

Study on Recovery and Adding More Value of the Component in Sea Water by Uniform Precipitation Method Using Urea

Kaoru ONOE

Department of industrial Chemistry, Chiba Institute of Technology

Takaji AKIYA

National Institute of Material and Chemical Research

Gensho MIYAKO

Shonan Institute of Technology

Summary

From the viewpoint of the effective recovery and the utilization of components in sea water, a reactive crystallization method using urea hydrolysis was developed. The effects of hydrolysis rate of urea and kind of salt on morphology of calcium carbonate were examined in several systems. The urea and urease were used as feedstock of the carbonate ion and the enzyme for decomposition of urea, respectively.

The experiment was carried out by the batch. Mixed aqueous solution of 0.2M- $(\text{NH}_2)_2\text{CO}$ (250ml) and 0.2M- CaCl_2 /chloride salt (250ml) was stirred at 313K by adjusting in the buffer solution in pH 7.8. Furthermore, 20-100mg/l of urease was added into the mixture, and the generation rate of calcium carbonate was controlled. The urea concentration was measured by the diacetyl monooxime test method, and the selectivity of polymorphism of calcium carbonate (calcite, vaterite and aragonite) was calculated from the peak strength of the X-ray diffraction.

The coexistent effect of different cation on morphology of calcium carbonate was examined, and features of each system are obtained like the following: (1) Potassium addition system: urea hydrolysis is promoted after 60 min reaction, and the main product is calcite; (2) Magnesium addition system: urea hydrolysis is inhibited in the initial stage, and aragonite is formed little only in this system; (3) Sodium addition system: both calcite and vaterite are formed, and the selectivity of the vaterite rises after 10 min reaction; (4) Barium addition system: amorphous product was observed, and $\text{BaCa}(\text{CO}_3)_2$ is formed after 60 min reaction; and (5) Strontium addition system: only calcite is formed in 10 min reaction, but $(\text{Sr,Ca})\text{CO}_3$ was formed in addition to calcite after 60 min reaction.