Asian Journal of Research in Social Sciences and Humanities
ISSN: 2249-7315 Vol. 12, Issue 05, May 2022 SJIF 2022 = 8.625
A peer reviewed journal

MODIFICATION OF VERMICULITE AND BENTONITE CLAY WITH CHITOSAN FOR USE CLEANING TEXTILE WASTE WATER

Ikhtiyarova Gulnora Akmalovna*; Umarov Boburbek Nosirugli; Turabdjanov Sadritdin Makhamatdinovich*****

* Professor,
Doctor of Chemical Sciences,
Head of the Department General Chemistry,
TSTU, UZBEKISTAN
Email id: gulnora74@mail.ru

**3rd year Doctoral Student,
Department of General Chemistry,
TSTU, UZBEKISTAN
Email id: boburbekumarov1993@gmail.com

***Professor,
Department of Ecology and Environmental Protection,
TSTU.d.t.s., UZBEKISTAN

DOI: 10.5958/2249-7315.2022.00298.2

ABSTRACT

In the state considered the acquisition of adsorbents on the basis of modified vermiculite and bentonite with chitosan when used for cleaning stochnyxvodtekstilnoypromыshlennosti. Change of adsorption capacity shows that the adsorption of active anionic acid on organosorbentax depends not only on the quantity of cation exchange units, but also on the availability of ego.

KEYWORDS: *Vermiculite, Bentonite, Chitosan, Aminopolysaccharide, Apismellifera, Stochnye Water, Orgonobentonite.*

INTRODUCTION

It is known that all over the world, industrial enterprises pollute wastewater with dyes, heavy metals, organic reagents, and surfactants. Thus, the specific amount of wastewater generated in the processes of dyeing and finishing production in Uzbekistan is 200 - 350 m3 per 1 ton of fabrics produced. The variety of pollutants and their nature requires the development of poly functional and selective adsorbents with the ability to purify from frequently occurring polar and non-polar substances. Composite sorbents based on vermiculite modified with organic amino polysaccharide, that is, with chitosan, can have such characteristics [1].

Expanded vermiculite has pronounced hydrophobic and anion-exchange properties [2]. Low specific gravity is another important property of expanded vermiculite.

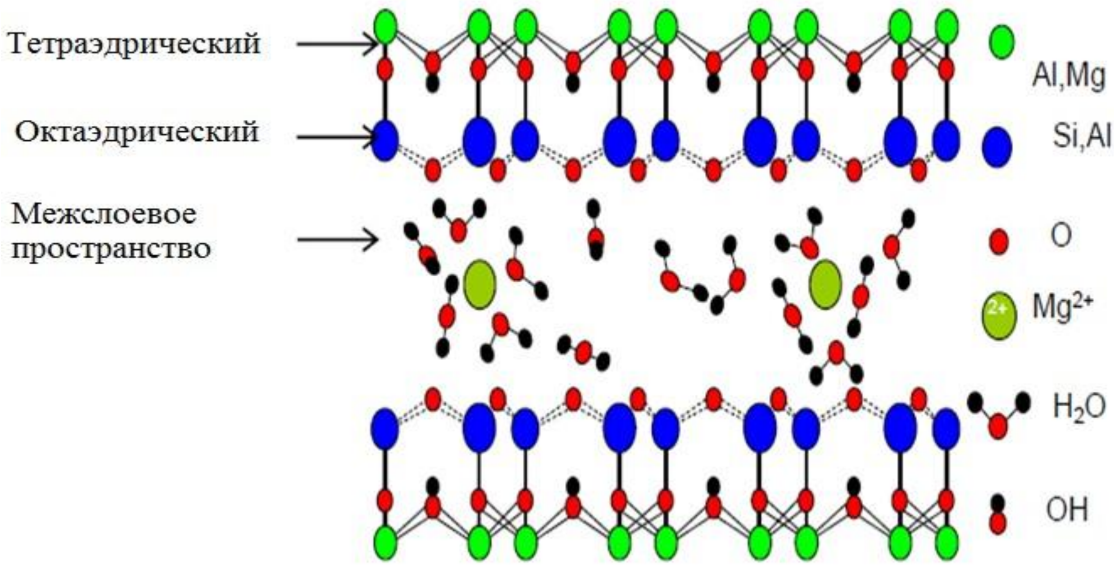


Figure 1. Structural diagram of vermiculite

Chitosan is a biocompatible, nontoxic, biodegradable amino polysaccharide with antimicrobial, sorption, and antioxidant properties [3]. The unique properties of chitosan are, of course, associated with its molecular characteristics, its own biological activity and the ability to form compounds and complexes with various chemicals [4]. In the scientific and technical literature, methods for obtaining modified bentonite minerals for the purification of active dyes are widely covered [5-7]. However, despite this, the industrial production of organ minerals in our Republic for the purification of various dyes remains from the production requirement. The main reason for this is the lack of a scientifically based acceptable technology that ensures the production of organ sorbents with high characteristics as adsorbents. Therefore, scientific experimental research in this direction is doubly relevant.

Research goal is a modification of the local vermiculite of the Tebinbulok deposit and Navbakhor bentonite produced in the Republic of Uzbekistan with chitosan synthesized from dead bees ApisMellifera and the study of their physico-chemical properties, as well as the sorption parameters of organosorbents in relation to dyes in the wastewater of textile enterprises.

EXPERIMENTAL PART

Alumino silicates were chosen for research: expanded Vermiculite (BB) hydromica of the Tebinbulok deposit and bentonite clay of the Navbakhor (Na-NB) deposit from the Navai region. As a mineral modifier, a reagent was used - chitosan ApisMellifera (KhZ) [8-9] obtained in the laboratory of the Tashkent State Technical University. Synthesized organ sorbents are conventionally named Kh3-Na-NB and organ vermiculite KhZ-VV. as a dye used imported dye Indigo used in the production of "Bukhara cotton" and active dye Reactive due -2B used in the production of JSC "Bukhara Brilliant silk" in the Republic of Uzbekistan.

When modifying minerals of the smectite group, which have an expanding structural cell with relatively large organic cations, the introduction of organic molecules into almost the entire inner surface of the minerals is observed. As a result, the molecules of the medium, i.e. waters are adsorbed mainly on their outer surface [10]. However, as the results of the study show, adsorption of molecules of polar organic substances is possible not only on the outer, but also on the inner surface of vermiculite and bentonites with organic cations in the exchange complex. From a scientific point of view, the replacement of inorganic exchangeable cations of clay minerals with organic ones should lead to a sharp change in their physicochemical and sorption characteristics [11–12]. There is data confirming an increase in the adsorption capacity of modified montmorillonite in relation to petroleum products, aromatic and paraffinic hydrocarbons. The increased interest in organo derivatives of clay minerals can be explained by the possibility of their use as selective sorbents [12].

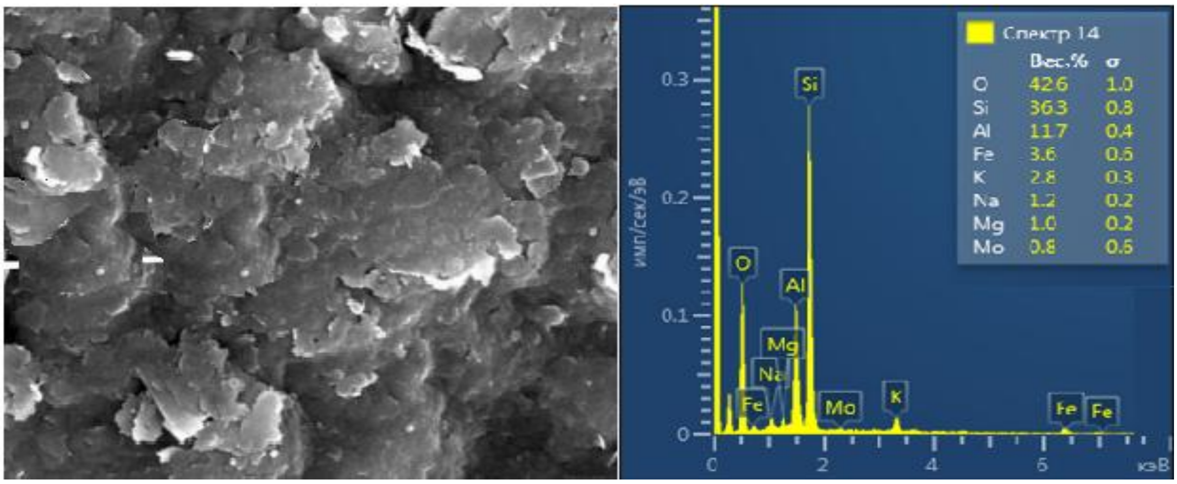
Adsorption tank for measuring Indigo dye and attracting dye reactive dye 2B. Active anionic dye 2B, is a dark blue crystals with a luster.

In laboratory experiments to determine the adsorption capacity, solutions of indigo dye and reactive dye 2B were prepared in water with a concentration of 1 to 200 mg/l, and the optical densities of these solutions were determined. Data on the optical densities of solutions were used to construct a calibration graph. In solutions with a volume of 100 ml were added 0.05-0.1 g of adsorbents in the form of a powder. After pH and adsorption equilibrium were established (from 6 to 24 hours for individual samples), the optical densities of the solutions were measured and, using the data from the calibration curve, their concentrations mg/l were established. The amount of adsorbed dye was determined by the formula:

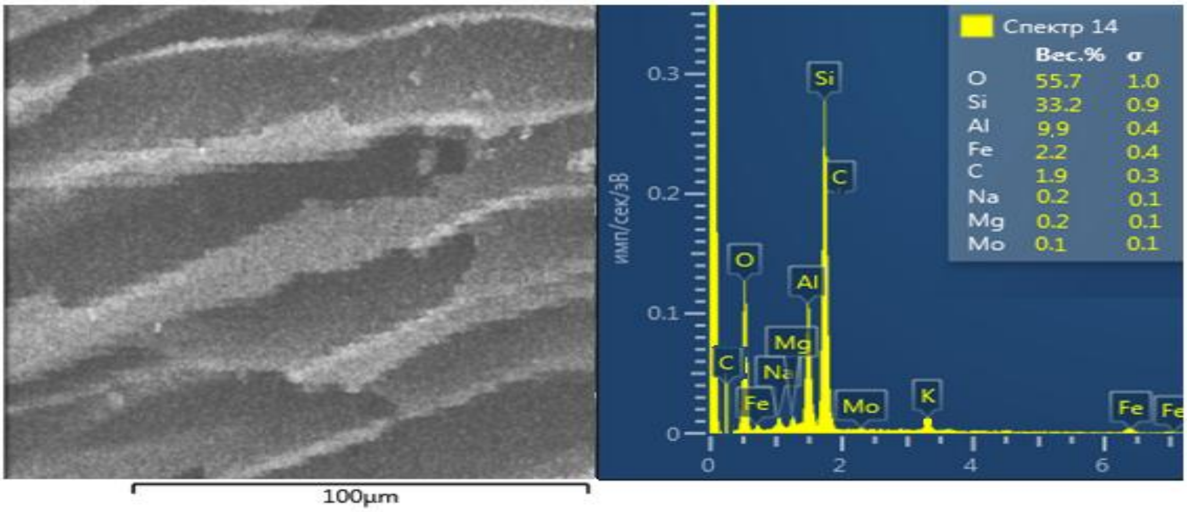
$$A = \frac{(C_0 - C_1) * V}{m}, \qquad (1)$$

where, A is the amount of adsorbed dye mg/g; C0 and C1 are the initial and equilibrium concentrations of the dye in the solution, mg/L; V is the volume of the solution, l; m is the mass of the adsorbent, g. The pH of aqueous solutions was measured using an I160-M ion meter.

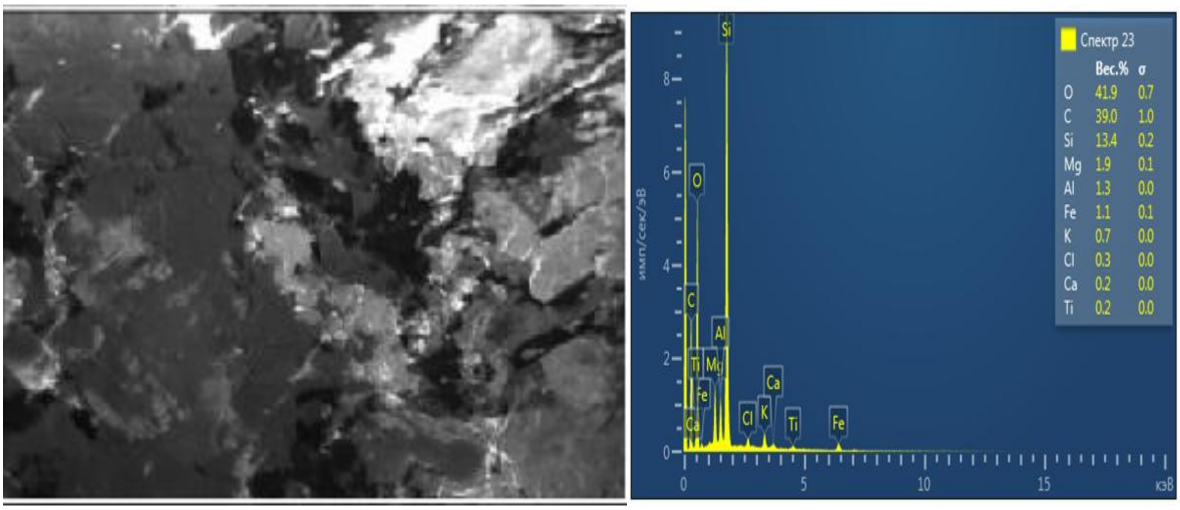
The main method for studying the crystal structure of orgone sorbents is also electron micro diffraction elemental analysis (Fig. 2).



A)



B)

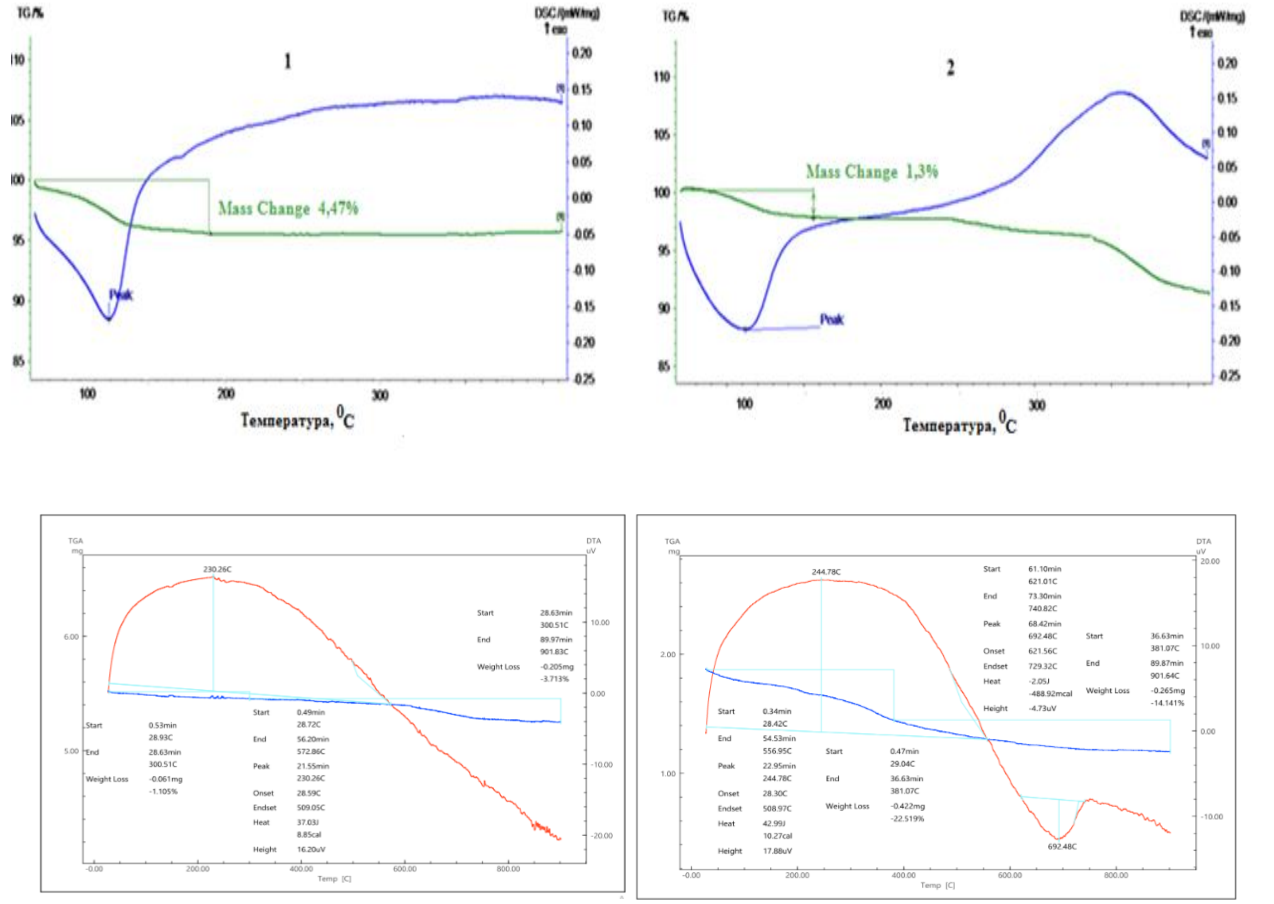


G)

Figure.2. Electron microscopic image of Bentonite and orgonobentonite and vermiculite and Organovermiculite A) Na-NB; B) XZ-Na-NB; C) modified explosive; D) HZ-BB

In the case of chitosan, a polymeric modifier, the formation of associates with a thickness of one layer of modifier cations is observed, instead of hydrate-ionic layers of the outer surfaces of montmorillonite crystals. At the same time, an increase in the size of the modifier molecules contributes to an increase in the degree of three-dimensional order in the packing of silicate layers. Under an electron microscope, it can be seen that large particles of CS-Na-NB and CS-BB are mainly rectangular in shape with a size of about 1 µm and can be used to treat wastewater from dyes.

These assumptions are fully consistent with the results of X-ray phase analysis. In order to determine the quantitative characteristics, thermogravimetric studies were carried out. Effects on thermograms at the temperature range of 350-450ºC indicate the amount of absorbed organic modifier; i.e. entered the interlayer space, and not remaining on the surface of the packages. So, an important characteristic is the value of loss on ignition within the above-mentioned temperatures. Orgonoclays dried at a temperature of 95ºC were taken for analysis, which contain minimal amounts of molecular water, and therefore the intensity of the first thermal effect should decrease as much as possible in relation to the intensity of the original clay. At the same time, the formation of a second thermal effect is observed at higher temperatures, the intensity of which characterizes the amount of chemically bound organic matter. The formation of the second thermal - exo effect at a temperature of about 400°C corresponds to the combustion of organic matter.



Picture. 3. Results of thermal analysis (simultaneous differential thermogravimetric analysis and scanning calorimetry): 1) Bentonite; 2) Chitosan - bentonite; 3) Vermiculite

4) Chitosan-vermiculite

This effect, as can be seen from Fig.3. absent in the natural sample of Na-NB. In the KhS-Na-NB sample during heat treatment, a decrease in the intensity of the first endoeffect, which characterizes the expenditure of heat to break molecularly bound water, is observed. Thus, the mass loss of natural bentonite at temperatures of 100-150ºC is about 4.4%, and that of its organic derivative XZ-Na-NB is 1.30%, respectively. A further noticeable decrease in the weight of KhZ-VV samples occurs at temperatures above 390ºC and amounts to 4.02% of the mass of the original orgonophilic clay.

Findings: Thus, on the basis of local raw materials, highly effective organosorbents based on vermiculite, bentonite modified with chitosan synthesized from dead bees ApisMellifera were obtained. Their high adsorption capacity for indigo and active dyes was revealed. In order to determine the quantitative characteristics, thermogravimetric studies were carried out. The location of the endo- and exo-effects, as well as the change in mass during heat treatment, prove a decrease in the intensity of the first endo-effect, which characterizes the expenditure of heat to break molecularly-bound water.

The change in the adsorption capacity shows that the adsorption of the active anionic dye on Ch3-Na-NB and Khz depends not only on the number of cation-exchange centers, but also on the size of its available surface.

LITERATURE

1. Hu Q.H., Qiao S.Z., Haghseresht F., Wilson M.A. and LuG.Q., Adsorption study for removal of basic red dye using bentonite, Ind. Eng. Chem. Res.45. 2006, pp.54-59.105.
2. ХальченкоИ.Г., ШапкинН.П.,Свистунова И.В., Токарь Э.А., Химическая модификация вермикулита и исследованиеего физико-химических свойств“Международном научном форуме Бутлеровское наследие – 2015”. http://foundation.butlerov.com/bh-2015/
3. Dutta P.K. Ravikumar M.N. Chitin and chitosan for versatile application JMS. Polym.RevC42. 2002y.P.307.
4. Сизых М.Р. Исследование иразработка технологии локальной очистки сточных вод с применением модифицированных минеральных сорбентов: На примере красильно-отделочных производств. Дисс….канд.тех.наук. Санкт-Петербург. 2011 г. 164 с.
5. Ихтиярова Г.А. Очистка текстильных сточных вод от активных красителей модифицированной бентонитовой глиной. //Журнал проблемы текстиля. –Ташкент. 2009. -№2. -С.40-45.
6. Ikhtiyarova G.A. Adsorption behaviour of reactive dye onto modified bentonite from aqueous solutions // International conference 6th Aegean analytical chemistry days. Turkey. 2008. p.323.
7. IkhtiyarovaG.A.,Ozcan A.A., Ozcan A.S. Characterization of natural- and organobentonite by XRD, SEM, FT-IR and thermal analysis techniques and its adsorption behaviour in aqueous solutions // Journal Clay Minerals, V.47, 2012y. pp.31-44.
8. Ikhtiyarova G.A., Umarov B.N., Turabdjanov S.M., Mengliyev A.S., et all. Physicochemical properties of chitin and chitosan from died honey bees *ApisMellifera* of Uzbekistan. Journal of Critical Reviews. Vol 7., Issue 4, -2020. pp.120-124.
9. Ikhtiyarova G.A., Hazratova D.A., Umarov B.N., Seytnazarova O.M. Extraction of chitozan from died honey bee Apismellifera // International scientific and technical journal Chemical technology control and management. -Vol. 2020:Iss.2, -№3.-pp.15-20.
10. Hu, Q., Xu, Z., Qiao, S., Haghseresht, F., Wilson, M., and Lu, G.Q., (2007), A novel color removal adsorbent from hetero coagulation of cationic and anionic clays. Journal of colloid and interface science, 308, pp 191-199.
11. Ихтиярова Г.А., Умаров Б.Н, Исомитдинова Д.С. Туробджанов С.М.Очистка сточных вод текстильного предприятия композиций на основе вермикулита и модифицированного хитозана. Журнал Композиционные материалы. -№4. -2021г., -С.116-118
12. Ikhtiyarova G.A., Umarov B.N., Turabdjanov S.M. Очистка текстильных сточных вод вермикулитом модифицированного с хитозаном. // International Journal of innovative research. -V 9. Issue 9., -2021. pp.9780-9786.