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THE STUDY OF EFFECT OF STATIC MAGNETIC FIELD ON IN-VITRO WHEWELITE CRYSTAL GROWTH

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Abstract: In the present work, Whewelite crystal one of the crystalline components of urinary stone also referred as renal calculi, are grown by single diffusion gel method in the presence of magnetic field of different strength such as 0, 0.1, 0.2 Tesla for constant pH, density and concentration of the solution at room temperature, yield and morphology of grown crystal are studied. The crystals are characterized by using XRD and FTIR method. The effect of static magnetic field exposure promotes in-vitro Whewelite crystal growth process.

Keywords:Whewelite Crystal growth; Single Diffusion Gel Method; XRD; FTIR.

1. INTRODUCTION

Calcium Oxalate is composed of CaC_2O_4. It occurs in mineral form as Calcium Oxalate Monohydrate (COM) it is known as Whewelite. It is one of the crystalline components of urinary stone which occurs in human, plants and animals. Many researchers have grown various types of crystals and the process is still going on…

Calcium oxalate crystal growth by gel method and its spectroscopic analysis had been studied by Valarmathi[1].Thermal analysis of kidney stones and their characterization had been studied by Kohutova[2].Fine structure of calcium oxalate monohydrate renal calculi had been studied by Olznel[3].The characteristics, properties and surface morphology of calcium oxalate mono hydrate single crystals grown in silica gel had been studied by Salim[4].Growth of some urinary crystals and studies on inhibitors and promoters for crystal growth and characterization of crystals had been studied by Srinivasan[5]. Characterization studies of uroliths had been done by Kumar [6].Crystal growth of cholesterol; struvite and whewelite in gel media and static magnetic field effect studied on struvite crystal growth by Bhagat et al [7]. In in-vitro gel; the environment is similar to physiological environment of living animal body so in the present work, in vitro gel for study of nucleation and growth of Whewelite crystal used and are grown by single diffusion gel method in the presence of magnetic field of different strength such as 0, 0.1, 0.2 Tesla for constant pH, density and concentration of the solution at room temperature, yields and morphology of grown crystal are studied. These crystals are characterized by using XRD and FTIR method.

2. EXPERIMENTAL DETAILS

AR grade chemicals used for study of Whewelite crystal growth as, Sodium Meta Silicate (SMS), Acetic acid (glacial), Calcium Chloride, Oxalic acid, Distilled water. Borosilicate Glass Test tubes of diameter (25x15) cm.

2.1 Gel Setting and Whewelite crystal growth in gel media

The gel preparation and gel setting is done by preparing stock solution by dissolving Sodium Meta Silicate powder in double distilled water and shaking this solution well. The solution is filtered and kept in clean flask. This solution was mixed

with glacial acetic acid for pH value 6.5 and with specific gravity1.04 gm. /cc. This solution of sodium Meta silicate mixed in 2.0M concentration of calcium chloride solution in the ratio 1:1 and allowed to set for 48 hours at room temperature.

2.2 Static Magnetic field set up:

An Electromagnets (EMU-50) of 7.5 kg placed at 10mm air gap with flat pole pieces (50 mm diameter) is used to apply magnetic field strength as shown in figure 1.The magnetic field strengths were varied by using appropriate current to the coils and it is measured by Gauss meter. After setting the gel, 2.5M concentration of Oxalic acid solution is poured slowly and gently around corners of test tubes over set gel. Then four Test tubes were kept in Electromagnets (EMU-50) one by one for exposure of steady magnetic field strength of 0.1 Tesla (Core coil current 1.46 Amperes) for different time periods 30min., 60min., 90min. and 120min. Similar procedure was repeated for magnetic field exposure of 0.2 Tesla (Core coil current 2.93 Amperes) at room temperature. The test tubes were tighten using cork and kept in a quiet and vibration free condition for 120 hours. The following chemical reaction took place.

$CaCl_2.H_2O+C_2H_2O_4 = CaC_2O_4.H_2O + 2HCl$.

Fine Whewelite crystals were observed in test tube at the centre of upper gel region and some at the bottom as shown in figure 2. Then crystals were collected from test tubes on filter paper for weighing.

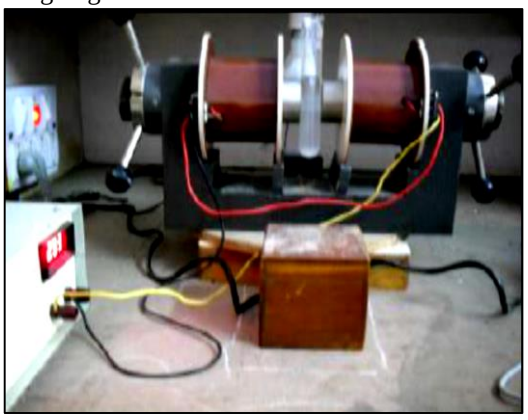

Fig.1. *Experimental Set up for Crystallization of Whewelite at 0.1 and 0.2 Tesla magnetic field strengths.*

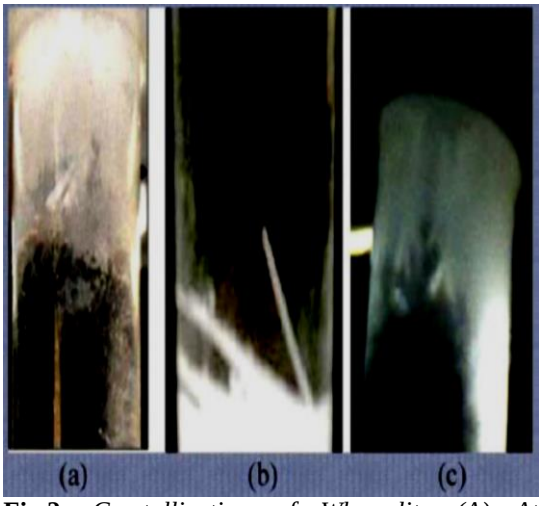

Fig.2. *Crystallization of Whewelite (A) At Nucleation State (B) & (C) After 120 Hrs. for pH 6.5, density1.04g/cc & 2.5M concentration of Oxalic acid***.**

2.3 Crystal Yield Analysis:

Yields of Whewelite crystals grown are given in table no.1.

Table.1. Yields of Whewelite Crystal after 120 hours in gm. at pH 6.5

Magnetic field in Tesla	Time in Minutes	Yield of Whewelite Crystal after 120hours in gm. at pH 6.5
0	0	1.70
0.1	30	0.98
0.1	60	1.25
0.1	90	1.38
0.1	120	1.48
0.2	30	1.15
0.2	60	1.35
0.2	90	1.49
0.2	120	1.58

And plotted in figure 3.

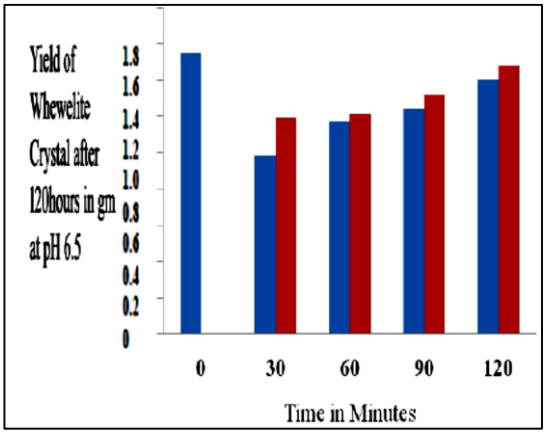

Fig.3. *Plot of Yields of Whewelite at SMS Gel Density1.04g/cc &2M Calcium Chloride Solution.*

2.4 Crystal Characterization Analysis:

XRD and FTIR Studies were conducted to characterize the crystals grown in silica gel media.

2.4.1 Powder X Ray Diffraction Analysis:

Powder XRD pattern of Whewelite crystal recorded by X Ray Diffractometer Philips PW1840 crystallizes in tetragonal structure with cell parameters as follows;

a=6.290A˚, b=14.583A˚, c=10.116A˚, β=109.46˚

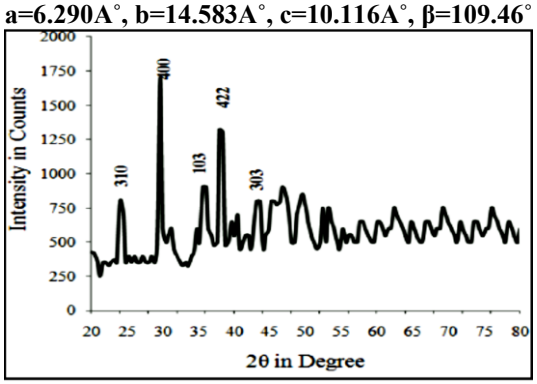

Fig.4.*Powder XRD pattern of Whewelite crystal.*

2.4.2 FTIR Analysis:

The FTIR analysis of Whewelite crystal grown as shown in figure 4.The FTIR spectrum of Whewelite crystal is confirmed by recording with FTIR-BUSY-6100 JASCO spectrometer in a ($4000cm^{-1}$-$400cm^{-1}$)scan range.

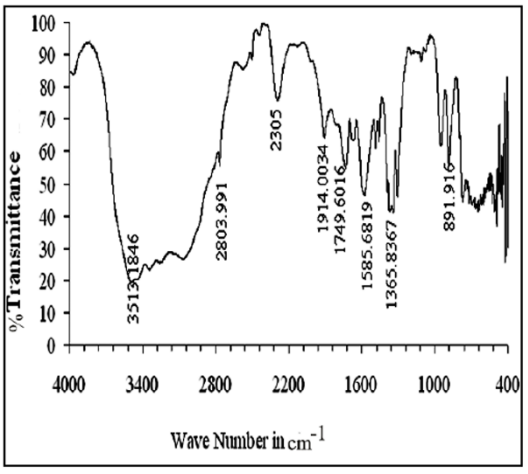

Fig.5. (A) *FTIR of UN Exposed Whewelite crystal.*

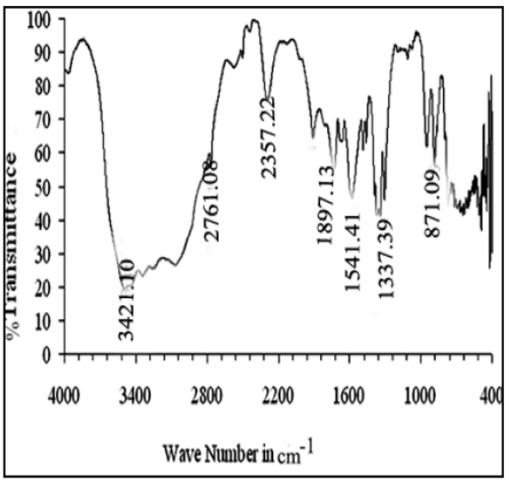

Fig.5 (B) *FTIR of Static Magnetic field Exposed Whewelite crystal*

3. RESULTS AND DISCUSSION

The photographs of Whewelite crystals grown are shown in figure 2. The morphology of Whewelite crystals observed as elongated rod like morphology and is in good agreement with result published.The powder XRD pattern shown in figure no. 4 of Whewelite crystal confirmed and results are in good agreement with results reported in literatures. Also FTIR analysis pattern shown in figure no.5(A,B) of Whewelite crystal confirmed and results are in good agreement with results reported in literatures.

FTIR pattern obtained for crystal for crystal grown under exposure of magnetic field at the nucleation time exhibits more % transmittance for magnetic field strength 0.1 T than 0.2 T. The difference of % transmittance found decreased and depth of %transmittance dip at frequency is found increased as exposure time is increased.

Rate of nucleation observed reduced and size of crystals decreased with increasing strength of magnetic field but number of crystals found increased.

Yields of Whewelite crystals grown are given in table no.1 and plotted in figure 3 is found slightly increased as influence of increasing magnetic field. Overall yield found less as compared to without exposure of magnetic field.

4. CONCLUSIONS

Whewelite crystals can be grown by single diffusion gel growth technique. By careful observations of the crystal the similar elongated rod like morphology of Whewelite crystal observed for without exposure, with static magnetic field exposure are as given in figure no.

2. Hence the effect of static magnetic field promotes in-vitro Whewelite crystal growth process.

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