UDC: 661.832.321

UTILIZATION OF POTASSIUM INDUSTRY WASTE AND ENVIRONMENTAL PROTECTION

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https://doi.org/10.5281/zenodo.7774898

Abstract. *This article provides information on the disposal of potash industry waste, halite waste, production of* ***KCl*** *from sylvinite by galurgy and flotation methods, production of industrial waste-halite waste, clay-salt slurries and dust-gas waste.*

Keywords: *potassium fertilizers, magnesium chloride, calcium chloride, "EXTRA" concentrated table salt, galurgy and flotation methods, sylvinite, calcined soda, HCl.*

A large amount of waste is generated in the production industry of various potash fertilizers. In the extraction of ***KCl*** from sylvinite by galurgy and flotation methods, industrial wastes - halite wastes, clay-salt slurries and dust-gas wastes are formed.

During the processing of sylvinite and carnallite minerals by the galurgy method, a concentrated solution containing $MgCl_2$ and $CaCl_2$ is produced from industrial waste. It is a source of environmental pollution as a waste.

Potassium phosphate and potassium sulfate are obtained from potassium chloride, and hydrogen chloride is formed as a waste product.

Some potassium nitrate production schemes produce chlorine as a by-product.

These gases are disposed of from an economic and sanitary point of view.

Halite waste

As a result of processing sylvinite ores, 3-4 tons of halite waste is obtained for every ton of potassium chloride. The main component of halite waste is ***NaCl***.

In addition, waste contains potassium chloride, magnesium chloride, calcium sulfate, bromine, water-insoluble precipitates and other components.

In the processing of sylvinite ores by the galurgy method, the amount of sodium chloride is 85-90%, and potassium chloride is up to 2.5%.

Halite waste causes an increase in the amount of salt in the surface and underground waters of the collected areas.

One of the effective and economic ways of using halite waste is the production of table salt.

Table salt (***NaCl***) is an important chemical raw material. The average annual consumption rate is 8-8.5 kg per capita, the total consumption is 75 kg per year.

Depending on the field of use, table salt - ***NaCl*** is produced in different varieties: technical (a large amount is used in the chemical industry); nutritious table salt (in agriculture and as animal feed); for food (in the food industry). Technical table salt contains 93% ***NaCl*** (on a dry basis).

The content of table salt used for food is determined by the State Standard.

Product parameters such as color, smell, granulometric composition, amount of toxic and mechanical additives are measured. Figure 1 shows the technological scheme of the production of technical table salt.

Halite is fed from the waste collection to the loading funnel 2 by the conveyor 3. The cooled solution from tank 5 is again fed to the loading funnel, the resulting arc-shaped bubbles with a ratio of S:Q=0.8-1.0 flow into 1, and are separated by +3mm class. The product remaining on the grid is further separated in wire mesh 4. Particles larger than 3 mm are sent to the storage area using conveyor 21.

The particles of the product under the grate of the arc-shaped sieves and the large wire sieve, the thickness of which is greater than 3 mm, flow into the mixer 20 and are sent to the water separator 6 with the pump 19.

Deep salt slurry is further separated in the water separator 7 and enters the centrifuge 15 through the mixer 8 in the ratio S:Q=1.5, where it is separated from the solution and washed with water. Salt with a moisture content of 5-7%, which has been squeezed out, is sent for drying using conveyor 16. 10 kg/m3 of the brine from the filtrate and water separators 6,7, obtained in the centrifuge 15, enters the intermediate tank 9, the PAA solution is added to it, and then the suspension flows into the settling tank 10.

The diluted solution of 0.1 kg/m3 is poured into the intermediate tank 12 and sent to the pressure tank 5 with the pump 19. A thick slurry consisting of a large number of clay particles flows into the mixer 13, and is discharged to the slurry tank with the help of a pump 14.

Halite wastes from flotation-enriched sylvinite mines need to be additionally cleaned from fatty amines, in addition to washing them from ***KCl***, in order to obtain food and feed table salt. Cleaning is carried out in several ways, including: in a turbulent flow, de-sludged waste is washed in a countercurrent flow with a saturated solution of sodium chloride; heating technical salt to 450ºC; melting the waste at 900ºC and extracting a medium-clear liquid zone free of grease and insoluble deposits.

The simplest and most economical way to obtain salt is to wash the waste in a counter current and then heat it. In order to completely destroy the amines, the washed salt is heated up to 450ºC, during which the amines are completely decomposed. "Extra" table salt used in the food industry is obtained from the halite waste generated during the processing of sylvinites by the galurgy method.

Use of halite waste in the production of soda ash.

Another major buyer of halite waste is the soda ash industry. This process occurs through the following reaction:

$$NaC1+NH_3+H_2O+CO_2=NaHCO_3+NH_4C1 \quad (1)$$

The ammoniated solution of sodium chloride is subjected to carbonization, in which the precipitated sodium bicarbonate is separated from the suspension and ***Na_2CO_3*** is calcined.

Up to 1.7 tons of ***NaCl*** are used to obtain 1 ton of soda ash.

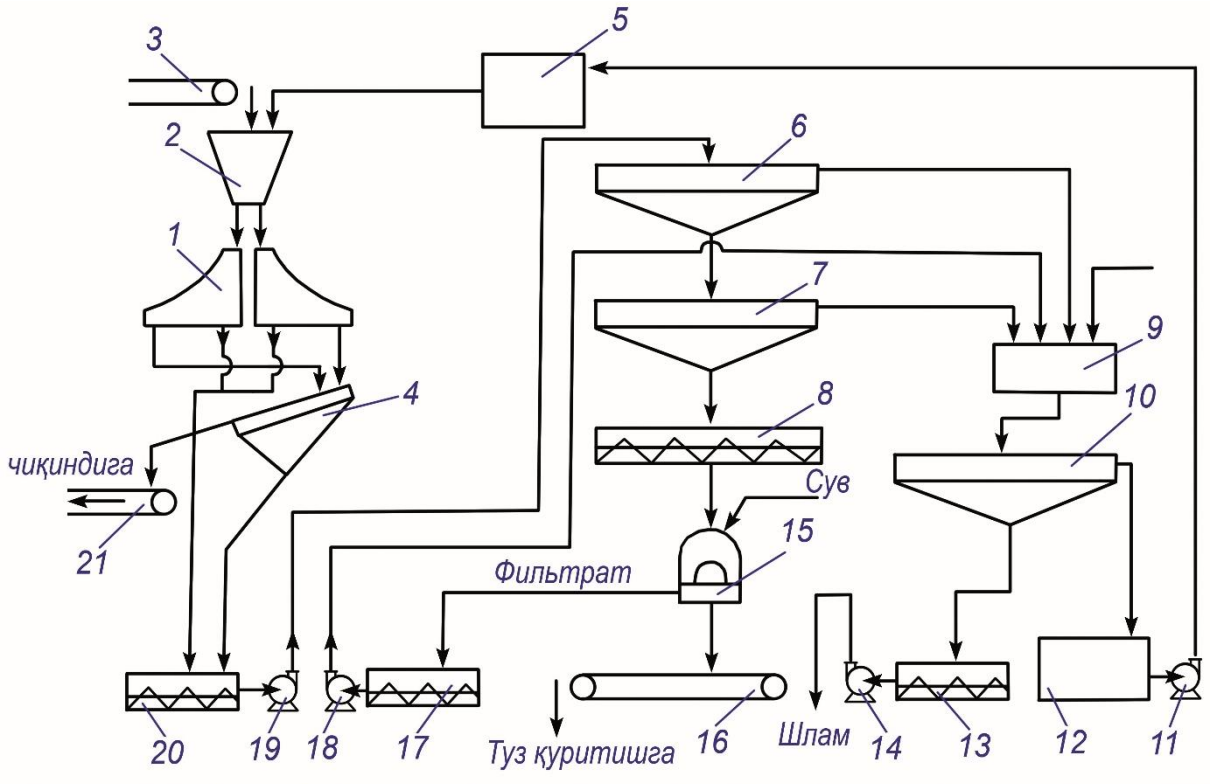

Figure 1. Technician from halite waste
technological scheme of table salt production

1-arc-shaped gallows; 2nd loading funnel; Conveyors 3, 16, 21; 4-big wire coil; Tanks 5,9,12; 6,7 separators; 10th silencer; 11,14,18,19 pumps; 15-centrifuge.

There are certain requirements for the brine used to obtain calcified soda. They should be sufficiently concentrated with ***NaCl***, calcium and magnesium salts should be as little as possible, and there should be no insoluble precipitates.

305 g/l in table salt according to technical conditions. not less than ***NaCl***, not more than 5 g/l ***KCl*** and Ca^{2+}, Mg^{2+} and e.q. It should not be more than 2 g/l.

Pour off excess liquid

Industrial effluents of potash plants: when newly brought halite waste is compacted in the warehouse; It consists of highly mineralized waters formed as a result of the melting of waste salt layers under the influence of atmospheric precipitation and condensation moisture.

In order to prevent the flow of saturated brine around the salt deposits, barrier dams are built around them, and the brine is collected in special drainage ditches. The height of the dam is from 1.5 m to 4.0 m.

The volume of industrial effluents of potash enterprises is several million cubic meters per year.

Currently, one of the cost-effective ways of disposal of industrial effluents of potash enterprises is the method of burying them underground. This method is used in Germany. Mineralized wastewater is pumped into 2000m deep wells and absorption horizontals.

The technological scheme of disposal of wastewater underground: the pressure-driven well includes the preparation of breaking horizontals for pumping wastewater, preparation for transporting wastewater, and preparation for driving and pumping under pressure in a convenient order.

The horizons composed of sandy loam and siltstone are more convenient than the absorbent horizons for disposal of excess leachate from potash plants.

Muddy turbids

Tons of waste from potash plants consists of clay-salt slurries formed during enrichment of sylvinite ores.

The water-insoluble part of the slurry consists of aluminosilicates, carbonates and sulfates, as well as finely dispersed crystals of ***KCl*** and ***NaCl***.

The liquid phase of the slurry consists of brine containing 10-11% ***KCl*** and 20-22% ***NaCl***, and the rest is water and some impurities. The S:Q ratio in the slurry pulp is 1.7-2.5.

The liquid phase is difficult to separate from the solid phase, because clay slurries are finely dispersed and retain moisture by capillary action.

Sludge reservoirs occupy certain areas, consist of working cards and an artificial sedimentation lake. The softened water from the artificial siltation lake is returned to the production process.

Thus, along with the halite salt waste layers of potash plants, sludge storage tanks should be considered as a major source of environmental pollution.

Currently, the solution of sludge waste disposal problems is carried out in the following three main directions:

1) Use of mixed potash salt from sludge waste:

It is proposed to add a slurry state to the potassium chloride in the commodity state instead of raw, non-wet enriched, potash-bearing ore. Clay slurries can be supplied as supplements with a more nutritious content and structure (structure) on peat and sandy soils.

Application of sludge waste in construction materials industry. The complex chemical composition of slurries, as well as the large amount of chlorides in their composition, does not allow them to be used directly in the building materials industry. However, if clay slurries are heat-treated, it is possible to partially obtain algoporite, ceramics and bricks from building materials;

Loads in the production of loads in drilling-excavation from mud slurries.

Sludge storage can be eliminated if the sludge and salt waste are sent together to a waste salt storage layer.

One of the necessary conditions for placing the waste together in the warehouse is the dewatering of the clay-salt slurries. Clay-salt slurries can be used to fill empty chambers together with halite at 10-12% moisture content.

Gas-dust waste

Gas-dusty waste of potash enterprises consists of fumes containing harmful components ***KCl***, hydrogen chloride dust, floto-reagent vapors, and amine vapors.

A high-efficiency venturi scrubber operating at low pressure is used to catch ***KCl*** and ***NaCl*** dust from chimneys during the wet cleaning stage. It uses highly mineralized production fluids.

The scrubber's efficiency is 98% for dust and 97% for ***HCl***. In the process of processing potassium chloride with acid in the production of non-chlorine potassium fertilizers, in the hydrothermal processing of sulfated potassium ores, ***HCl***-containing gases are formed as a by-product, and in the production of potassium nitrate, Cl_2 is formed.

Creating an appropriate technological system for the use of ***HCl*** in waste gases is of great importance for the potash industry.

A kilo of technical chlorate containing 27.5% ***HCl*** is obtained from these waste gases.

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