Electrolytic production of chlorine and alkali

Electrolysis of sodium chloride solution is carried out on the installation in the form of an electrolysis cell with an iron cathode, a perforated coated by a semipermeable membrane, and a graphite anode. The electrolysis process is carried out at a concentration of the initial brine (*NaCl*) - 305-315 g/l and a temperature of 70-90°C. The concentration of liquor obtained in the electrolysis process is 130-140 g/l. As raw materials for the process, natural salt sources (brine) and sodium chloride solutions are used.

The electrolysis proceeds with the formation of chlorine, hydrogen and alkali (caustic soda) in accordance with the reaction equation:

$$NaCl + H_2O = \underbrace{0.5Cl_2}_{\text{at the anode}} + \underbrace{0.5H_2 + NaOH}_{\text{at the cathode}}$$

The electrolysis of a sodium chloride solution with a mercury cathode proceeds according to the reaction equation:

$$NaCl + H_2O = \underbrace{NaOH + 0.5H_2}_{\text{in the decomposer}} + \underbrace{0.5Cl_2}_{\text{at the anode}}$$

The plant consists of a pump for pumping mercury, a mercury cathode and graphite anodes located in the electrolyzer and decomposer. The process is carried out at room (ambient) temperature. Solutions of pure table salt are used as raw materials. The purity and yield of the resulting products are several orders of magnitude higher, but the process is energy-consuming and harmful to the environment.

The production of hydrochloric acid

Hydrochloric acid is a solution of hydrogen chloride gas *HCl* in water. It is a hygroscopic colorless gas with a pungent smell. Usually concentrated hydrochloric acid contains 36-38% hydrogen chloride and has a density of 1.19 g / cm^3. It smokes in the air, as it is released from the gaseous *HCl*, which when combined with the moisture of the air forms droplets of acid. Dilute acid containing up to 10% hydrogen chloride is often used. Dilute solutions do not emit gaseous *HCl* and do not smoke in either dry or wet air.

Pure acid is colorless, and technical acid has a yellowish tint caused by traces of compounds of iron, chlorine and other elements ($FeCl_3$).

Hydrochloric acid is used in the chemical, food industry, non-ferrous and ferrous metallurgy. It produces a variety of salts for laboratory or technical use. In metallurgy, it is used for etching the surface of metals. Hydrochloric acid is used in the analysis of ferrous and non-ferrous metals. In a mixture with nitric acid, it is used to dissolve platinum and in the processing of precious metals. Significant amounts of dry hydrogen chloride are used in industry to produce various chlorine derivatives from unsaturated hydrocarbons (for example, ethyl chloride, vinyl chloride, etc.).

In industry hydrochloric acid is obtained by the following main methods:

- sulphate;
- synthetic;
- from waste or exhaust gases (gas side) of a number of processes.

It should be noted that the first two methods are now losing their industrial value.

The production of synthetic hydrochloric acid involves two successive stages:

- synthesis of hydrogen chloride from chlorine and hydrogen;
- absorption of hydrogen chloride by water.

The raw materials for the production of synthetic hydrochloric acid are hydrogen, chlorine and water.