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COAGULATION DIRECT RED DYE AND TEXTILE AUXILIARY AGENTS IN THE PRESENCE OF FREE FORMALDEHYDE

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Introduction

Wastewaters generated from textile factories are linked to one of the main water pollution problems. They contain a mixture of different dyes, auxiliaries, additives, and additional chemicals that were added during textile production processes. If these effluents do not treat they will cause serious environmental concerns. However, the main problematic pollutants from textile factories in the aquatic environment are dye mixtures. These mixtures can be treating by more physic-chemical methods such as electro flotation, coagulation, exchange ions etc.

Coagulation process is important in several wastewater treatment operations. It reduces suspended solids and organic loads from primary clarifiers in overloaded wastewater treatment plants and is the practice of chemically enhancing primary treatment.

The main purpose of the research is to evaluate the effectiveness of treatment by coagulation process in model systems with the following composition: red direct dye – dispersing agent – emollient – fixing agent, *I – DR – LS – Bis-MPA – DEG* and the second system contains also free formaldehyde, *II – DR – LS – Bis-MPA – DEG – FA*. The related objectives were to (i) determine the chemical oxygen demand of mixtures that containing direct red dye and textile auxiliary agents and (ii) comparing these results.

Materials and methods

In this research were used direct red dye 81, DR (50,0%), 2,2-Bis (hydroxyl methyl) propionic acid, Bis-MPA (98,0%), lingo sulfonic acid sodium salt, LS (averageM_w~52,000 and M_n~7,000), diethylene glycol, DEG (99,0%), and free formaldehyde, FA (95%). Aluminium sulphate*18H_2O is used as a coagulant. Their characteristics and structures are illustrated on the Sigma-Aldrich sit.

The different operating parameters like initial concentration of dye and mixtures, pH value and amount of coagulant used have also been investigated. The coagulation efficiency has been confirmed by Chemical Oxygen Demand (COD) measurements. COD concentration was measured by potassium dichromate standard method using UV-Vis spectrophotometer T80+.

Results and conclusions

It has been found that direct and reactive dyes can be removed from the textile effluents by applying the coagulation process with aluminium sulphate. In this paper it has studied more complex systems, containing dyestuffs and a series of textile auxiliary agents that found in the wastewater.

Knowing from the specialities literature that the rate of fixation of the dyestuffs on fabrics is 70-95% so that their residual concentration in the textile effluent varies within the limits of 200-300 mg/L. For this purpose, it was modelled systems with a dye concentration ranging from 100–300 mg/L and textile auxiliary agents were varied within the limits of 60 – 180 mg/L (I) and 80 – 240 mg/L (II), respectively. The coagulation process was studied in the pH range of 4.5 to 9.0 in order to determine optimal pH value of coagulation. It carries out that the chemical oxygen demand decreases and has values of 5.6– 6.9 mgO/L in the pH range of 5.0–5.5 as a result of the coagulation process. The removal efficiency depends on the initial COD of the system and its values are 97–98%. Efficiency drops considerably (85-90%) at pH values above 6.0.

Likewise, the coagulant concentration is an important factor that influence the coagulation process. As a result of the research it was established that the concentration of the aluminium ions necessary to remove the pollutants by coagulation is 4.32 mgAl^{3+}/L for model system DR-LSS-Bis-MPA-DEG that has COD = 300 mgO/L. For the coagulation system model DR-LSS-Bis-MPA-DEG-FA having the COD =700 mgO/L is required 17.24 mgAl^{3+}/L. Decolouration effect has confirmed results shown in Figure 1.

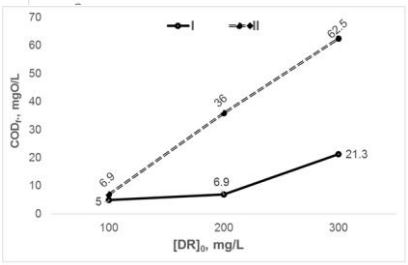

Fig.2. Remaning COD of first and second systems after coagulation;[AL^{3+}] =4.32 mg/L L respectively

Figure 2 shows that COD values increase in the result of the coagulation process because 1) increases dye concentration up to 300 mg/L and 2) by the presence of free formaldehyde.

In order to increase the degree of removal of organic pollutants from the studied systems and attainment of the acceptable CMA and treated water can be reused in technological process, the treatment can be carried out in 3 ways: a) increasing the concentration of the aluminium ions (but disadvantages are the formation of large quantities of sludge which require further treatment); b) coagulation process has followed by catalytic oxidation by Fenton reagent and c) coagulation has followed by adsorption on active charcoal.