



Study of Growth parameters of Lithium Crystals by Single Diffusion Gel Method

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ABSTRACT

Single crystals of Lithium tartrate ($C_4H_4O_6Li_2$) Crystals were grown by single diffusion gel technique in a sodium meta silicate gel media at room temperature. Methanol used as solvent for lithium chloride. Optimum conditions were established for growth of good quality pure crystals. The effect of various parameters like were studied pH gel, gel density, concentration of inner and upper reactants. The Ethanol and methanol are used to dissolve lithium chloride. The good size of crystal are grown and The gel method is very simple and within the scope of the laboratory, method be utilized to synthesise crystals. The tartrate crystals have potentials applications such as dielectric, ferroelectric and piezoelectric. In the present work The Lithium tartrate crystal of white color, transparent are obtained, Needle shaped, dendrite crystal were grown [1-10]

Keywords: Gel Technique, Lithium tartrate Crystals, Various parameters (Gel density, pH, & Temperature.)

I. INTRODUCTION

Gel technique is the best technique for growing single crystals at ambient temperature, the compounds which are insoluble in water and decompose before melting can be easily grown by this technique. Due to very slow controlled rate of crystallization and non-turbulence during growth, good quality single crystals are obtained from this technique. The aim of the present work is to grow good quality single crystals of pure lithium tartrate in sodium metasilicate gel. Many researchers have grown the tartrate crystals of different elements having potential applications. The tartrate crystals have potentials applications such as dielectric, ferroelectric and piezoelectric.

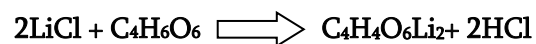
1.1 CRYSTAL GROWTH-

The growth of crystal in the gel media is based on the diffusion of the reactant i.e. supernatant. Two techniques can be used for the process of diffusion of reactant in gel media.

- 1) Single diffusion technique and
- 2) Double diffusion technique

1.2 CHEMICAL REACTION –

The expected reaction taking place in this work is as below:



II. EXPERIMENTAL PART

2.1. PREPARATION OF GEL –

The various concentrations of tartaric acid and those

of sodium metasilicate solutions were tried. The solution was added drop by drop with continuous stirring by using a magnetic stirrer till pH is reached in between 3.8 to 4.4. The acid was used for setting of the gel. The solution was then transferred to the corning glass tube. The mouth of the tube was covered by cotton plug. Initially, the mixture appeared to be quite transparent. The gel setting time was about 96 hours. It was observed that the period of setting also depends upon pH of the solvent. Table 1 .Shows optimum conditions to grow the crystals.

Table 1. Optimum conditions for growth of lithium tartrate crystals.

Sr.No	Various Parameter	Process	Optimum conditions
1	Density of sodium metasilicate solution		1.04 g/cm ³
2	Volume of sodium metasilicate solution		18ml
3	Volume of tartaric acid		7 ml
4	Concentration lithium chloride		0.2 to 1M
5	pH		4.2
6	Concentration of tartaric acid		1 M
7	Environment temperature		25 to 30 °C
8	Solvent used		Ethanol or Methanol

2.2.EFFECT OF VARIOUS PARAMETERS ON CRYSTALS GROWTH

2.2.1. EFFECT OF GEL DENSITY-

As the gel densities increases, decrease in its transparency is observed like setting time of gel increases with decrease in density. The sodium metasilicate of density 1.04gm/cm³.

Table 2. Effect of gel density on nucleation density.

Test tube No.	Tartaric acid 1M(ml)	Density of gel (gm/cm ³)	Number of nuclei formed	Observations
1	7	1.038	20	Nucleation process fast but very small crystals
2	7	1.040	24	Transport, well shinning
3	7	1.042	28	White, semitransparent
4	7	1.044	34	Big crystals formed
5	7	1.046	40	Small crystals

2.2.2. EFFECT OF CONCENTRATION OF REACTANTS -

Table 3. Volume of sodium metasilicate required for various concentration of tartaric acid

Test tube No	Concentration of tartaric acid (M)	Sodium metasilicate (ml)
1	1	18
2	1.25	22
3	1.5	25
4	1.75	28
5	2	32
6	2.5	36

(Volume of tartaric acid = 7 ml and pH=4.2)

Fig 1 Graph of sodium metasilicate vs concentration of tartaric acid

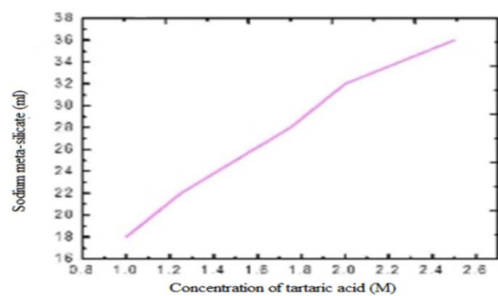
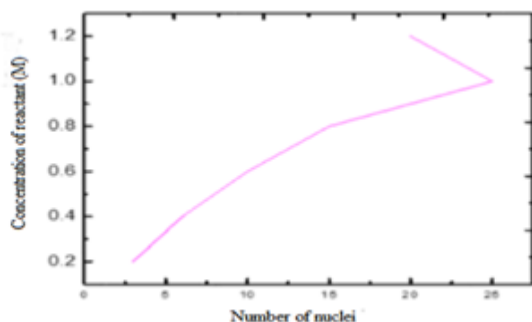


Fig.2. Graph of concentration of supernatants vs number of nuclei.



2.2.3. EFFECT OF CONCENTRATION OF SUPERNATANT –

Upper reactance from conc.0.2 to 1M where obtained dissolving LiCl in methanol solvent, It was added over the set gel. Very few nucleations were observed with very tiny size of the white crystals.

Table 4. Effect of concentration of supernatant (pH=4.4)

Test tube No.	Concentration of reactant (Supernatant LiCl)M	No. of nuclei	Observations
1	0.2	3	Crystal size is very small.
2	0.4	6	Slight increase in crystal size
3	0.6	10	Star shaped well isolated crystal
4	0.8	15	Well isolated crystals of various shapes and size
5	1.2	20	Transparent whitish well isolated crystals.

III. RESULT AND DISCUSSION -

Crystals of lithium tartrate are whitish, semitransparent and star shaped . crystals having size 2.5 mm x 4.5mm and thickness of about 2.5 to 3 mm are obtained. Different parameters such as concentration of reactants, pH of gel, impurities in the solvent, gel setting time, gel aging time etc. have considerable effect on growth rate. However as the reactants percolates through the gel, the controlled reaction occurs below , at the depth of 3 to 4 cm. Hence good quality, semitransparent , well developed faces of crystals are observed.

IV. CONCLUSION

1. Gel method is very simple and within the scope of the laboratory, method be utilized to synthesize crystals, if optimum conditions are established.
2. The grown lithium tartrate crystal are white color good size of crystals are grown.
3. The supernatant solution prepared in methanol and ethanol gives good quality crystals.

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