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Potash Cold Crystallization

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Potash is the common name for mined and manufactured salts that contain potassium in water-soluble form. The name derives from “pot ash”, which refers to plant ashes soaked in water in a pot, the primary means of manufacturing the product before the industrial era. Potassium derives its name from potash, and was first derived by electrolysis of caustic potash, in 1808. Today, potash is produced worldwide in amounts exceeding 30 million tons per year, mostly for use in fertilizers. Various types of fertilizer potash thus comprise the single largest global industrial use of the element potassium.

Potash Cold Crystallization

Potash is an important family of potassium-based industrial chemicals. It is used in glass production and soap making, but its most prevalent use is as an agricultural fertilizer. This flow sheet describes the production of potassium chloride from the decomposition of carnallite ($\text{KCl} \cdot \text{MgCl} \cdot 6\text{H}_2\text{O} + \text{NaCl}$) and the subsequent re-crystallization of KCl (Sylvite) under ambient or “cold” conditions.

Carnallite

Carnallite is a naturally occurring dual salt commonly found in the presence of other salt-type minerals such as halite. Under certain conditions, significant amounts of carnallite can be formed by means of solar evaporation in ponds filled with saturated brine solutions. Two major brine sources suitable for primary carnallite production are the Dead Sea in Israel and Jordan as well as brines found in the Qinghai province of China.

Thickener

Carnallite is harvested from evaporation ponds and delivered to a primary sizing screen where oversized material can be separated, resized, and processed. Screened material is delivered to the carnallite thickener where excess transportation brine is removed and the crystals are concentrated. The saturated overflow brine from this thickener is returned to the evaporation ponds.

Flotation Circuit

Thickener underflow is sent to a selective flotation circuit where collector and frother chemicals are added and the gangue minerals and crystals are selectively separated. Concentrated carnallite from the flotation circuit is transferred to a flotation thickener where saturated flotation brine is removed and recycled to the flotation circuit or returned to the evaporation ponds.

Dewatering

Concentrated carnallite is then further “dewatered” on horizontal belt filters producing a low moisture crystal product suitable for the decomposition/recrystallization process. In cold crystallization, carnallite is decomposed into free ions and by carefully controlling the concentration at the appropriate ambient conditions, Sylvite (KCl) will recrystallize while the MgCl remains in solution. However, any halite remaining in the solution also recrystallizes at these concentrations and conditions.

The halite crystals are generally much larger than the Sylvite crystals and can be removed by screening prior to product thickening. The concentrated product Sylvite moves from the product thickener to product horizontal belt filters where the crystalline product can be countercurrent-washed and dewatered to remove wetting brine which contains MgCl. The filter cake is then leached for final cleaning in a centrifuge. Centrifuge cake is then dried, compacted, sized, and bagged for sale and use.