

ECHAHID HAMMA LAKHDAR UNIVERSITY - EL-OUED
Under the Supervision of the DGRSDT and in collaboration with the CRTI
International Pluridisciplinary PhD Meeting (IPPM'20)
23-26, 2020 1st Edition, February
Theme: Modern Technology and Fineness Life

4 to 5 pages

Synthesis and Physicochemical Properties of Purple Clay

Aicha KOURIM*, Moulay Abderrahmane MALOUKI*, Aicha ZIOUCHE**,
Mouna BOULAHBAL*, Madjda MOKHTARI***

* Sciences and Environment Laboratory, P.O. Box 10034, Sersouf-Tamanrasset, Algeria

**Research Center in Industrial Technologies CRTI, P.O. Box 64, Cheraga 16014- Algiers, Algeria

***Laboratory of valorisation and technology of saharian resources (VTRS), faculty of technology, Hamma Lakhdar University,
39000, Algeria.

aichakourim@gmail.com

moulayabderrahmane61@yahoo.fr

aicha_ziouche@yahoo.fr

nonamm15@gmail.com

madjda.mokhtari@yahoo.fr

Abstract

Natural clays are very abundant, eco-friendly, and available materials for depollution. Over the recent years, these natural resources and their modified forms are used as low-cost adsorbents in the removal of pollutants. This paper describes the variations of physicochemical properties values of pH, the specific surface area, the point of zero charge and the cation exchange capacity between natural clay and its composites.

Keywords: Clay, modified-clay, physicochemical properties.

1. Introduction

Clays play an important role in the environment by taking up cations and anions either through ion exchange or adsorption or both. Montmorillonite, kaolinite and Illite have been considered as efficient mineral clays for the treatment of contaminated water. For this reasons many researchers of water's contamination tried to increase the capacity adsorbed of clays deals with physical and chemical modification of this materials.

Modified and intercalated clay minerals are widely used because of their high specific surface area, chemical and mechanical stability, a variety of structural properties, and low cost useful for various environmental applications. In this study, pH, specific surface area, point of zero charge and cation exchange capacity were calculated for following clay modifications Purified-Clay, Activated-Clay, Pillared-Clay and CTAB-Clay of purple clay.

2. Material and methods

2.1 Preparation of materials

Raw material

The natural clay sample was obtained from Tamanrasset south of Algeria. It was prepared before use by sun drying, then ground into fin particles and sieved to a particle size of 80 μm after that, it was stored in a desiccator for late experimental use.

Purified material

The clay was purified with the purpose of removing all crystalline phases and organic matter according to the procedure described by Robert and Tessier in order to obtain 2 micrometers clay fractions intercalated with sodium ions (Clay-Na) (13).

Activated material

The chemical activated clay was carried out by adding 50g of raw clay to 500 ml of sulfuric acid 1.5 M and refluxing at 110°C for 4h. The resulting clay suspension was then rapidly quenched by adding 500 ml of ice water. After cooling the sample was washed several times with distilled water until neutral pH, then filtered, dried in oven and calcined at 500°C for 4 hours (14) (15).

Pillared material

The pillaring solution was prepared by the slow addition of NaOH 0.225M to a 0.5M solution of AlCl₃ at room temperature, until a molar ratio of OH/Al=1.8 was reached. The pillaring of Clay-Na by polycation of aluminum is carried out according to the conventional procedure (cationic exchange with a heat treatment) (16).

Modified by CTAB

In 500 ml Buchner, 10 g of purified clay was added to 250 ml of CTAB solution 0.02M, the mixture was stirring at room temperature for 24h. Then, the suspension was filtered and washed several times until the negative test of Br⁻. The CTAB-Clay was dried at 105°C for one hour, ground and stored in sterile glass box (17) (18).

2.2 Physicochemical characteristics of materials

The pH of material:

Ten grams of crushed material was stirred in 75 ml of deionized distilled water in a beaker all the night and filtered. The pH was measured by a glass electrode (pH METER HI2210) (19).

The specific surface area:

Sear's method was chosen to estimate the surface areas of clay adsorbents (20). 0.5 g of each clay was acidified with 0.1 M HCl to a pH 3-3.5. The volume was made up to 50 ml with distilled water after addition of 10 g of NaCl. The titration was carried out with standard 0.1 M NaOH to pH 4 and then to pH 9. The volume, V, required to raise the pH from 4 to 9 was noted and the surface area was computed from the following equation:

$$S(m^2/g) = 32V - 25$$

The point of zero charge:

The point of zero charge or pH_{Pzc} is point where the net charge of the material equal to 0.

The PZC was determined by the pH drift method (21) (22).

The cation exchange capacity:

The CEC of materials was calculated by methylene blue method.

3. Results and Discussion

Characterization of materials

Table 1 Physicochemical properties of samples

Properties	pH	Point of Zero Charge	Surface Specific Area (m ² /g)	Cation Exchange Capacity (meq/100gr)
Raw clay	7.03	9.03	58.04	22.95
Purified Clay	10.13	8.5	93.14	49.07
Activated Clay	4.73	7.90	81	60.09
Pillared Clay	8.69	9.21	114.66	85.88
Clay-CTAB	8.3	10.06	147.5	90.12

4. Conclusion

In this study, we prepared a modified clay successfully by several methods. Many of modification on the surface of the clays with bases, acids, some poly hydroxyl cation and surfactants were conducted to improve their sorption capacity after.

References

1. *Méthode de préparation des argiles des sols pour études minéralogiques*. **Robert, M et Tessier, D.** 1974, Ann. Agrom, pp. 25, 859-882.
2. *On the investigation of acid and sulfactant modification of natural clay for photocatalytic water remediation*. **Sori, V.K, et al.** 2018, J Master Sci, pp. 53, 10095-10110.
3. *Effect of sulphuric acid treatment on the physic-chemical characteristics of kaolin clay*. **Panda, A. K, et al.** 2010, Colloids and Surfaces A : Physicochem. Eng. Aspects, pp. 363, 98-104.
4. *PREPARATION DES ARGILES PNTEES D'ORIGINE ROUMAINE AVEC DES POLYCATIONS D'ALUMINIUM ET DE FER*. **Nistor, D.I, Miron, N. D et Siminiceanu, I.** 2006, Quatrième Colloque Franco-Roumain de Chimie Appliquée, pp. VII(3), 1582-540X.
5. *Adsorption of Acid Dyes onto Bentonite and Sulfactant-modified Bentonite*. **Akl, M. A, Youssef, A. M et Al-Awadhi, M. M.** 2013, J. Anal. Bioanal. Tech., p. 4: 174.
6. *Adsorption of acid dyes from aqueous solution by CTMAB modified bentonite: Kinetic and isotherm modeling*. **Yan, L-G, et al.** 2015, Journal of Molecular Liquids, pp. 211, 1074-1081.
7. *The pH of clay suspensions in the field and laboratory, and methods of meausurment of their pH*. **Keller, W.D et Matlack, K.** 1990, Applied Clay Science, pp. 5, 123-133.
8. *kaolinite, montmorillonite, and thier modified derivatives as adsorbent for removal of Cu (II) from aqueous solution*. **Bhattacharyya, K. G et Gupta, S. S.** 2006, Separation and Purification Technology, pp. 50,388-397.
9. *On the characterization of acidic and basic surface sites on carbons techniques*. **Lopez-Raman, M. V, et al.** 1999, Carbon, pp. 37: 1215-1221.
10. *Adsorption de la quinine bichlorohydrate sur un charbon actif peu couteux à base de Bagasse de canne à sucre imprégnée de l'acide phosphorique*. **Kifuani, K. M. A, et al.** 2012, Int. J. Biol. Chem. Sci., pp. 6(3): 1337-1359.