No. 1612

Study of Crystallization Operation Conditions for Resource Recovery from Integrated Process of Salt Production and Seawater Desalination

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Summary

Introduction The integrated process of salt production and desalinization of sea water has attracted attention in the viewpoint of resource recovery and environmental impact reduction. In this integration process, the process fluid with different admixture ion composition is discharged for feed of the resource recovery process. It is necessary to investigate which process fluid is suitable as feed of resource recovery process. It is also important to decide an effective side cut position for the resource recovery. So, this research investigated the production method of desired resources as a selective crystalline particles from the concentrated sea water by using various side cut process fluid. Magnesium hydroxide $Mg(OH)_2$ (MH) is an object resource and the reaction crystallization method by which $Ca(OH)_2$ (CH) is added as a base was used. Reaction crystallization was carried out by using concentration sea water, brine, bittern, and those mixed solutions as feed solution for the resource recovery process. CH powder and CH tablet addition methods were applied to the reaction crystallization. The obtained crystals were analyzed by XRD and were observed by SEM.

Results and Discussion As the comparing results of the addition method of CH, not only MH crystal but $CaCO_3$ crystal deposited under the condition of CH powder addition. Therefore, it became clear that the selection of addition method of CH was important. The reaction crystallization was investigated under the various feed solution composition. When any process fluid was used, MH crystal was obtained selectively under the condition of CH tablet addition. By comparison of the powder pattern of XRD, it became clear that XRD peak shape changes with process fluid composition. Then, the crystallite size which is an index of crystal quality was evaluated. As the result, mapping between process fluid solution composition and crystal qualities was able to be proposed.

Conclusion The integrated process which combined the desalinization of sea water, the salt production, and magnesium recovery was considered, and the side cut strategy of the process fluid for recovering MH was investigated by the viewpoint of crystal qualities. For selective deposition of MH crystal, selection of the addition method of CH was important, and tablet addition was effective. It became clear that process fluid composition is important for the crystal qualities of deposited MH, and that process fluid with brine composition was suitable for MH with high crystal quality. From the results, the side cut strategy for the integrated process for the resource recovery of MH was proposed.