

Improvement of Wastewater Treatment In Textile Production

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Abstract

At the enterprises of textile industry water is used as a solvent (for preparation of dyeing, bleaching and finishing solutions and washing of materials after their processing), extractant and cooling agent. About 70% of water consumed by the production is used for washing of raw materials and semi-finished products at different stages of the technological process. In this regard, wastewater generated at the enterprises can be divided into two groups:

- concentrated - these are various spent process solutions, which contain the main amount of contaminants;
- wash waters - the volume of these waters is many times higher than the volume of concentrated wastewater.

Keywords: intensifiers, dyes, adhesion, adsorption, suspensions, biochemical destruction, electrolytic dissociation.

Introduction

Wastewater from textile production is a complex heterogeneous system. Pollutants present in wastewater are in dissolved, colloidal and insoluble state. Colloidal and insoluble substances are able to form persistent roughly and finely dispersed suspensions and emulsions[1-4].

Discharge of waste water into water bodies without bringing its composition to the appropriate quality is inadmissible, because many textile-auxiliary organic substances used as intensifiers of dye fixation on fabrics (organometallic compounds, polyalkylene glycols) and thickeners (maleic acid anhydride, amides and esters of methacrylic acid) getting into water bodies cause death of fish, violate the sanitary regime of water bodies, worsen organoleptic indicators of water. Deterioration of water taste and odor is observed when dispersant NF, Stroks-6 (surfactant) and preparation OS-20 get into water bodies. In addition, a significant amount of chemical reagents is lost with wastewater[5-7]. Thus, losses of dyes and chemical materials with wastewater in the process of dyeing at knitting factories are 25-40% and losses of finishing and auxiliary chemical materials - 50-90%. At the same time, some of the reagents used in the technological process are

expensive chemical raw materials, which from an economic point of view it is advisable to return to production[8-11]. Complex solution of problems of textile enterprises wastewater treatment (reduction of wastewater discharge into water bodies, return of treated water and valuable chemical reagents to production) is possible at creation of closed water rotation systems at the enterprises of the industry. The separating factor in the choice of methods of industrial wastewater treatment is the phase-disperse state of impurities contained in wastewater. To purify wastewater from textile industries are used methods used both in water treatment and in the processes of chemical technology: filtering, sedimentation, filtration, chemical reduction, adhesion, adsorption, destruction by strong oxidizers, flotation, etc[12-16].

In water management systems of textile industry enterprises the following methods are predominantly used: foam flotation for separation of synthetic surfactants, dyes and suspended solids from production wastewater:

- water synthetic surfactants, dyes and suspended solids;
- adsorption on aluminum and iron hydroxides for separation of high-molecular colloidal and suspended substances;
- chemical recovery (with the use of iron chips in acidic medium and subsequent alkalization and clarification of the liquid);
- chemical destruction of persistent suspensions of wool wastewater;
- liquid-phase \rightarrow oxidation of organic matter of concentrated

wastewater; evaporation, biochemical destruction of organic matter. The following is a brief analysis of the methods used for wastewater treatment in the textile industry[17-21].

Wastewater treatment by flotation method

The essence of flotation is the molecular interaction of water impurities with finely dispersed air bubbles and floating of the formed systems of flotation air bubble particles on the surface in the form of foam. The flotability of synthetic surfactants is related to their foaming ability: the higher the foaming ability of the surfactant, the greater its flotability from the liquid[22-25]. The efficiency of the method increases significantly if the surfactants present in the solution not only promote foaming, but also interact with other non-foaming components of the contaminant. The nature of the interaction should be such that the resulting flotation units can concentrate at the water-air interface and create a stable foam. Froth flotation can be used for the separation of wastewater pollution components such as suspended solids, dyes and finishing agents.

The efficiency of ionic flotation of dyes is influenced by the pH value of the solution. Improvement of purification performance is explained by the increase in the degree of electrolytic dissociation of the interacting components of the solution. In acidic environment non-ionic surfactants of OP-IO type behave similarly to cationic surfactants due to formation of oxonium compounds in water. Dispersed and cube dyes are practically not floated in the presence of anionic surfactants due to their high hydrophilicity. The effect of purification by flotation according to the data is: on suspended solids 50-70% COD = 26-30%; BOD full. =28-32%; at the same time the concentration of non-ionic surfactants is reduced by 60%, anionic - by 42%, and their mixtures - 47-50%. Approximate cost of treatment of 1 m³ of wastewater is \$23 USA dollars, and when using secondary heat in hot water supply systems - \$6.5 USA cents.

Wastewater treatment by adsorption method

Adsorption method is based on the extraction of dissolved organic substances from solutions by the surface of solid solids - adsorbents. This method is effective in the treatment of incompletely treated wastewater, when the extraction of specific contaminants by other methods is inexpedient or impossible. Adsorption of the dissolved substance is the result of the transition of its molecules from the volume of solution on the surface or in the volume of adsorbent under the action of the

force field of the surface[26-28]. Adsorption is most active in the presence of double conjugated bonds and aromatic structures in the molecules of dissolved organic matter. Adsorption capacity increases with increasing molecular weight of the substance, so dyes, synthetic surfactants and finishing preparations with long hydrocarbon radicals or with aromatic base - colloidal electrolytes associated in the presence of mineral salts in large micelles are sorbed from aqueous solutions with much higher energy than single molecules. The adsorption capacity of a particular sorbent is estimated by the value of F_{ads} - the difference between the sum of adsorption forces acting in the system and the value of hydration energy[29-30].

Along with the chemical nature of the extracted substance and physical and chemical characteristics of the adsorbent, the amount of adsorbed substance from the plant is determined by the conditions of the process: concentration of the extracted substance, temperature and active reaction of the medium, the ratio of areas occupied on the surface of the adsorbent by molecules of the substance and water, changes in the activity of the components of the solution and others. Assessment of the influence of all the above factors is based on the developed theory of adsorption (in particular, on the provisions of the theory of monomolecular adsorption Langmuir, etc.).

One of the simplest methods of adsorption treatment of wastewater is filtering from bottom to top through a layer of activated carbon (with mandatory preliminary separation of suspended solids from water). Table 1 shows data characterizing the process of filtration through a layer of activated carbon of wastewater model containing 25 mg/l of non-ionogenic surfactant, 12 mg/l of acid dyes mixture and about 200 mg/l of sodium chloride.

Results of adsorptive treatment of model wastewater textile production wastewater

Table 1

	Non-ionogenic PAV	The dyes	
200	Volume of solution passed through the layer of 1 kg of coal, l	Concentration, mg/l	Efficiency of dye extraction, %
230	0,8	3,5	85
265	1,7	4,0	84
300	2,8	4,0	84

It should be noted that adsorption method of purification is the most effective for extraction of specific contaminants from industrial wastewater, the separation of which can be cost-effective in aniline paint and other industries.

CONCLUSION:

1. Deterioration of taste and odor of water is noted at getting into water bodies dispersant NF, Strokes-6 (surfactant) and preparation OS-20. In addition, a significant amount of chemical reagents is lost with wastewater.
2. Approximate cost of treatment of 1 m³ of wastewater is \$23 US dollars, and when using secondary heat in hot water supply systems - \$6.5 US cents.
3. One of the simplest methods of adsorption treatment of wastewater is filtering from bottom to top through a layer of activated carbon.

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