Degassing is the removal of dissolved gases from water by a chemical method in which gases are absorbed by chemicals, for example, in the case of carbon dioxide:

$$CO_2 + Ca(OH)_2 = CaCO_3 + H_2O,$$

or by physical methods of thermal deaeration in air or in vacuum.

Desalination is used in those industries where particularly stringent purity requirements are imposed on water, for example, in the preparation of semiconductor materials, chemically pure reagents, and pharmaceuticals. Desalination of water is achieved by ion exchange, distillation and electrodialysis.

The ion exchange method is based on the property of some solids (ion exchangers) to absorb ions from solution in exchange for an equivalent amount of other ions of the same sign. Ionites are divided into *cation exchangers* and *anion exchangers*. Cation exchangers contain mobile sodium or hydrogen cations, while anion exchangers contain mobile hydroxyl ions. Sulfonated coal, aluminosilicates (permutite, zeolite, etc.) are used as cation exchangers, artificial resins, for example, urea resins, are used as anion exchangers.

Accordingly, the processes of ion exchange are divided into:

- H(Na)-*cationization*, for example: $Na_2[Cat] + Ca(HCO_3) \rightarrow Ca[Cat] + 2Na_2CO_3$,
- *anionization*, for example: $An\ [OH] + HC1 \rightarrow An\ [C1] + H_2O$, where: [Cat] and [An] is the ion exchange matrix not participating in the exchange.

Since the ion exchange process is reversible, the establishment of equilibrium in the system means the termination of the desalination process. The absorption capacity of an ion exchanger is characterized by its exchange capacity equal to the number of calcium and magnesium ions, which can be absorbed by a unit of the volume or mass of the ion exchanger, expressed in gram equivalents: g-eq / m^3 and g-eq / kg.

The duration of the working cycle of ion exchange filters depends on the exchange capacity for a given volume of ion exchanger. When the ion exchanger is saturated, it can be regenerated by washing with solutions for H acid cation exchangers, Na sodium chloride cation exchangers, and for anion exchangers with an alkali solution. In the above examples of the operation of anion exchangers, the following reactions occur:

$$Ca\ [Cat] + 2NaCl \rightarrow Na_2\ [Cat] + CaC1_2 \text{ and}$$

$$[An]\ Cl + KOH \rightarrow [An]\ OH + KCl.$$

One of the main and mandatory operations for the water treatment of process water is its *softening*. *Softening* is the treatment of water to reduce its hardness, that is, to reduce the concentration of Ca^{+2} and Mg^{+2} ions by various physical, chemical and physicochemical methods.

In the physical method, water is heated to a boil, as a result of which soluble calcium and magnesium bicarbonates are converted into their carbonates, which precipitate:

$$Ca(HCO_3)_2 = CaCO_3 + H_2O + CO_2.$$

This method removes only temporary stiffness. Chemical softening methods include phosphate and lime-soda, consisting in the treatment of water with trisodium phosphate or a mixture of calcium hydroxide and sodium carbonate. In the first case, the reaction of the formation of insoluble tricalcium phosphate precipitates:

$$3CaSO_4 + 2Na_3PO_4 = 3Na_2SO_4 + Ca_3(PO_4)_2.$$