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PRELIMINARY INVESTIGATION FOR REMOVAL OF TUDBIDITY FORM WASTEWATER IN CERAMIC INDUSTRY

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ABSTRACT: *The wastewater from the ceramic industry contains a concentrated, white-coloured complex of substances in suspension due to the mineral content of most of the raw materials entering the production process, such as kaolin, clay, feldspar, sand, etc. The high issue of these types of water is the very high level of turbidity and its removal often involves high costs. In this context, we investigated the efficiency for the removal of turbidity of two types of flocculants, namely aluminium polychloride and an emulsion of cationic polyacrylamide. Following the series of laboratory scale experiments, we achieved a 91.3% reduction in turbidity for the cationic polyacrylamide solution with a volume of 5 ml at a speed of 150 rpm and a shaking time of only 2 minutes , and for PCA 94.67% with 5 ml of solution at 150 rpm for 2 min, after which the rate was reduced to 30 rpm for 20 min.*

Key words: *coagulation-flocculation; polyacrylamide cation emulsion; aluminium polychloride.*

Introduction

The wastewater of the ceramic-tile industries is produced through the following processes: slurring, spray drying, preparing glaze, coloring, engobing, as well as polishing and washing the floors of the production halls [1].

Wastewaters of such industries contain clays, insoluble ferrites and silicates, electrolytes, anions such as sulfate (100–500 mg/L) and chloride (100–700 mg/L), as well as heavy metals such as lead, zinc, chemical oxygen demand (COD) (150–1000 mg/L), and BOD_5 (50–400 mg/L) [2].

Colloidal particles in nature normally carry charges on their surface, which lead to the stabilisation of the suspension.

By addition of some chemicals, the surface property of such colloidal particles can be changed or dissolved material can be precipitated so as to facilitate the separation of solids by gravity or filtration.

Conversion of stable state dispersion to the unstable state is termed destabilisation and the processes of destabilisation are coagulation and flocculation [3].

Through this process, the water purification rate reaches 70-90%, reaching values up to 95%, if the chemical reaction is carried out in optimal conditions [4].

So far, a variety of flocculants have been developed or designed to improve the process of wastewater treatment.

Polymer flocculants, synthetic and natural ones have become very popular in the treatment of industrial effluents due to their inertia to changes in pH, low dose and high efficiency with ease of application [5].

In order to save the treatment cost and time, direct flocculation was proposed and investigated in some studies.

In direct flocculation, medium charge density with high molecular weight cationic polymers is normally used.

It has dual functions: neutralise the negative charges ofthe colloidal particles and bridge the aggregated destabilised particles together to form flocs. [5].

Materials and methods

For the preparation of the solutions, we used 100 ml of distilled water, 0.10 ml of polyacrylamide cation emulsion, obtaining a dilution of 1: 1000 and 10 ml of aluminium polychloride giving a 1:10 dilution. For the complete dissolution of the flocculants a magnetic stirrer was used at a maximum speed of 300 rpm for 20 minutes.

Wastewater subjected to the coagulation-flocculation process was analysed to determine physicochemical parameters, so the turbidity meter HI 83414 (Hanna Instruments) was used to determine the turbidity, the results being expressed in the NTU (Nephelometric Turbidity Units). Analysis of chemical composition of water and samples was performed using an ARL Quant'XEDXRF X-ray fluorescence spectrometer (Thermo Scientific).

To perform the coagulation-flocculation experiments, the Jar test FC4S (Velp Scientific) was used. Wastewater that we are working with was dosed in Berzelius glasses with a volume of 1000 mL of 500 ml of water for each sample, which were placed on the Jar test for flocculant injection, this being done with automatic pipettes with adjustable volume. In order to identify the optimal dose, quantities between 1 and 20 ml were injected, following the effectiveness by determining the turbidity value, starting from a value of 170 NTU for the raw water sample. I mention that all experiments were performed at room temperature of 20-25 ° C.

Results and discussions

After the chemical analysis of the wastewater, there is a significant presence of heavy metals, as well as some predominant elements in very large quantities, namely calcium and silicon.Their concentration is explained by the fact that these elements underlie the chemical composition of most of the raw materials used in the ceramic materials production process (fig. 1).

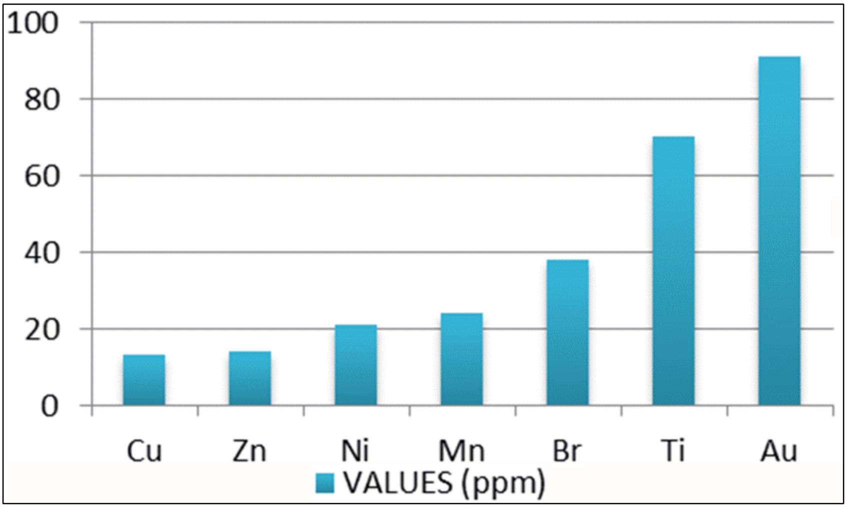

Fig. 1. Chemical composition of waste water

For the purposes of cleansing treatment of the wastewater, we investigated the effect of turbidity removal using two flocculants agents. To achieve the polyacrylamide solutions a dilution of 1-1000 was used and for the aluminium polychloride a dilution of 1-10. For optimal dose identification, quantities of 1, 2.5, 5, 10, 20 ml flocculant were injected, following efficacy by determining the turbidity value. The results of experiments performed using different doses are shown in Fig. 2

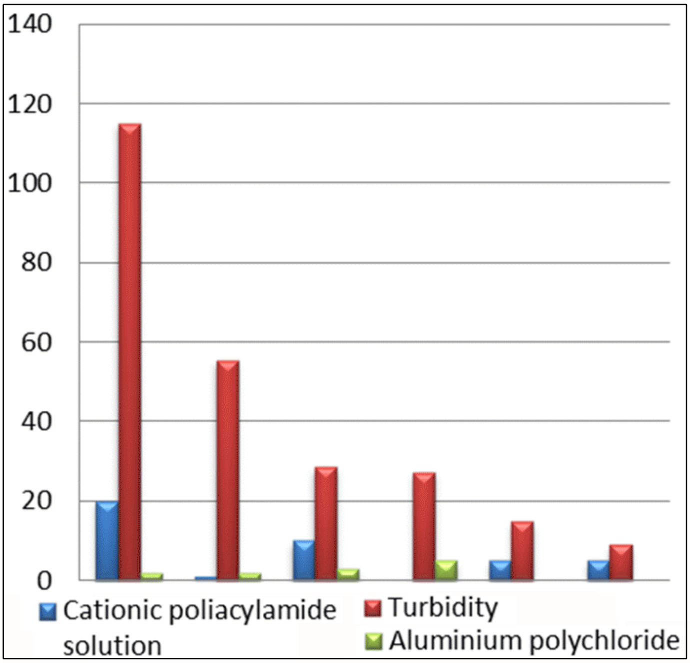

Fig. 2. Values of turbidity according to the dose of floculant

From the experimental conditions that we investigated, in Table 2 shows a decrease in lower turbidity at doses of 1 and 20 ml respectively in 67.41% and 32.35% respectively, a relatively close decrease between doses of 2.5 and 10 ml respectively in 84.0% and 83.24%. The lowest value is obtained with a volume of 5 ml flocculant, the removal being 91.30% at a rate of 150 rmp and a shaking time of 2 minutes and 10 sedimentation.

Aluminium polychloride reaching a 94.67% recovery threshold. with 5 ml of the solution at a rate of 150 rpm for 2 min and 30 rpm for 20 min. With respect to the formed flasks, for the polyacrylamide, a proportional increase thereof is noted with the amount of flocculant injected.Their sedimentation velocity is dependent on size.

The flocks formed by interaction with aluminum polychloride are of small size, with a very small variation in the size between different volumes.

Conclusions

In the present study, we tested two flocculants, namely aluminium polychloride and polyacrylamide, in order to determine the turbidity removal efficiency for wastewater from the ceramic industry. On the basis of the results we have concluded that a higher reduction of 0.05 NTU turbidity was achieved using aluminium polychloride, reaching a percentage removal of 94.67%. With polyacrylamide, the turbidity was reduced to a value of 14.8 NTU, i.e.91.30%.

The flocks formed by interaction with aluminium polychloride are of small size, with a very small variation in the size between different volumes. For the flocks formed following the polyacrylamide inertia, a proportional increase of the flocculant injecting agent is observed, their formation being almost instantaneous.The difference in turbidity removal between the two flocculants is 3.37%, both of which ensure the degree of purification required, but taking into account the dilution factor of the solutions used, the benefit balance is clearly inclined towards the polyacrylamide.

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