Water is used in industrial production to solve a large number of problems. It plays the role of working agent in the cycle of steam machines and steam-water vacuum refrigeration machines. It is widely used for heat supply as a heat carrier (heating, heating of various materials, liquids, etc.) and for its removal (cooling of reaction apparatuses, internal combustion engines and compressors, etc.). With the addition of salts such as $NaCl$ and $CaCl_2$, water is used as a brine to remove heat at temperatures below 0ºC. It also serves as a working fluid to transfer pressure during hydraulic strength and permeability testing of various pipes, to transfer work in hydraulic presses.

Water is used for transportation of eroded soil, rock, peat, slag, ash, chemical intermediates and other purposes. Water is also used as a technological component for leaching, dissolution, as a medium for chemical processes.

The requirements for the quality of water in industrial production are mainly reduced to the fact that impurities should not interfere with or harm its industrial use. Water should not cause corrosion of the equipment, boilers, pipes, equipment, various mechanisms, and also should not contain excess of the weighed substances clogging channels of cooling system, to clog and wear out details of presses, pumps, pipes, to spoil production. Salts and other impurities that cause water hardness can form on the working surfaces of heat-power, water-heating and cooling plants scum (salt deposits that conduct little heat). This leads to damage to metal surfaces, reduces the vacuum in the condensers of turbines, increases the temperature of flue gases, impairs the operation of heat exchangers, which leads to fuel overruns and increased costs associated with the need to repair production equipment.

Classification of natural waters on the content of impurities

Natural water contains many organic and inorganic substances, which depending on the particle size can be divided into three groups: suspended or coarse (more than 100 nm), colloidal (from 1 to 100 nm), true, or molecular dispersed (less than 1 nm).

According to the chemical composition of impurities are divided into organic (complex in composition in colloidal or truly dissolved state) and inorganic (ions Na^+, Ca^{+2}, Mg^{2+}, K^+, Cl^-, HCO_3^- and gases N_2, CO_2, O_2).

In accordance with sanitary rules and norms of protection of surface waters from pollution, the oxygen content in the water should be at least 4 mg/l at any time of the year. Removal of oxygen from water is carried out by deaeration and chemical reduction. Deaeration is based on the use of *Henry's law*:

$$C = K \cdot P,$$

where P is the partial pressure of the gas above the surface of the liquid, kg / cm^2;

C is the oxygen concentration ml / l;

K is Henry constant, solubility coefficient, mg / (l · kgf / cm^2).

In open systems with fresh water in the presence of oxygen with corrosion up to 60-70ºC, corrosion occurs, which then decreases due to a decrease in the solubility of oxygen in water. In a closed system, corrosion does not decrease with increasing temperature. The oxygen corrosion process is particularly intense at pH <7.

It is possible to reduce the solubility of oxygen in water by lowering its partial pressure. This is achieved by reducing the total gas pressure or by displacing one gas with another. For example, water is purged with water vapor, and then degassed using thermal deaerators, in which the condensate and additional water are brought to a boil at an excess pressure of 2-4 kgf / cm^2.

The deaeration method fails to provide deep oxygen removal, therefore, chemical methods are also used. To bind the residual oxygen, sodium sulfite is used:

$$2Na_2SO_3 + O_2 = 2Na_2SO_4$$