

Production of Table Salt from Kohat Rock Salt

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Abstract: Purified salt, table and iodized, was produced from the Kohat rock salt. A process was developed for this purpose. Pure salt contains 39.3% Na and 60.7% Cl by weight. Chemical analysis of Kohat rock salt was carried out having the composition of Na 33.91, Cl 54.40, K 1.58, MgO 0.05, CaO 1.66, SO₃ 1.30 and other insoluble impurities of 6.90%. During the process of rock salt, impurities were reduced to negligible values and standard composition of Na and Cl was achieved to 39.23 and 60.61%, respectively.

Key words: Kohat, rock salt, table salt, chemical analysis, pilot plant

INTRODUCTION

Salt mines occurring in the salt range formation are one of the oldest mines of the sub-continent^[1-4]. Right from the eastern terminal part of the salt range^[5,6], the plugging of salt has been outcropped at several places like Khewra, Warcha, Kalabagh, Jatta and Bahadur Khel from which several thousand tones of salt is being mined annually^[7,8].

Large deposits of salt occur at a number of places in NWFP. Important salt mines are those of Jatta, Bahadur Khel and Karak. All these deposits are accessible by roads from Bannu-Kohat metalled road^[9]. The salt beds are approximately 105 m thick in Bahadur Khel while more than 30 m thick in Jatta and Karak. In Bahadur Khel and Jatta areas, the rock salt contains 90 to 98% sodium chloride, 0.6 to 3.0% calcium oxide (lime) and traces of other oxides. No reserve estimates are available for any of these deposits; however, the extensive areas of occurrence speak of fairly large deposits.

Rock salt or common salt is dominantly composed of mineral halite having the chemical formula of NaCl. It is found in deposits of rock salt, brines, saline lakes, marshes, seawater and saline earth^[9]. All these sources have been utilized in various parts of the world according to local conditions. Pure salt contains 39.3% sodium and 60.7% chlorine by weight. Halite deposits usually contain 1-4% impurities. Common impurities are gypsum, shale dolomite and quartz. Rock salt is used for the production of purified salt by ordinary mining. Evaporated salt is the term applied to fine crystals of salt obtained by evaporating brines, either natural or manufactured. Solar salt is applied to salt deposits obtained from shallow; pounds by sailer and Aeolian evaporation.

MATERIALS AND METHODS

Different samples of rock salt were collected from different sites of Kohat area and were analyzed by conventional as well as instrumental methods^[10-12].

The rock salt, first of all was dissolved in water to make saturated brine. The insoluble from the brine were removed by filtration and the soluble impurities of brine were then removed by chemical treatments. The purified brine was concentrated to such a point that the crystals of desired dimensions were separated. In next step the crystals were separated from mother-liquor with the help of centrifuges and subjected to drying. In the last step the dried crystals were iodized and classified into table salt and granulated salt etc. The product was finally packed. A brief description is given in flow sheet (Fig. 1). A small pilot plant for working demonstration has been setup at PCSIR Laboratories, Peshawar for the production of the purified salt.

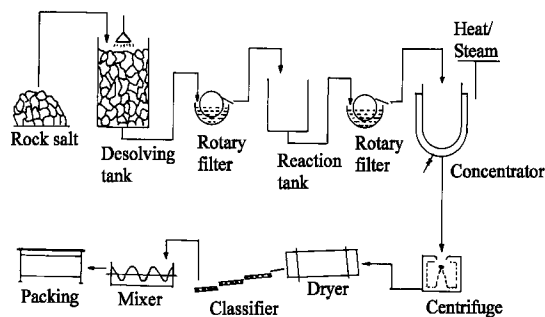


Fig. 1: Flow chart for the production of Table salt from Kohat rock salt

RESULTS AND DISCUSSION

Chemical composition of rock salt before the process and refined salt after the process was determined and the results are shown in Table 1 and 2, respectively. Chemical analysis shows that raw material has the composition of water insoluble impurities 6.90, moisture 0.12, sulfite 1.30, CaO 1.66, MgO 0.05, Cl 54.40, Na 33.91, and K 1.58%. After the process, the required composition of pure salt has been achieved to the standard level of purified salt. This salt has the composition of Moisture 0.12, Sodium 39.23, Chloride 60.61, Potassium 0.002 and Sulfite 0.01%, with other traces of lead <2-5 ppm, arsenic 1-4 ppm, iron 0.8-1 ppm.

Human beings have been using salt since time unrecorded in history as a part of his and his animal's food. In today's world, beside such uses, it has obtained a position of one of the most important industrial raw material. Rock salt is the abundant source of sodium and chloride ions, which are used for making a number of industrial chemicals such as soda ash, chlorine, caustic soda and metallic sodium. It is said that there are 14000 uses for salt, but only a few consume a major position of the salt produced. A modern use of salt is in-situation of cavities for storage; these are used for storing liquid hydrocarbons, hazardous wastes, nuclear wastes, compressed air, geothermal energy and other insoluble (waste) materials.

Rock salt has a multitude of uses, which may be used as nutrient / flavour in baking, breakfast cereal, butter and cheese canning cattle block flour mixes, isotonic solutions, livestock feeds, pickles, potash substitute, salted nuts and table salt.

Used as preservative in cheese making, cucumber preserving, fish salt curing, meat curing, sausage casings and well drilling fluids.

Salt is used as food processing in bleaching seafood and vegetables, crab meat pickling, egg preservative, fish striking agent, gravity separation, wine stabilization and yeast processing.

Used as chemical manufacturing in calcium hydrochloride, chlorine dioxide, sodium chlorate, sodium fluorosilicate, sodium hypochlorate, sodium per chlorate soda ash, sodium metal, sodium sulphate, hydrogen chlorine, hydrochloric acid, and caustic acid.

As freezing point depressant in coal antifreeze, ice cream making, ice manufacture, iron ore antifreeze, refrigerating brines, refrigerating cars are also used.

Salt is used as metallurgical processing in chloride roasting, drawing lubricant, foam killer, heat treating, iron ore cementation, metallurgical flux, mill scale remover, molten metal cover rare metal refining, sink and float baths.

Table 1: Chemical analysis of rock salt before process

Water insoluble impurities	6.895±2.46%
Moisture	0.121±0.006%
Sulfur as sulfite (SO ₃)	1.302±0.003%
Calcium as calcium oxide (CaO)	1.655±0.039%
Magnesium as magnesium oxide (MgO)	0.053±0.002%
Chloride (Cl)	54.402±0.340%
Sodium (Na ⁺)	33.906±0.879%
Potassium (K ⁺)	1.583±0.252%
Total	99.917%

Results are given by calculating means of twenty samples with ±standard deviation

Table 2: Chemical analysis of purified salt after process

Moisture	0.120±0.005%
Sodium (Na ⁺)	39.230±0.536%
Chloride (Cl)	60.610±0.401%
Potassium (K ⁺)	0.002±0.004%
Sulfur as sulfite (SO ₃)	0.010±0.004%
Lead (Pb)	<2-5 ppm
Arsenic (As)	1-4 ppm
Iron (Fe)	0.8-1 ppm

Results are given by calculating means of twenty samples with ±standard deviation

Salt also has miscellaneous processing in artificial seawater, dehydrating agent, dye processing, dyestuff carrier, electrolytic milling, emulsion breaker, etching aluminum foil, herbicides, ion exchange regeneration, leather tuning, rubber coagulant, soil stabilizer, stretch manufacture, textile dyeing, tile glazing, water softening and weed killing.

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