara on December 2024.

The plant species was recognised by the botany department of Parul university and characteristics was examined iin the pharmacy laboratory of JNhmc with a code no Pharma: CL 59.16

Rhizomes were cleaned with rubbing and a small amount of water, alcohol.

Then they are chopped in small parts and dried. The dry powder 100 GM, purified water 400 ml, strong alcohol 635ml is mixed in a macerator and kept for 15 days. Then it is filtered by a what man’s filter paper.

Now we get the crude drug of C. Longa.(According to HPI),From the Primary tincture we prepared 2x by taking one part of mother tincture,3 parts of Purified Water and six parts of Strong Alcohol. 16

Synthesis of Nanoparticles:

1 st step; Cleansing of all the laboratory utensils under Hot air oven for attest 10-15 minutes

2 nd Step: Take 1 ml of Curcuma longa as drug material with 20 ml distilled water and adding 1 gm Potassium ferricyanide as a biocatalyst. Solvent name as Mother base of Nanoparticles. Same procedure is done for 2x potency.

3 rd step: Mother base of Nanoparticles Sample should undergoes into potentization with electric potentizer machine, which gives 10 downwards strokes for liquid medium. Same procedure is done for 2x potency.

4 th step: Take 1 millilitre of the mother base of nanoparticles, 9 millilitres of dispensing alcohol, and 10 downward equal strength strokes after potentization. Same procedure is done for 2x potency.

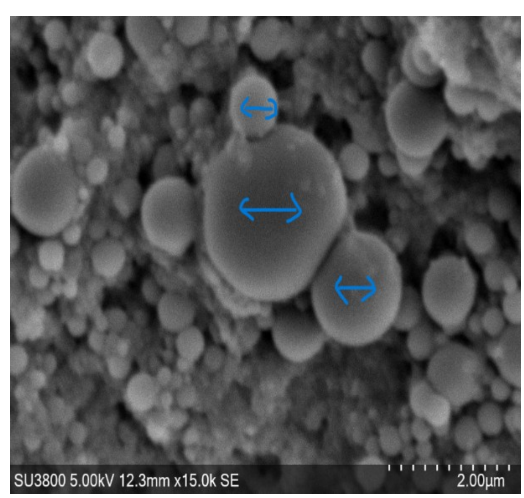
5 th step: Change in colour, odour and texture of Mother base of Nanoparticles Same procedure is done for 2x potency.

6 th step: Analysis were done under Scanning electron Microscope.

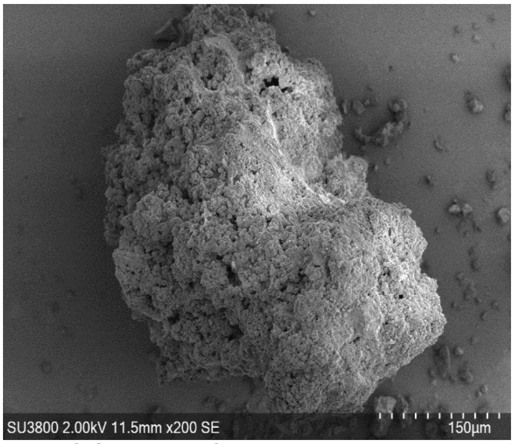
Results:

After scanning under Scanning electron microscope the sample size are given below as

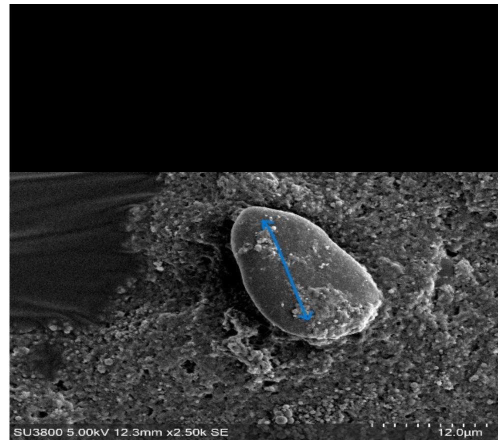
Picture1:Curcuma Longa pri.tinc. at 30 μm:Arosol with particles Particles



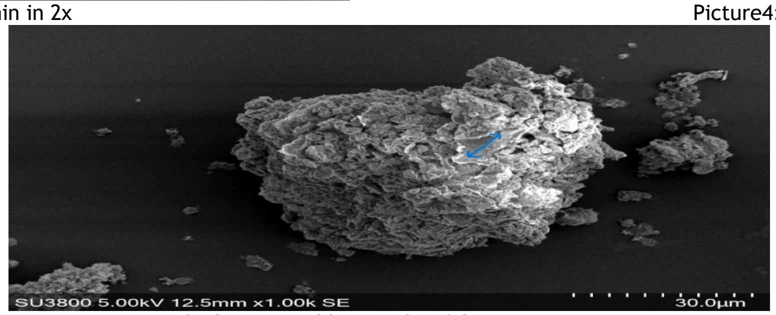
Picture2:Curcuma Longa Primary tinc: solid lipid Nano Particles



Picture3:Curcumin in 2x



Picture4:Arosol



Picture 5: Particle Curcumin: 30 µm in 2x of Curcuma Longa

DISCUSSION

Synthesis of Nanoparticles in the Curcuma Longa by chemical method and Dynamisation were done successfully. By this analysis we visualize the surface of the sample of curcuma Longa Primary tincture and 2x where we find the particles of Curcuma and the elemental composition of Curcuma in mother tincture and 2x.

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Conflict of interest

The authors declare that there is no conflict of interest. The authors alone are responsible for the accuracy and integrity of the paper content.

Note:

Figure 1 Bragg's law is inspired by - https://www.globalsino.com/EM/page3882.html

All Pictures (results) are provided by the Micro Nano department of Parul University, Vadodara after the analysis.

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