Products & Operations

Potash Facts & Figures

Product Specifications

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Potash Production Process

APC has the capacity to produce an approximate total of 2.35 million tons per year of potash via its four plants in Jordan: The Hot Leach Plant (HLP), the Cold Crystallization Plant (CCP I), the Industrial Potash Plant (IPP) and the New Cold Crystallization Plant (CCP II).

1. Dead Sea brine is pumped to solar ponds at the Dead Sea Pumping Station, and an initial concentration process is developed. The solids formed in the brine precipitate to form salts in the ponds.
2. Brine is transferred to the pre-Carnallite pond (PC-2) through gravity. The density of the brine is then increased.
3. Brine concentration in the salt ponds and PC-2 is continuously adjusted to achieve satisfactory Carnallite production. Brine is then pumped to two parallel systems and their respective Carnallite ponds.
4. The refineries' effluent feed collects in pond C-4, which is designed to recover the unrecovered K+ ions.
5. Brine from pond C-7 is discharged into the flood channel and back to the Dead Sea. Part of the brine is sent to the bromine plant.
6. Carnallite deposit on the pond bed is harvested as slurry from beneath the brine, and delivered to booster pumps on the dikes then to the refinery through steel pipes. Nine floating track system harvesters are used to gather the Carnallite.
7. Carnallite is harvested and pumped to APC's refineries, where HLP, CCP I and CCP II process it to extract the potash. Product is transported to warehouses in Ghor Al Safi or Aqaba.

Plant Processing

Hot Leach Plant

Carnallite Processing – Carnallite slurry is received, dewatered and decomposed with water. The resulting solids mixture (Sylvinite) is dewatered and washed, creating a cake-like material.

Sylvinite Processing – Sylvinite cake is leached. Heated brine returned from the crystallization stage is used for leaching the potassium chloride (KCl) solids. The hot KCl-saturated brine is clarified in a thickener, and then the overflow is pumped to the crystallization stage. The underflow slurry containing sodium chloride crystals is dewatered, repulped with waste brine and pumped to tailings.

Crystallization – Hot brine is cooled successively in a six-stage vacuum crystallizer system. Upon cooling, the KCl decreases in solubility and crystallizes under controlled conditions.

Product Dewatering – Potash slurry from the crystallization stage is dewatered using hydro-cyclones and centrifuges.

Drying – Cake from the centrifuges is conveyed to the rotary dryer to remove the last traces of moisture entrained with the crystals. The product is then sent to the screening unit, while the dust is collected using high-efficiency cyclones.

Screening – The product is segregated into standard and fine grades, and an anti-caking agent is added to both products in controlled amounts to minimize potash's natural tendency to agglomerate during storage and shipment.

De-dusting Systems – Specially installed systems, such as bag filtration units and high-efficiency cyclones minimize environmental impact and potash losses as dust.

Cold Crystallization Plant I

The cold crystallization plant I is independent of the hot leach facility. It is operated at ambient temperature and therefore requires less energy.

• Carnallite Receiving

Crude carnallite slurry is first beneficiated by wet screening to separate the high-grade carnallite fraction, which is about one quarter of the solids. This high-grade carnallite (coarse carnallite) is fed directly to the cold crystallizers. The screen undersize

quarter of the solids. This high grade carnallite (coarse carnallite) is fed directly to the cold crystallizers. The screen undersize slurry is mixed with brine discharge from the cold crystallizers overflow, which is at or near saturation, in a draft tube reactor. When solar pond brine mixes with crystallizer brine in the reactor, precipitation of carnallite occurs as the brine mixture equilibrates. Slurry from the reactor is densified in the carnallite thickener and the overflow is returned to the evaporation ponds.

- **Flotation**

Carnallite thickener underflow is beneficiated by a flotation technique, in which sodium chloride is floated and pumped to the tailings area. Sink slurry is settled in a flotation thickener, the overflow of which is used as make-up brine to the flotation cells and the excess is pumped to the carnallite thickener. Flotation thickener underflow is dewatered in centrifuges. Centrifuge cake (fine carnallite) is conveyed to the cold crystallizers and the effluent is recycled to the flotation thickener.

- **Crystallization**

Coarse carnallite and fine carnallite are decomposed in a two-stage crystallizer system in the presence of water. Potassium chloride crystals are formed in the crystallizers. Crystallizer discharge slurry is wet screened to remove large particles of carnallite and/or sodium chloride. Screen oversize is pumped to the tailings area along with flotation overflow slurry. Screen undersize is directed to the leaching area.

- **Cold Leaching**

In order to remove adhering high magnesium chloride brine from the crystallizer product, two-stage leaching and dewatering centrifuges are used to reduce the magnesium chloride content in the product down to the allowable limit.

- **Drying**

Second-stage centrifuge cake is dried to 0.1% moisture content in a co-current, rotary dryer. The product is then cooled in a rotary cooler by a counter-current air stream.

Cold Crystallization Plant II

A second Cold Crystallization Plant (II) came into service in late 2010 to give a total production of 450,000 tpy. The new plant is similar to the Cold Crystallization Plant I, but it has certain modified processes and more advanced technology, mainly in crystallization, flotation, screening, leaching and other areas, and an advanced control system (DCS) was incorporated to facilitate control of various processes. Highly efficient dust collection systems were included in the new plant to ensure minimum dust emissions into the surrounding environment, and a new compaction plant was also installed to produce more than 260,000 tpy of high quality granular potash. The new compaction plant comprises a post-treatment unit intended for enhancing the quality of granular potash.