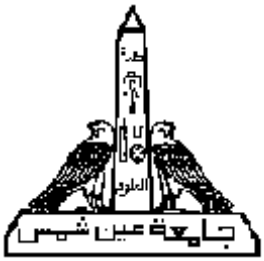

Alkali Conversion of Celestite Concentrate for Preparation of Strontium Compounds

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

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Under the Supervision of

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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 tartarate 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.

Acknowledgements

The author would like to express her deep thanks to **Prof. Dr. M. FathiEl–Shahat,** Professor of Inorganic and Analytical Chemistry, Faculty of Science, Ain Shams University for continuous guidance, support and kind advice over the whole duration of the study.

The author is also greatly indebted to **Prof. Dr. El-Sayed Ali Abdel-Aal,** Head of Mineral Technology Department, Central Metallurgical Research and Development Institute (CMRDI) for suggesting the problem, direct supervision, valuable and fruitful comments and discussions and kind help during the experimental work and theoretical calculation.

I would like to appreciate **Associate Prof. Dr. Mohamed Mohamed Rashad**, Head of Magnetic and Electronic Materials Division for kind help, friendly assistance and fruitful discussions.

Many thanks are also directed to all staff members of the Chemical and Electrometallurgy Division, Minerals Processing and Technology Department (CMRDI) for their assistance and cooperation.

Ayat El Shazly

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