



Alkali Conversion of Celestite Concentrate for Preparation of Strontium Compounds

Thesis

Submitted in the Partial Fulfillment

For

M. Sc. Degree in Chemistry

To

**Chemistry Department, Faculty of Science,
Ain Shams University**

By

Ayat Nasr Mohammed Shazly

B. Sc. in Chemistry, 2007

2012

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ABSTRACT

This study deals with developing a process for synthesis of organic strontium compounds such as strontium malonate and strontium tartarate from Egyptian celestite concentrate after sodium carbonate conversion. Egyptian celestite concentrate (SrSO_4) is directly reacted with Na_2CO_3 solution in order to obtain crude SrCO_3 and Na_2SO_4 solution. For purification, the crude strontium carbonate was leached with hydrochloric acid followed by pH adjustment for iron precipitation as iron hydroxide. Precipitated iron hydroxide was then removed together with hydrated silica leaving pure SrCl_2 . The SrCl_2 is reacted with Na_2CO_3 solution to precipitate pure SrCO_3 . The obtained optimum alkali conversion conditions are 60 minutes reaction time, 800 rpm agitation speed, 100 % -230 mesh particle size, 3 % Na_2CO_3 concentration and 95°C reaction temperature. Under these conditions, 100 % SrSO_4 conversion efficiency was achieved. Alkali conversion kinetics of celestite concentrate with Na_2CO_3 solution was studied. It was concluded that the diffusion (reactants) through boundary layer around celestite particles is the rate controlling step within the first 10 minutes of the reaction. On the other hand, the chemical reaction on the surface of celestite particles is the rate controlling step within the next 50 minutes of the reaction. The apparent activation energy was determined and found to be about 34.7 KJ/mole (i.e. 8.3 Kcal/mole),

which is characteristic for celestite conversion reaction. The effect of organic additives on the crystallization of strontium malonate and strontium tartrate was studied. Strontium malonate and strontium tartrate crystallization reaction was carried out at 45 °C and 37°C, respectively. The applied additives are sodium dodecyl sulfate (SDS) as anionic surfactant and poly ethylene glycol (PEG) as organic polymer. The obtained results revealed that the addition of SDS and PEG to the crystallization medium decreased the induction time of crystallization of compared with the base line (without additives). On the other hand, addition of SDS and PEG to the crystallization medium increased the induction time of strontium tartrate at low supersaturation but decreased the induction time at high supersaturation compared with the base line (without additives). The change of surface energy was calculated with and without additives. Strontium malonate and strontium tartrate morphology were investigated using the scanning electron microscope.

Key words: celestite concentrate, strontium malonate, strontium tartrate, crystal growth, surfactant, polymer, induction time, kinetics.

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