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Abstract

This research focuses on the alteration of a natural clay source; its analysis indicated that it has an expanded porous structure and may be used to cleanse water for the textile industry, enabling us to utilize them to get rid of colors like Congo red and methylene blue. As a result, the primary goal of this work is to first enhance the surface qualities of bentonites after various treatments before applying the adsorption approach to remove organic contaminants since it has a higher absorption capacity.

Keywords: Clay, porous, water treatment, surface properties, Bentonite

Introduction

Environmental degradation is caused by specific chemical compounds of industrial or agricultural origin that pollute water and soil. This issue is now gaining attention, especially worldwide. Aromatic chemicals are thought to be harmful micropollutants that can cause cancer because of their overall toxicity. For its part, several organic micropollutants, particularly certain detergents and dyes, are also present in the effluent from the textile sector. The effluent is so heavily concentrated in dyes whose low biodegradability makes biological treatments challenging to apply. This is usually employed excessively to enhance the dye. Coagulation-flocculation-decantation cannot sufficiently reduce these chemicals; conventional purification techniques have reached their limits

Clays are a novel class of microporous materials with regulated porosity that are now being extensively explored for a variety of applications, including adsorption and catalysis. Numerous publications provide details on the various processes used in the synthesis and characterization of these clays.

Methodology

Natural and modified bentonite

The bentonite was modified with a cationic surfactant by ion exchange. (Shaking) at room temperature under constant stirring. Following that, the obtained suspension was centrifuged and rinsed several times with distilled water. The modified bentonite was dried at a temperature of 50°C for 8 h. Both materials have been characterized (by EDX AND SEM)

A series of solutions (methylene blue) with different concentrations (12, 14, 16, 18, 20 mg/l)

A: Effect of the mass of bio adsorbent:

To observe the effect of the mass of clay materials, several tests were carried out by varying the mass of the latter in the range from 0.01 g to 0.05 g. The solution was used in a different concentration. For each adsorption test, a mass of clay is placed in a beaker; 30 ml of the MB solution is added. The solution is stirred for 45 minutes to 1 hour.

B: The duration of the stirring:

We fixed the mass of clay at 0.03 g in a solution of various BM concentrations and changed the sample collection period from 10 to 80 minutes to examine the impact of the stirring time.

C: Effect of initial concentration:

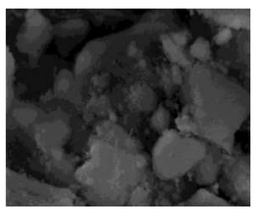
The effect of the initial concentration is studied in a discontinuous regime for the concentrations of MB solutions of 12 mg. L-1 to 20 mg L-1. The stirring time is set at 45 minutes, a time in the equilibrium range. The mass of clay used in these tests is 0.03 g in 30 ml of solution

Results

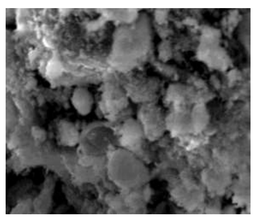
EDX analysis

Samples	SiO2	AL2O3	Fe2O3	CaO	MgO	K2O	Na2O	SO3	CL
Bentonite	57,87	18,38	9,58	4,06	1,72	2,47	0,96	0,01	0,011
Modified Bentonite	59,52	17,6	8,72	4,56	1,56	1,84	0,14	0,054	0,011

SEM analysis



a) Bentonite



b) Modified Bentonite

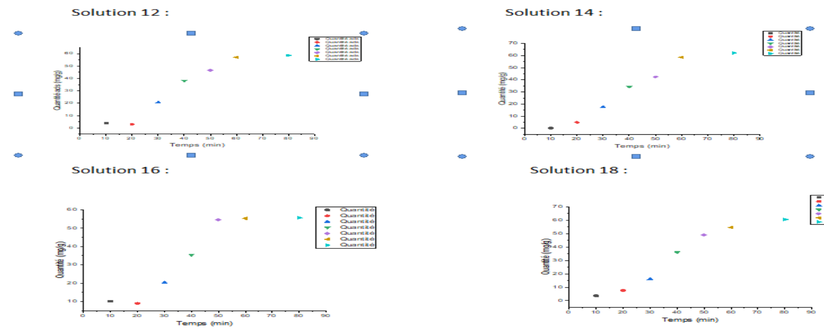
Effect of adsorbent mass:

has. Natural:

These curves show that the absorbance of the dye decreases with the increase in the mass of the adsorbent.

These results show that the increase in the mass of the supports causes a decrease in the absorbance (A) or the quantity adsorbed (Qe). This can be explained by the fact that the increase in the mass of the adsorbent creates clay aggregates which will in turn cause the reduction of the adsorption sites.

The ultimate adsorption capacity expresses the amount of solute adsorbed per unit mass better per unit of adsorbent particles. By expressing the adsorption capacity in this way per mass unit or per particulate unit, we obtain a low apparent ultimate adsorption capacity. Steric hindrance is also the basis of the reduction of the total accessible surface, hence a reduction in the adsorption capacity as a function of the mass of the bio adsorbent.



b. Synthetic:

These curves show the growth of the absorbance of the dye (BM) with the increase of the mass of the adsorbent.

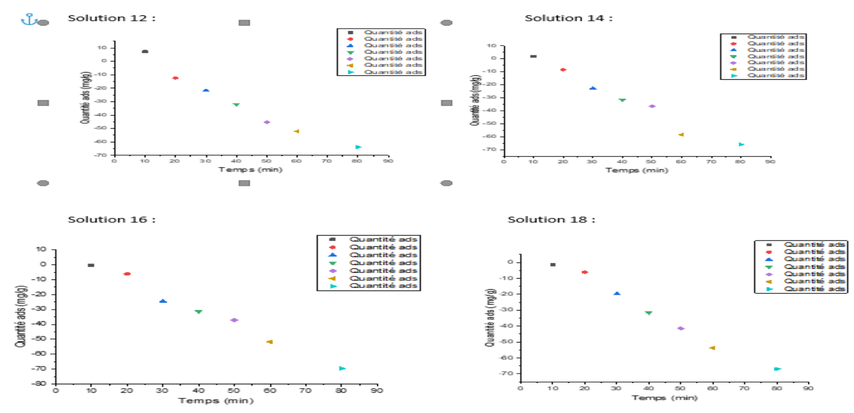
The results obtained are given in figures. It is clear that the absorbance (A) or the quantity adsorbed (Qe) of the zeolite decreased with the increase in the mass of the bioabsorbent from 0.01g to 0.05g. This can be attributed to the overlapping of adsorption sites, which leads to a decrease in available adsorbent surface area and an increase in diffusion path length

Effect of contact time:

has. Natural :

The results obtained are shown in the figures. It is clear that the absorbance (A) or the adsorbed quantity (Qe) of the dye decreases with the increase in the contact time of the absorbent from 10 min to 80 min.

In conclusion, the optimal time considered in this study is about 45 min for clay.



Conclusion

- The adsorption capacity obtained with modified bentonite is better than that obtained with natural bentonites since they have a better adsorption capacity for dyes
- The characteristic hydrophobicity of modified bentonites allows better fixation of the anionic dye. We can say that the improvement of the adsorption capacities of the dye through the use of bentonite modified (synthetic) is not due to the hydrophobic character but especially to the importance of the sheet spacing.
- Finally, this study was intended to be an important source of information on the clay. Several characterizations and application data have been generated, but the complexity of the subject leaves the way open for further work.
- Additional adsorption tests on various industrial waste effluents are also necessary in order to consider some applications