



RESEARCH ARTICLE

THE STUDY OF CRYSTAL GROWTH OF WHEWELITE IN GEL MEDIA

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INTRODUCTION

Calcium Oxalate is composed of CaC_2O_4 . It occurs in mineral form as Calcium Oxalate Monohydrate (COM) it is known as Whewelite and Calcium Oxalate Di hydrate (COD); it is also known as Wedellite. It is one of the crystalline components of urinary stone which occurs in human, plants and animals. Fine Structure of Calcium Oxalate Monohydrate Renal Calculi reported (Ólznel *et al*, 1993). Development of Calcium Oxalate Crystals on Urothelium reported (Grases *et al*, 1998). A chemical analysis of renal stones of patients reported (Risal *et al*, 2006). A Quantitative study on the chemical composition of renal stones and their fluoride content in Anantapur District, Andhra Pradesh India reported (Sai *et al*, 2008). Kidney stones and their characterization reported (Kohutova *et al*, 2010). We had studied Crystal growth of Cholesterol and Struvite in gel media (Bhagat *et al*, 2009; 2013; 2014). We have now studied the effect of pH, specific gravities and concentrations of the solution on growth and morphology of Whewelite crystal at room temperature.

MATERIALS AND METHODS

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. Entire crystal growth process was carried out in dust free and quiet environment.

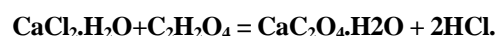
Gel Setting and Whewelite crystal growth in gel media

The gel was prepared 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

ABSTRACT

The renal calculus popularly known as kidney stone constitutes mainly Calcium Oxalate, Calcium Phosphate, Ammonium Magnesium Phosphate Hex Hydrate and Uric Acid. In human and animal renal calculi the Whewelite is known as Whe welite is about 40% to 60% which is a major component of kidney stone. The kidney stone is major health problem all over the world. In the present work, in vitro Whewelite crystal growth in silica gel media is carried out. The chemical reaction in gel method is employed in crystal growth and the effect of pH, specific gravities and concentrations of the solution on growth and morphology of crystal was studied at room temperature. The grown crystals are characterized by using XRD and FTIR method.

with glacial acetic acid for pH values 6.0 and 6.5 and with four different specific gravities (1.03, 1.04, 1.05, and 1.06) g/cc. This solution of Sodium Meta Silicate mixed in 2M concentration of Calcium Chloride solution in the ratio 1:1 and allowed to set for 48 hours at room temperature. After setting the gel, various five concentrations 0.5M, 1.0M, 1.5M, 2.0M and 2.5M of Oxalic Acid solution is poured slowly and gently around edges of test tubes over set gel. The test tubes were tighten using cork and kept in a quiet and vibration free condition. The following chemical reaction took place



After 120 hours; Fine Whewelite crystals were observed in test tube at the centre of gel region and some at surface of test tube. Then crystals were collected from test tubes on filter paper for weighing.

Crystal Yield Analysis

Yield of Whewelite crystals grown are given in figure 2 for solution of pH 6.0 and 6.5 for different specific gravities and concentrations of solution.

Crystal Characterization Analysis

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

Powder x ray diffraction analysis

A Philips X-ray Diffractometer model PW/1840 with Ni filter, Cu-K radiation is used to identify the crystal structure of Whewelite crystal which crystallizes in tetragonal structure with elementary cell has the symmetry space group P21/c with the parameters are

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$a=6.290 \text{ \AA}$, $b=14.583 \text{ \AA}$, $c =10.116 \text{ \AA}$, $\alpha =109.46^\circ$ indexed as (JCPDS Card No.14-0770) shown in figure 3.

FTIR analysis

The FTIR spectrum of Whewelite crystal is recorded using FTIR-BUSY-6100 JASCO spectrometer in a scan range ($4000-400\text{cm}^{-1}$). The functional groups of Whewelite crystals involved in vibration frequency were identified using FTIR analysis as shown in figure 4.

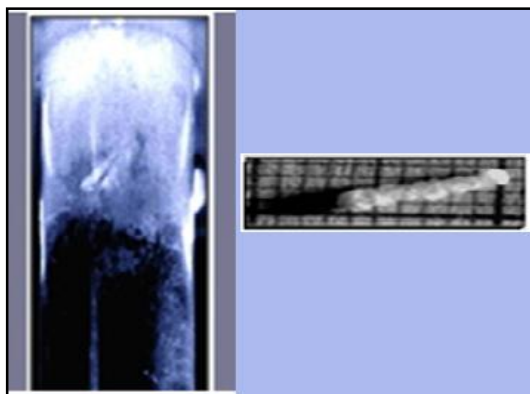


Figure 1 Crystallization of Whewelite after 120 Hrs at pH6.0, specific gravity 1.04g/cc & concentration 2.5M of Oxalic Acid solution. Dimension of crystal is [0.7mmx0.1mmx0.1mm].

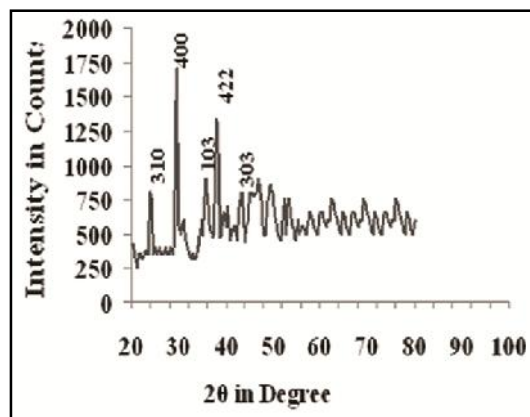


Figure 3 Powders XRD of Whewelite Crystal.

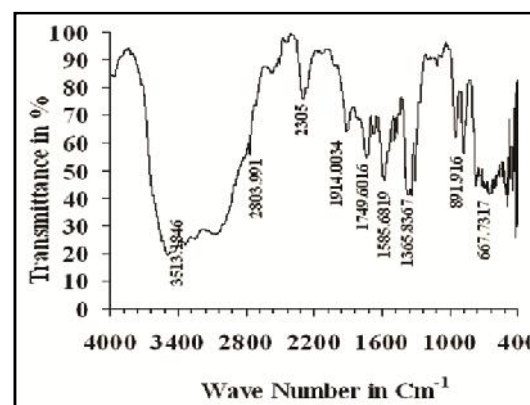


Figure 4 FTIR of Whewelite Crystal.

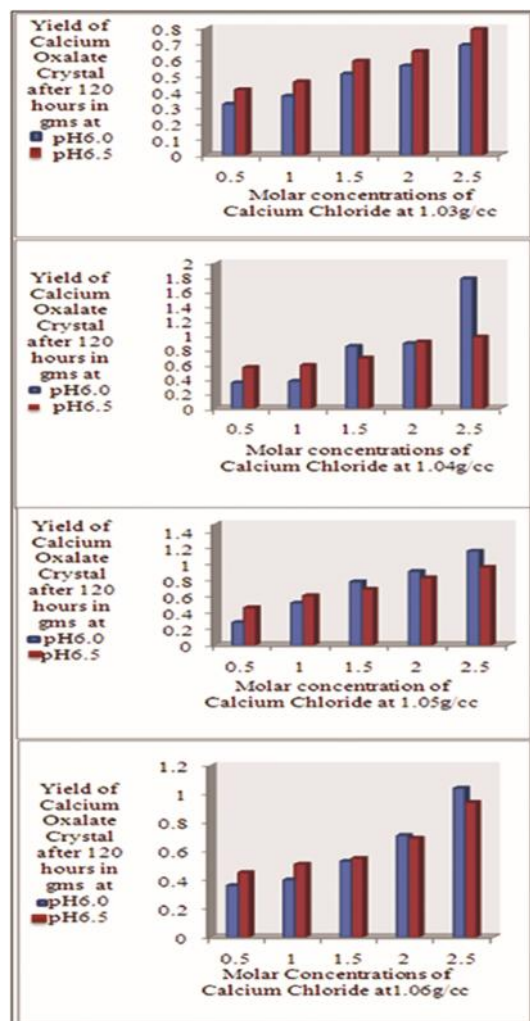


Figure 2 Yield of Whewelite crystal for specific gravities (1.03, 1.04, 1.05 & 1.06 gm/cc) in 2M Calcium Chloride Solution.

RESULTS AND DISCUSSION

The photographs of Whewelite crystals grown are shown in figure 1. The morphology of Whewelite Crystals observed as elongated rod like and is in good agreement with result published. (Valarmathi *et al*, 2010; Abdul, 2012).

The powder XRD pattern of Whewelite crystal shown in figure 3 confirmed crystal of Whewelite and results are in good agreement with results reported in literatures. (Srinivasan *et al*, 1996; Kumar *et al*, 2006; Taur *et al*, 2012).

Also FTIR analysis pattern shown in figure 4 confirmed crystal of Whewelite crystal and results are in good agreement with results reported in literatures.(Valarmathi *et al*,2010; Abdul ,2012).

Yield of Whewelite Crystal grown is found increasing as concentration of Oxalic acid solution increases.

CONCLUSION

Good quality crystals of Whewelite ($\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$) have been grown in sodium metasilicate (SMS) gel at room temperature. The morphology of Whewelite Crystals observed as elongated rod like. The Powder X-ray diffraction pattern and FTIR analysis pattern of the gel grown Whewelite show the crystals possess tetragonal structure with lattice parameters in good agreement with the reported data (JCPDS Card No.14-0770). Yield of Whewelite Crystal grown by chemical reaction in gel method is found increasing as concentrations of Oxalic acid solution increases.

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