

## SALT PRODUCTION AND PROCESSING IN JORDAN

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Jordan safi salt company (Jossco) is one of the major salt producers in the Middle East established in the year 1996 and has been penetrating successfully the international market since that time. Jossco has the potential to succeed due to several reasons the main of which is the Dead Sea; the source of the salt for ever as well as minerals such as Potassium, Bromine, Magnesium, Calcium and derivatives and other elements. Therefore, The Dead Sea is the Gods gift to that area of Middle East.

The salt is extracted from Dead Sea by solar evaporation process. For the purpose of producing Potash (KCL) by the Arab Potash Company, the Dead Sea water is drawn to the salt pond the surface area of which is about seventy (70) square kilometers. Due to the substantial high temperature particularly in summer season in that area located in the southern part of Dead Sea, which is the lowest point all over the world, ie (400) meters below the sea level, evaporation takes place so that the most part of the sodium salt which forms about 75 % by weight of Dead Sea water precipitates on the bottom of the salt ponds. For the production of Potash is concerned the brine, after having been concentrated due to the salt precipitation, is drawn by gravity to the next series of what is called carnallite ponds in which the carnallite is precipitated. Carnallite ( $KCl \cdot MgCl_2 \cdot 12H_2O$ ) is then harvested and pumped in the form of slurry to the refinery to extract KCl.

Since the commencement of commercial production of Potash in 1983, the Sodium Salt has been precipitating in the salt pond to form what is called Mushrooms as they take the shape of the mushrooms of about two meters height spreading in the whole surface area of the salt pond (about 50% of the total area).

Salt Mushrooms have caused two problems for Arab Potash company. The first one is the decrease of salt pond capacity due to the mushrooms occupancy. The second one is the restriction of the free brine flow in the pond which creates some stagnant areas at which the carnalite started to precipitate in the salt pond instead of the carnalite ponds. These two problems have a negative effect on the production capacity of Potash Plant. Therefore, Arab Potash Company has started dredging the salt mushrooms in 1992. The salt obtained by dredging is disposed on salt pond dikes. The amount of the dredged salt is estimated to be 20 million tons by the end of the

year 2000 and would be continuously increasing due to mushroom formation and dredging thereof. For this reason the decision has been taken to construct the Safi salt plant. This plant was built by the joint venture with NAVO-SPA – Milan as the contractor and IDECO- Rome as the technological partner. The Plant has been completed and put into operation and commercial production since Jan 1997.

### PLANT DESCRIPTION :

The plant which is located at southern part of Dead Sea consists of Industrial Salt washing unit with a capacity of 1.2 million tons per year and a storage capacity of 100,000.0 tons, edible salt washing unit with a capacity of 32,000.0 tons per year, and a shipping terminal at the port of Aqaba with a storage capacity of 75,000.0 tons and loading capacity of 1000.0 tons per hour.

The process of the plant could be described as follows: -

#### 1-INDUSTRIAL SALT PLANT:

Raw Salt is transported by trucks from the salt dikes at the salt pond through a distance of about 5 km to the washing plant. In the washing process the salt is fed by pay loaders to vibrating feeders which uniformly feeds the vibrating screens to get rid of the lumps accompanying the raw salt. The next stage is washing the salt in a conical tank by counter flow effect of the saturated brine having a density of 23 °Be. The overflow of this tank is purged outside to the salt pond. The salt, after having been washed, is pumped as a slurry to the hydrocyclones and then to dewatering conveyors which are followed by hydromills to make the salt ready for the second washing stage which is similar to the first one, but with different washing brine which is more clean. The last stage is the final dewatering by worm scroll

type centrifuge to have a moisture content of 4.0 % by weight max. Dedicated trucks to the port of Aqaba then transport the finished product. To avoid contamination of the salt during transport, all trucks are covered and lined with a fiberglass coating. The main features of this washing process are:

a) The brine coming out of the centrifuge is directed to its own settling pond. After the addition of clear water in a rate of 0.3 m<sup>3</sup>/ton product, this refreshed brine is directed back to the second washing stage. The overflow of 2<sup>nd</sup> stage is directed to the 1<sup>st</sup> washing stage. The overflow of 1<sup>st</sup> washing stage, which is the most impure part, is purged outside the battery limit. The washing brine for 2<sup>nd</sup> stage has its own settling pond. This procedure maximizes the utilization of the brine.

b) The last stage of washing is carried out by the addition of clear water through the centrifuge.

c) Recovery of this process is 85 to 90%.

d) After the 1<sup>st</sup> washing stage, the internal surface of salt crystal is subject to washing in the 2<sup>nd</sup> stage due to grinding effect by the hydromills.

e) The anticaking agent (Potassium Ferrocyanide) is added as a solution after the centrifuge in a rate of 10 ppm which proves the free flowing property of the industrial salt irrespective of long, storage period.

f) Typical specification:

Ingredient	Raw Salt	Industrial Salt
	%WW	%WW
Mg++	0.25	0.04
Ca++	0.25	0.07
S04	0.3	0.1
Insolubles	0.1	0.05
H2O	3.0	3.0
NaCl(on dry basis)	99.8	99.6
Ca /Mg		1.75

#### Particle Size Distribution

Mesh Size (mm)	%wt Retained
4.75	3
2.8	16
2	28
1.4	50
0.85	75

A complete chemical analysis indicating all remaining elements was carried out by SGS as per their report dated 6th August 1999 (see table 1).

As far as chlor - alkali industries are concerned, which are the most important consumers of the industrial salt, the specification of Safi Salt proves to be one of most suitable compared to the other producers particularly the Australian Salt producers.

g) Permanent availability of salt raw material and its independence from the seasonal effect, which strengthens the customer security factor.

h) Upgrading possibility of the plant in terms of both capacity and purity. Total storage capacities of both plant and shipping terminal, which is equal to 175000.0 tons, as well as the high shipping rate of 1000.0 tons/hr.

j) Production cycle is accomplished within about three hours compared to the production cycle of traditional solar salt of about one complete year in the normal case.

#### 2-EDIBLE SALT PLANT:

The industrial salt is fed to the hydromill and then to another washing stage followed by hydrocyclones and pusher type centrifuge. Iodine is then added as Potassium Iodate. The iodine concentration varies between 40 and 60ppm. The salt is then dried, cooled screened and then packaged in 25 kg sacks, 1 kg pillow bags or 700 grms bottles according to grain size classification. The other product is the salt tablets which is needed mainly for water treatment. The total production this capacity of unit is 32000.0 ton per year.

3- Since the early stage plant operation in 1997, and as a parallel step to strengthen the existing economic situation, as well as to meet the local and

international demands and standards, the company has taken steps leading to the creation of new production lines utilizing the existing resources to the fullest, thus creating the world's first integrated salt production. The new products have been already produced and now existing in the local and outside markets are the following;

- 1-Animal feed salt in 1 kg bags.
- 2-Low and lite sodium salt in 350 grms bottles.
- 3-Dish washers salt in 2kg carton bags.
- 4-Different grain size products of both raw and industrial salt.

5- Oil holes drilling salt which is alternative to Pkl).

6-Animal Salt lick blocks (Under construction).

As far as the quality management is concerned, Jossco has successfully got the certificate of ISO 9002 (Quality Management System) since 20 Dec.1998, and the certification body was SGS -UK. Currently, Jossco is in the process of obtaining the certificates of both Environmental Management System ISO 14001 and BSCCP (Hazard Analysis Critical Control Point System) for food industry as well.

Table 1:  
Results of the chemical analysis carried out by SGS Agrilab N.V.

Impurity	Concentration (ppm)	Impurity	Concentration (ppm)
Heavy metals	< 5	Barium	< 0.1
Sulphate	110	Nickel	< 0.1
Fluorine	< 10	Aluminium	1.7
Insolubles	24	Silicon	1.6
Calcium	420	Manganese	18
Magnesium	280	Chromium	0.13
Iron	2.5	Vanadium	0.65
Potassium	210	Copper	0.20
Selenium	2.2	Molybdenum	< 0.1