

## Analysis of By-Products of Salt Baking Process and Utilization for Anticaking Agent

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### Summary

In the salt baking process, by-products are generated by the difference in specific gravity. Currently, by-products have been discarded. On the other hand, by-products have a possibility of the utilization for the anti-caking agent.

In the analysis of energy dispersive X-ray spectroscopy (EDX) and differential scanning calorimetry (DSC), by-products include NaCl, KCl, MgO, and CaSO<sub>4</sub>·1/2H<sub>2</sub>O. These compounds were included in bittern in the form of NaCl, KCl, MgCl<sub>2</sub>, and CaSO<sub>4</sub>·2H<sub>2</sub>O. By thermal decomposition in the salt baking process, MgCl<sub>2</sub> in bittern is changed MgO via Mg(OH)Cl. CaSO<sub>4</sub>·2H<sub>2</sub>O in bittern is changed CaSO<sub>4</sub>·1/2H<sub>2</sub>O for the same reason. In spite of containing the same bittern, the compounds in the by-product are different from the compounds in the salt before baking and in the baked salt.

We baked the baking-before-salt that contained with bittern under various temperatures in research oven, but those baked salts do not contain the same compounds of by-products. By-products were made industrial salt baking process specifically, not only temperature condition.

In the analysis of EDX, fine particles spouted from clacked NaCl crystals were obtained. The fine particles contained Cl, K, and Mg. When NaCl crystallizes, a NaCl crystal made cavities encapsulating bittern. In the salt baking process, these cavities were expanded and spouted the fine particles.

Anti-caking test was done by loading 0.25 kg/cm<sup>2</sup> to NaCl or NaCl with testing salt for 6 weeks packed in PE or PE/Al film. In the analysis of anti-caking test mixed by-products or one of the compounds (KCl, MgO, or CaSO<sub>4</sub>·1/2H<sub>2</sub>O) of by-products with NaCl, the main anti-caking factor of by-products is KCl, and sub-factor is MgO and CaSO<sub>4</sub>·1/2H<sub>2</sub>O. Utilization for an anti-caking agent, by-products mixed 0.5% with NaCl packed in PE film is enough effect. By-products mixed with baked salt or packed in PE/Al film read to enough affect smaller than 0.5%. We therefore concluded that by-products of salt baking process show promise of anti-caking agent.