Part 2

WATER PROTECTION FROM DISCHARGES

2.3. Treatment of industrial and surface waste water from power companies

2.3.1. Technologies of treating industrial and surface waste waters from power companies

2.3.1.4. Physical and chemical waste water treatment

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Physical and chemical water treatment methods usually include coagulation, flocculation, flotation, adsorption, extraction, an ionic exchange, ultrafiltration, reverse osmosis, evaporation, etc. Coagulation and flocculation of waste water proceed similar to natural water treatment for household purposes.

Let's analyze waste water flotation types and equipment used.

In respect to environmental problems flotation is mainly used in two basic directions, namely in the processes of treatment of waste water containing hydrophobic impurities, and for concentration of active silt. In the first case almost all basic ways of flotation are used: mechanical (impeller), pneumatic, pressure and electric flotation and only several cases are known of application of flotation at the expense of gases appearing in chemical and biochemical reactions.

In the second case pressure flotation is mainly applied. Use of flotation with various ways of liquids aeration in the first case is caused by presence in liquids of both particles, possessing well expressed hydrophobic properties (for example, oil products and fats), and particles having a surface with both hydrophobic and hydrophilous areas (for example microorganism cells). The pressure flotation units, mostly applied in water treatment are shown in fig. 2.17. Devices of other designs and operation principles are applied considerably less often.

Impeller flotators have also found application for clearing of liquids, containing oil products, oils, fats. According to "Vemco" (USA) company, clearing of oil-containing waste water in a four-chamber flotator provides residue concentration of oil products of less that 10 mg/l. At use of the combined ways of flotation with application of impeller flotation oil product concentration of 2 … 3 mg/l may be achieved, according to the research results. Such results were reached at use of a combined flortator designed by GosNII-sintezbelok (fig. 2.18). In this case intensification of flotation waste water treatment consists in an increase of degree of liquid aeration at simultaneous decrease of power consumption.

Pneumatic flotators are widely used for flotation of fine-grained pulps and circulating liquids. In this case aeration of liquids is carried out by air or any gas passing through various porous elements, for example ceramics, porous rubber, etc.

Pressure flotation is widely spread for waste water treatment, for example from oil products, oils, fats etc. Pressure flotation can be performed both with use of reagents, or without addition of various chemical substances. Wide use of the given treatment is due to both sufficient waste water treatment effect, and simple equipment.

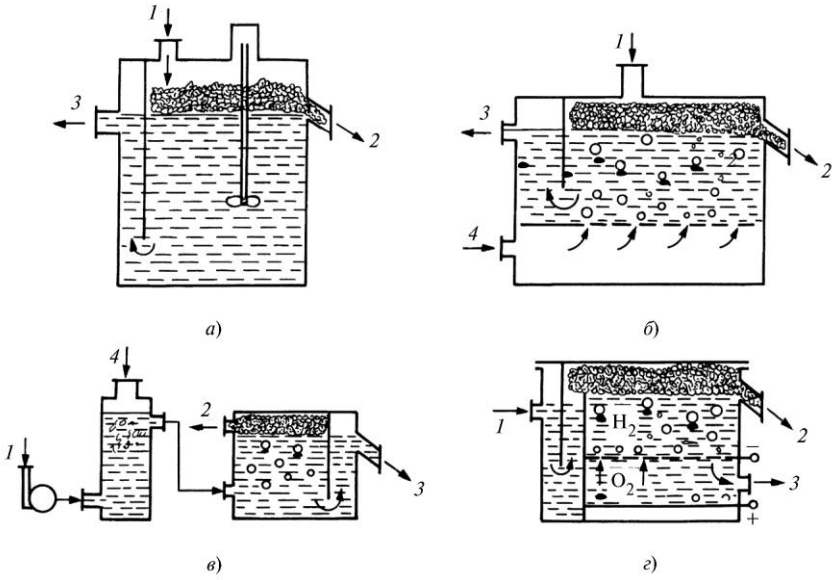

Fig. 2.17. Flotators of different types for waste water treatment:
а and *б* — mechanical and pneumatic flotators; *в* and *г* — pressure and electric flotators;
1 — waste water; *2* — flotation froth; *3* — cleared water; *4* — air

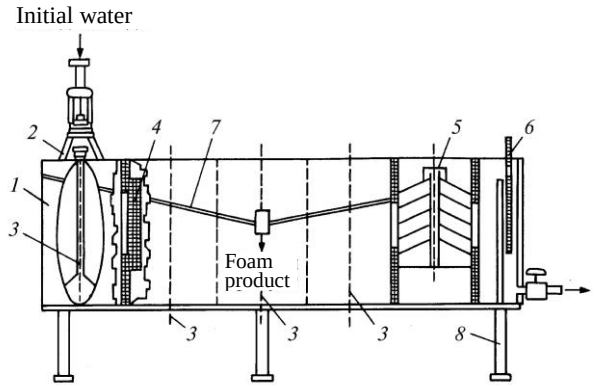

Fig.2.18. Combined mechanical flotator of GosNIIsintezbelok: *1* − casing; *2* − aeration unit; *3* − impellers; *4* − screening; *5* − lamella clarifier; *6* — gate valve; *7* — froth;*8* — frame with stand

High effect of waste water treatment with pressure flotation is reached because gas bubbles are allocated in floculation chamber directly on pollution particles. In this case the probability of adhesion of pollution particles with a gas or air bubble is close to theoretically possible. Therewith process efficiency considerably goes up at use of gases differently dissolved in water. So, consecutive introduction of air and carbonic gas into water accelerates flotation by 2 … 3 times. The core of intensification is that air injected at first at pressure of 0,4 … 0,6 MPa appears in a flotation as bubbles with the size of 0,2 … 0,5 mm, and then their agglomeration occurs due to allocation of carbonic gas.

Capability of electric flotation for different types of waste water treatment is rather well-known. However implementation of this method revealed many drawbacks both of apparatus and technological character. First of all it concerns the phenomenon of electrodes passivation. Experience in electric treatment of liquids determined that it is possible to overcome to a certain extend a negative effect of electrodes passivation, but keeping a clearing efficiency at a constantly high level failed.

The conducted researches have shown that electric flotation is mostly effective for treatment of the electric conducting environments, for example discharges containing salts, and also sewage of galvanic manufactures. Operation experience of electric flotators have shown that it is possible to use small units producing 1…3 m^3/h for decontamination of galvanic waste water, for example, from trivalent chrome, and also nickel and other heavy metals.

Adsorption using more often an activated coal as an absorber is applied for waste water clearing along with flotation. This technology yields residual concentration of main contaminants below regulatory values. Thus, concentration of oil products in the cleared water after adsorption under the correct process management doesn't exceed in most cases 0,05 mg/l, that is maximum permissible concentration for fishery reservoirs.

Membrane ways of waste water treatment have received limited application in practice because of necessity to have deep preliminary treatment of water directed to a membrane, and also in connection with high costs of the corresponding equipment.

Special methods of waste water treatment, including extraction for example, are of an informative interest only, as they are very seldom applied in waste water treatment practice.