

2.7. PRODUCTION OF SODA PRODUCTS

Production of soda products. Production of lime and carbon dioxide.

Production of soda by the ammonia method

Soda is produced in the form of several main products:

- *soda ash* - anhydrous sodium carbonate Na_2CO_3 ;
- *bicarbonate soda* - sodium bicarbonate $NaHCO_3$, or drinking soda;
- *crystalline soda* $Na_2CO_3 \cdot 10H_2O$ and $Na_2CO_3 \cdot H_2O$;
- *caustic soda* ($NaOH$).

Ordinary soda, depending on the method of preparation, is *Leblanc* and *ammonia*. The latter is a cleaner product.

In addition, soda is either in the form of calcined (anhydrous, calcined), or crystalline. It contains up to 10 parts of water.

Natural soda is found in solid form as part of the throne mineral $Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$; as an aqueous solution, it is found in soda lakes and alkaline mineral springs, as well as in the ash of some plants. Until the beginning of the XIX century natural soda was used, but with the increase in its consumption, the need arose for the technological production of soda on a large scale. Modern industrial soda production uses sodium carbonate (or crude bicarbonate) of sodium, as well as carbon dioxide from lime kilns, as a raw material for producing purified baking soda.

Currently, the world produces several million tons of soda per year.

Soda and soda products:

- soda (Na_2CO_3) - from the ash of the plant *Salsola Soda*;
- sodium salts of carbonic acid:
 Na_2CO_3 - soda ash (the product of heating soda crystalline hydrate over *Ca*),
 $Na_2CO_3 \cdot 10H_2O$ - sodium carbonate decahydrate, 62.5% water;
 $Na_2CO_3 \cdot H_2O$; $Na_2CO_3 \cdot 7H_2O$ - *washing soda*,
 $NaHCO_3$ - *baking soda* (bicarbonate, sodium bicarbonate, sodium bicarbonate).
 $NaOH$ - *caustic soda*.

Raw Material:

- algae and coastal plants;
- minerals:
- *nacholite* - $NaHCO_3$;
- *throna* - $Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$;
- *sodium (soda)* - $Na_2CO_3 \cdot 10H_2O$;
- *termonatrite* - $Na_2CO_3 \cdot H_2O$;
- *davsonite* → soda and alumina.

The largest reserves are discovered and developed in *the United States* (40% of the minerals, *green river, lake Searles*), *Africa* (*Tanzania, lake Natron*), *Russia* (*Transbaikalia and Western Siberia*).

History of soda production

In 1791 *Leblanc N.* (*France*) developed a method for producing soda from *glauber's salt* (Na_2SO_4), chalk and charcoal at $T = 1,000$ °C:

- 1) $Na_2SO_4 + 2C \rightarrow Na_2S + 2CO_2 \uparrow$,
- 2) $Na_2S + CaCO_3 \rightarrow Na_2CO_3 + CaS$ (solid melt),
- 3) $Na_2CO_3 \text{ solid} + CaS \text{ solid} + H_2O \rightarrow Na_2CO_3 \text{ liquid} + CaSO_4 \downarrow$,
- 4) *Recrystallization*