Advantage Of Treatment of Industrial Wastewater Using the Coagulation Method

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ABSTRACT

This article describes the coagulation method, its working principles and advantages from the physico-chemical treatment methods of wastewater.

Keywords: Wastewater, reagent, coagulation, coagulant

Physico-chemical treatment methods are used in the treatment of wastewater from various industrial enterprises. In this method, wastewater is purified based on coagulation, flotation, adsorption, ionization, extraction, rectification, evaporation, distillation, crystallization, desorption, and similar processes. It is used in the separation of dissolved mineral, organic and gas compounds in water, as well as in the separation of very small dispersed floating particles. The advantages of these methods are that it is possible to clean non-biochemically oxidizable organic toxic wastes from wastewater, it is possible to carry out deep and permanent cleaning, the size of treatment facilities is small, and it is possible to recuperate various substances in wastewater. The choice of one or another method of treatment is based on the sanitary and technological requirements of the wastewater to be treated, the concentration of waste materials, the amount of wastewater, the availability of the necessary material and energy resources, etc. is their combination and the formation of associates. The coagulation process accelerates the sedimentation of small dispersed particles in the wastewater. Special coagulants are added to the water during wastewater treatment. Under the influence of coagulants, small dispersed particles in water turn into large particles (like particles in rotten milk) and they sink under the influence of their own gravity. When a coagulant is added to water, metal hydroxides are formed, which, due to their partial positive charge, attract negatively charged colloids and suspended particles. As a result, the particles become larger due to mutual attraction and sink to the bottom of the water. As a coagulant, aluminum salts, iron salts and their mixtures are used in industry. Often $A1_2(SO_4)_3 \cdot 12H_2O$, $NaA1O_2$, $Al_2(OH)_5Cl$ - aluminum hexa chloride and similar salts are used. $Al_2(SO_4)_3$ salt is widely used among them (pH=5-7.5). It is used dry or in the form of a 50% solution. In the process of coagulation, aluminum sulfate combines with hydrocarbons in water:

$$Al_2(SO_4)_3 + 3Ca(HCO_3)_2 \text{—>} 2A1(OH)_3 + 3CaSO_4 + 6CO_2$$

$Al(OH)_3$ gradually forms a precipitate and absorbs dispersed particles in the system and becomes larger. An excessively alkaline environment is neutralized using acid or flue gases containing CO_2:

$2NaA1O_2 + CO_2 + H_2O = Al(OH)_3 + Na_2CO_3$

As a coagulant, iron salts are also widely used. Iron salts have a good effect even at low temperatures, the particles are larger and stronger. It hardens (absorbs H_2S). Disadvantage - it can form colored solutions during the cleaning process, and the acidity is high, and the surface of the pumice particles is less. Therefore, $A1_2(SO_4)_3$ and $FeCl_3$ salts are often used together, and mixtures of 1:1 to 1:2 ratio give good results in water purification processes. Coagulation is better in polydisperse systems, because during sedimentation, large particles precipitate together with small particles. The shape of the particles is of great importance in the coagulation process. Elongated particles coagulate better than spherical particles. Hydraulic and mechanical mixers are used to mix coagulant and water. In hydraulic mixers, the mixing process is carried out by changing the direction and speed of the water flow. In mechanical mixers, the mixing process is carried out by moving the mixer slowly at one time, because large particles formed when the mixer is turned quickly can be destroyed. After that, water mixed with coagulant is sent to the chamber for the formation of particles. In mechanical mixers, the mixing process is carried out with the help of mechanical mixers. But the mixing should be carried out gently, because the lumps formed when mixing quickly can be destroyed. After the wastewater is mixed with reagents, it is sent to the flocculation chamber. Here, the formation of pāga takes place gradually. This chamber is a reservoir equipped with barriers located in a row, in which the speed of water movement along the corridor is about 0.2-0.3 m/s.

In addition, a mixture of $A1_2(SO_4)_3$ and $FeCl_3$ salts in a ratio of 1:1 to 1:2, aluminum-containing waste, slag, and pastes can also be used as coagulants. Depending on the concentration of the mixture in the wastewater, the determination of the coagulant dose is given in the table below.

Flocculants, as mentioned above, are used to accelerate the formation of aluminum and iron hydroxides in water during the coagulation process. Active silicic acid ($xSiO_2 * nH_2O$) and polyacrylamide are used as flocculants. The dose of flocculant to the softener is 0.4 to 1.5 mg/l for polyacrylamide, 2-3 mg/l for silicic acid.

Coagulants are prepared in the form of a solution or suspension. They are prepared in special tanks (at least 2).

The concentration of the coagulant solution should be 10-17%. Dissolving time is 10-12 hours at a water temperature of 10°C. Compressed air is supplied for mixing. The lower part of the tank should be conical in shape and it will be connected to a pipe with a diameter of not less than 150 mm.

Mixers are used to mix wastewater with coagulant solution. They can be perforated, barrier, vertical and claw-shaped mixers.

A perforated mixer can be reinforced concrete or a metal tray consisting of perforated barriers. The distance between the barriers corresponds to the width of the tray.

Currently, coagulation and flocculation processes are widely used in petrochemical and chemical enterprises for wastewater treatment.

Wastewater from production is reused in the technological processes of the enterprise. The waste water generated from the economic and drinking activities is thrown into the city sewer network. It is not expected that the soil and underground water will be contaminated by wastewater during the enterprise's operation. The results of the analysis of wastewater generated during the production process of the enterprise revealed that the pH and other indicators did not exceed the permitted sanitary standard (PSS). This shows that the waste water produced during the activity of the enterprise does not pollute the environment. A certain amount of ultramarine pigment accumulates in the filter of the pond and at the bottom of the pond during the treatment of the waste water from the production process of the enterprise where the scientific research was carried out. Dispersed

particles of ultramarn in the pool become larger and sink to the bottom of the wastewater as a result of their joining and the formation of associates. We know that ultramarine pigment can be used not only for varnishes, but also as a dye in the production of textiles, paper, and plastic. The technology of recycling the ultramarine pigment collected as waste in the pond and using it as a dye in the production of textiles, paper and plastics is being considered.

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