LABORATORY APPLICATIONS IN WASTEWATER TREATMENT BY USING FLOCCULATION PROCESS

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Abstract: In the application of coagulation and flocculation process in the wastewater treatment, the laboratory activities are very important and sometime even indispensable. These activities provides some solutions to the efficiency that can be obtained and offer the possibly of results extrapolation to the industrial applications. The present study attempted to verify some possible laboratory application of the Acefloc organic flocculants series to the municipal waste leachate treatment. In these sense, some laboratory techniques were implemented to evaluate de flocculants efficiency by analyzing some quality parameters. In the case of Acefloc 00303L flocculants use were obtained the best performances regarding the analyzed quality indicators reduction. By using the flocculation process, the COD concentration decrease with 85.35 % in the case of Acefloc 00303L flocculants use

Keywords: wastewater, waste leachate, organic flocculants, flocculation process, COD

1. INTRODUCTION

The flocculation processes applied in wastewater treatment to separate the destabilized colloid particles (or the particles formed during the coagulation phase) by forming flocs [1-8].

In wastewater treatment processes the flocculation process is applied only when the particles have been destabilized. In many wastewater or sludge treatment processes are used synthetic organic flocculants due to its advantages creates respectively waters with low solids suspension concentrations and weak solutions [1-10].

Synthetic flocculants are obtained by monomers polymerization. The synthetic flocculants are made from different types of monomers such as acrylamide, acrylic acid, ammonium chloride, styrene sulfonic acid etc. The acrylamide is a crystalline and stable monomer, soluble in water [4-6, 11].

In some studies, various combinations of physicochemical and biological (aerobic oxidation) treatment methods are used to treat industrial wastewater and coagulation can be an option for the first step of chemical pre-treatment process [4-6, 12].

Application of flocculation process for dispersions from wastewater, by using synthetic organic flocculants, occurs in principal by the "bridges" connections respectively, the same macromolecule polymer adsorb several

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particles from suspension and form flocs with different dimensions and weights. Also, if we consider the type of wastewater it can be noted that the flocculation processes is applied for the municipal and/or industrial wastewater treatment to reduce the pollutants concentration to the regulations acceptable limits [4-6, 13-14].
In some studies several types of flocculants with different dosages were analyzed. The coagulation-flocculation process efficiency was monitored by analysis of some quality indicators (TDS, TSS, TP and COD) [4-6, 9, 15]. Also, in the literature are presented researches regarding to the use of cationic polyacrylamides (C-PAM) and anionic polyacrylamides at different dosages for the wastewater treatment [4-6, 14].

In the application of coagulation and flocculation process in the wastewater treatment, the laboratory activities are very important and sometime even indispensable. These activities provides some solutions to the efficiency that can be obtained and offer the possibly of results extrapolation to the industrial applications [4-6, 16].

The present study attempted verify some possible laboratory application of the Acefloc organic flocculants series to the municipal waste leachate treatment. In these sense, some laboratory techniques were implemented to evaluate de flocculants efficiency by analyzing some quality parameters.

2. EXPERIMENTAL SETUP

For these studies a series of six powder organic flocculants were used. The flocculants solutions were prepared in 0.5 % working solution. The samples was treated with 100 ppm quantity from each type of prepared solution flocculants.

For the laboratory evaluation, were consider 100 mL of municipal waste leachate samples. Considering the municipal waste leachate particularities, in the first part of the sample treatment a 10 % ferric chloride solution were added to determine a coagulation process and to accelerate de flocculants action and efficiency. In the each samples were added 5 mL of ferric chloride solution.

In the first part of the laboratory evaluation the TDS concentration were evaluated for the liquid faze obtained after flocculation process. For this evaluation the 3210 WTW conductivity meter. Also the pH value were determined by using 3210 WTW pH meter.

To evaluate the final quality of the treated liquid phase, the COD concentration were determined in the case of some flocculants uses (for the best results obtained in the case of TDS analysis). For COD analyses were used DR3900 Hach spectrophotometer.

The used organic flocculants for the present research was: Acefloc 50753L; Acefloc 40753L; Acefloc 30603L; Acefloc 30703L; Acefloc 30403L; Acefloc 00303L.

3. RESULTS AND DISCUSSION

The municipal waste leachate samples (treated with 5 mL of 10 % ferric chloride solution) was put in contact with each analyzed flocculants Figure 1. Form the Figure 2 it can be observed that the chemicals addition were determine a solid phase separation on the top of the working glass.

The initial sample evaluation of the monitored indicators are presented in the Table 1.

Table. 1 Initial quality indicators.

Quality indicator	Values
pH	8,35
TDS	19.84 g/L
COD	2212 mg/L

From the results presented in the Table 1 it can be observed that the municipal waste leachate samples present a high load which can determine some serious problems in the treatment methods implementing.

After the sample treatment with 5 mL of 10 % ferric chloride solution and analyzed flocculants series were obtained some data regarding the TDS indicator reduction (Figure 3).

Fig. 1. Samples treatment with flocculants solutions.

Fig. 2. Solid phase separation in comparison with witness sample.

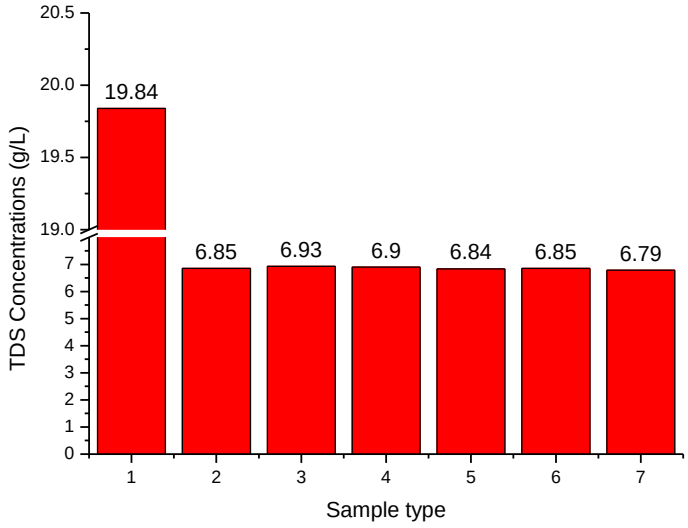

Fig.3. TDS concentrations variation:
1. Witness sample; 2. Acefloc 50753L; 3. Acefloc 40753L; 4. Acefloc 30603L; 5. Acefloc 30703L; 6. Acefloc 30403L; 7. Acefloc 00303L.

From the above graph can be observed that in the case of Acefloc 00303L flocculant used was obtained the lower concentration for TDs parameter.

Considering the results obtained in the case of TDS concentration were analyzed the COD parameter for the sample treated with Acefloc 30703L, Acefloc 30403L and Acefloc 00303L (Figure 4).

Figure 4 reveals that by flocculants Acefloc 00303L added to the sample was obtained a liquid phase with COD concentration lower that the legislative limit (of 500 mg/L) [17] required for the municipal sewage network wastewater discharge. It is means that in the real conditions it can be possible to treat primary the municipal

waste leachate by using the analyzed flocculants. Of course, it will be necessary an advance treatment for the obtained liquid phase, but the cost of successive treatment operations will decrease substantially by flocculation treatment.

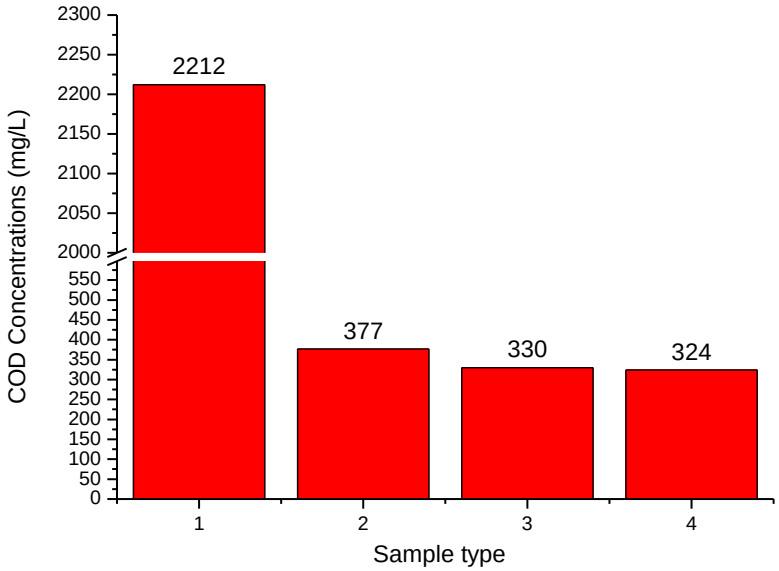

Fig.4. COD concentration variation:
1. Witness sample; 2. Acefloc 30703L; 3. Acefloc 30403L; 4. Acefloc 00303L.

4. CONCLUSIONS

The flocculation's process are very important in the wastewater treatment, if we refer to a primary or advance treating.

A laboratory evaluation of the flocculants products application for wastewater treatment can offer a predictive solution for the possible real treatment methods.

The evaluation of the TDS concentration reductions reveals that the reduction performed by using Acefloc 00303L flocculants was 65.77 %. Also, by comparing the analyzed products it can be observed an 2.02 % TDS concentration reduction in the case of Acefloc 00303L product use.

By using the flocculation process, the COD concentration decrease with 85.35 % in the case of Acefloc 00303L flocculants use. The same product obtain an 14.05 % COD concentration reduction, in comparison with Acefloc 30703L and 1.81 % by comparing the Acefloc 30403L result.

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