# Removal of a local antiseptic dye on two solid supports by adsorption

# Remoção de um corante antisséptico local em dois suportes sólidos por adsorção

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## ABSTRACT

In this research, we studied the adsorption of an Eosin B (EB) dye is a local antiseptic, available in pharmacies in the form of an active preparation on the surface of activated carbon and natural clay. Activated carbon and natural clay were characterized using various physicochemical techniques to determine the crystalline structures of the two adsorbents by DRX, and the chemical bonds by FTIR analysis, and finally, to know the maximum absorbance λmax of the dye by UV-Visible analysis. The effects of various experimental parameters, such as the effect of adsorbent mass**,** the initial concentration of eosin B is $1.610^{-4}$ $molL^{-1}$, the contact time is 24 hours, and the pH 7 ~ 9, were studied. The removal of the dye increases with the decrease of the initial concentration of Eosin B (EB) and the contact time of the solution. The percentage of Eosin B (EB) removal increases accordingly, which arrives at 80% for activated carbon and 92% for natural clay. Langmuir and Freundlich adsorption models were used for the adsorption equilibrium descriptions. The data was very well corrected with these models. Monolayer adsorption capacities were equal to 50 $mgg^{-1}$ at pH 8.3 and 25°C. Adsorption measurements show that the adsorption process is very fast and physical in nature.

**Keywords:** Eosin B, Activated carbon, Clay natural, DRX, FTIR, Adsorption isotherm

## RESUMO

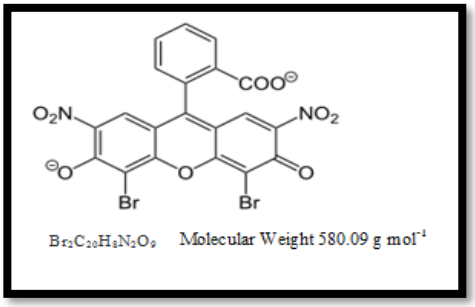
Nesta pesquisa, estudamos a adsorção de um corante Eosina B (EB) que é um antisséptico local, disponível em farmácias na forma de uma preparação ativa na superfície de carvão ativado e argila natural. Carvão ativado e argila natural foram caracterizados utilizando várias técnicas físico-químicas para determinar as estruturas cristalinas dos dois adsorventes por DRX, e as ligações químicas por análise FTIR, e finalmente, conhecer a máxima absorbância λmax do corante por UV-Análise visível. Os efeitos de vários parâmetros experimentais, como o efeito da massa adsorvente, a concentração inicial de eosina B é de $1,610^{-4}$ $MolL^{-1}$, o tempo de contato é de 24 horas e o pH 7 ~ 9, foram estudados. A remoção do corante aumenta com a diminuição da concentração inicial de Eosina B (EB) e o tempo de contato da solução. A porcentagem de remoção de Eosina B (EB) aumenta de acordo, o que chega a 80% para carvão ativado e 92% para argila natural. Os modelos de adsorção de Langmuir e Freundlich foram utilizados para as descrições de equilíbrio de adsorção. Os dados foram muito bem corrigidos com esses modelos. As capacidades de adsorção de monocamada foram iguais a 50 $mgg^{-1}$ em pH 8,3 e 25 °C. As medidas de adsorção mostram que o processo de adsorção é muito rápido e de natureza física.

**Palavras-chave:** Eosina B, carvão ativado, argila natural, DRX, FTIR, isoterma de adsorção

## 1 INTRODUCTION

Water is a fundamental element in the maintenance of life, and essential to existence resource is used in many sectors, including industry, but once used, water is often released into the natural environment, causing aquatic pollution. Pollution is a serious problem affecting virtually all ecosystems, including the aquatic environment. Among the main water pollutants ar organic pollutant (Pharmaceutical, agricultural and domestic)(KARIC ,20221).Pharmaceutical and textile industries generate liquid waste charged with organic matter that is difficult to biodegrade and sometimes toxic (ISLAM,2023). Over the past two decades, several research projects have been attributed to the identification of the main pollutants likely to increase the fragility of water resources, namely; pharmaceuticals and dyes. Nowadays, drugs play a dominant role in increasing the quality and life expectancy of populations (ABEDPOUR,2023).Every year, thousands of tons of pharmaceuticals are used in human and veterinary medicine to treat symptoms, diseases, bacterial infections and stimulate the growth of agricultural and aquaculture farms. Antibiotics and antiseptics are an important part of pharmaceutical consumption in this large family of medicines. The treatment of pharmaceutical effluents will protect the environment, reuse purified water for irrigation and recover the resulting sludge for agriculture (SAMAL,2022).Dey (EB), imperial red, is a dibromo dinitro derivative. Hygroscopic red crystalline powder. Slightly soluble in water, slightly soluble in an aqueous solution of sodium eosin, it should be red. It has disinfectant and drying properties of the mucous membranes. Specifically, Eosin B is a typical acid dye with the chemical formula $C_{20}H_8Br_2N_2O_9$ and is a commonly used dye in industry (HUANG,2019). Eosin B is an acid, which has a selective affinity for the cellular cytoplasm (plant or animal), it binds preferentially to basic molecules and can replace the carmine dye for zoological preparations. Eosin Dye is a local antiseptic, available in pharmacies in the form of an active preparation. It is generally used to dry up light skin wounds on previously cleansed skin. The antiseptic is a pharmaceutical preparation. This product temporarily eliminates or kills microorganisms and/or inactivates certain viruses on living tissue (HA WANG, 2023).These are persistent and toxic, for which several treatment methods have been developed to eliminate them. The colorant can cause serious health problems in different organs like liver, kidneys, lungs. In addition, this dye causes gastrointestinal DNA damage and its metabolites are also highly toxic and carcinogenic (MITTAL,2013). This mixture is therefore not completely removed by conventional wastewater treatment systems, such as sludge processes, due to their high resistance to biodegradation (HUANGA,2011).

Figure 1. Chemical structure of Eosin B




The pigment EB and its derivatives are very dangerous pollutants, and once dissolved in water they will often be difficult to treat (NAJAFZAADEH,2022). There are several physical, chemical and biological methods to treat and eliminate polluted effluents such as coagulation and flocculation, biodegradation, membrane filtration, chemical oxidation, ozonation, ion exchange, electrochemistry and adsorption. The most favorable method is adsorption, it has become an analytical method of choice, very effective and easy to use (HADI,2023) .Adsorption is commonly used in industry to treat water containing drying properties. Activated carbon and natural clay are the best adsorbents, especially recommended for treating dilute solutions, because the rate of adsorption is imposed by the diffusion of the molecule towards the absorbent surface. An important parameter in adsorption is chemical structure of the molecule is the place of the functional groups Since basic color indicators have a great ability to dissolve in water, adsorption is considered one of the most common and effective methods for dealing with the resulting polluted pollutants (.FARIAS,2022). Among the most considerable properties, there is the maximum adsorption capacity ($q_e$), which can be found by adsorption kinetic. The adsorption kinetics can be exploited to evaluate the solute the absorption rate, which verifies the equilibrium time, as well as to unveil the time required for the adsorbent and adsorbent interaction to preserve. Kinetic parameters are important because they are used as a means of estimating the size and transfer rate of industrial equipment adsorption systems (ALI, 2019).However, this chemical cannot be easily removed by conventional water treatment technologies. This note we will study the adsorption of Eosin B dye on the surface of two different materials, activated carbon and clay, where we will observe how the adsorption process is affected by changing the dye concentration, the mass of the adsorbents, the temperature, and the pH and contact time.

## 2 MATERIALS AND METHODS

Eosin Dye is an orange-pink colored dye obtained during the distillation of coal during the manufacture of coke (tar). It is used as a dye in the laboratory, to dye the cytoplasm of cells, collagen, muscle fibers, lymphocytes and bacteria. It can also be used to color raw wood a burgundy red

before applying varnish. The adsorbate used was Eosin B dye in solution with an initial concentration of $1.610^{-4}$ $molL^{-1}$ and molar mass of 580.09 $gmol^{-1}$.In this work, the experimental methodology for the study of the adsorption of carmine dye on activated carbon and clay will be explained, because activated carbon its large active surface area gives it a very high adsorbent power. Nevertheless, from an economic point of view it is an expensive adsorbent, the high adsorption capacities of clays result from a net negative charge on the structure of the minerals, their porosity and their high cation exchange capacity. The market price of clays is 20 times cheaper than that of activated carbon. Where we will present the tools, devices and materials necessary to conduct this study, in addition to explaining how to collect and analyze samples, the effect of changes in concentration, temperature and pH will also is studied. And its effect on adsorption capacity, and all the results obtained, will be shown.

Preparation of adsorbate solutions

Eosin B (EB) is an orange-pink colored dye found as fluorescent acidic compounds that bind and form salts with basic or compounds, such as proteins containing amino acid residues. Eosin is an acid, which has a selective affinity for the cell cytoplasm (plant or animal), it binds preferentially to basic molecules and can replace the carmine dye for zoological preparations. It is often used with hematoxyl in, which stains cell nuclei well. Eosin is therefore widely used as a stain for laboratory microscopy, to stain the cytoplasm of cells, collagen, muscle fibers, lymphocytes and bacteria. Eosin dye, also known as eosin B, eosin red, is a red crystalline powder, with a molecular weight of 580.09$gmol^{-1}$. It was purchased from Merck (Germany) and used without any purification. A stock solution (1liter) of eosin was prepared by dissolving a known amount of dye in distilled water. Other solutions of lower concentrations were prepared by diluting the stock solution with distilled water. These solutions were used in adsorption experiments.

Preparation of adsorbents

Two types of adsorbents were used. The first is the activated carbon produced from carbonaceous source materials. The second is natural clay produced from the Maghnia mine in Algeria. The resulting phase analysis was performed by recording the X-ray diffracts of grams of powder using a Xpert Pro (Panalytical) diffract meter using the CuKα radiation of copper (λ=1.5418Å) shown in Figure 3 and infrared spectroscopy in Figure 4. The natural clay, dried at 100 °C/24h, was analyzed by infrared Fourier transform spectroscopy on a SHIMADZU FTIR-8000 spectrometer. The two solids were prepared as a solid mixture (KBr mixture) and analysed by absorption

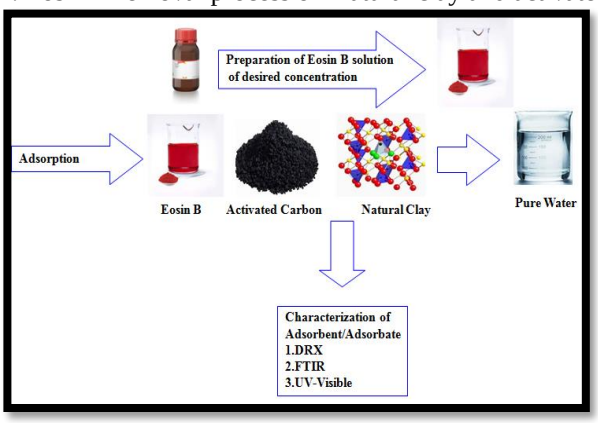
Adsorption process

The adsorption isotherms were constructed by placing a series of beakers in a thermostatically controlled bath with continuous stirring at 2500 rpm. Each vial contained an amount of adsorbent (m) and a volume (V) of eosin solution of an identified concentration. The concentration of eosin inside the supernatant solution had underwent an analysis by means of a UV (Shimadzu UV Mini-1240) spectrophotometer at a wavelength of an utmost absorbance of 555 nm. The amount adsorbed is calculated using the following formula: The amount of carmine adsorbed on clay and activated carbon, $Q_e$ ($mgL^{-1}$), was evaluated using the following equation 1.

$$Qe = (C0 - Ce) * V/M \quad (1)$$

Where $C_0$ and $C_e$ ($mgL^{-1}$) referred to the initial and the equilibrium concentration of carmine respectively; V (L) is the volume of the carmine solution and M (g) is the mass of the Clay and activated. Figure 2 shows the adsorption of EB, a virgin material, is required in which different functional groups are available for the adsorption of dyes. Other factors, such as porosity, temperature, pH, etc., are also responsible for the effective adsorption of dyes**.**

Figure 2. Eosin B removal process on Natural clay and activated carbon




## 3 RESULTS AND DISCUSSION

X-ray diffraction (XRD)

The spectrum presented in Figure 3 makes it possible to identify the structure. Figure.3shows the diffractogram of the natural clay and activated carbon according to the XRD diagram obtained, the clay has a mineralogical composition and interlayer distances practically identical to natural clay (ZHITOVA,2023).

Figure 3. Diffractogram of natural clay and activated carbon

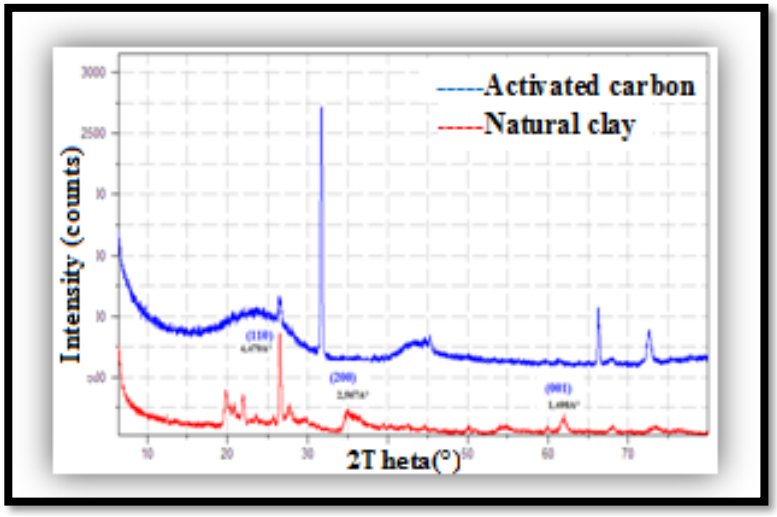



Table 1. Chemical composition of natural clay (KAYA.2005] and (LIU,2008).

| Elements | % |
|---|---|
| $SiO_2$ | 54.92 |
| $Al_2O_3$ | 16.92 |
| $Fe_2O_3$ | 1.95 |
| MnO | 0.02 |
| MgO | 4.29 |
| CaO | 0.71 |
| $Na_2O$ | 1.23 |
| $K_2O$ | 0.73 |
| $TiO_2$ | 0.05 |
| $P_2O_5$ | 0.13 |

From Figure .3 we can see: The natural clay is characterized by four peaks, the first is located at 15.037 Å (001) and the other three are at 4.479Å (110), 2.567 Å (200) and 1.498Å (001). This diffracts gram shows that the non-clay minerals present in varying amounts from one sample to another are mainly quartz with characteristic reflections at d001 = 3.35 Å and 4.28 Å, calcite (d001 = 3.21 Å), and feldspars (d001 = 4.06 Å) (ZHANG,2010). We also observe in the same Figure .3. The XRD pattern of standard activated carbon shows two peaks at ~ 24° and ~32° (weak) diffraction angles. The XRD diffractogram of the activated carbon the presence of a large peak (2Θ = 32°) indicating to amorphous structure (SENTHILKUMA,2011).

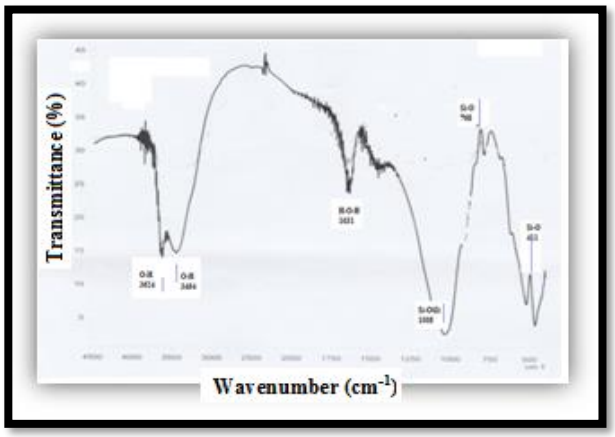
FTIR Analysis

Spectra for natural clay

The FTIR tests confirmed that the analyzed materials have a crystalline structure. The spectra obtained are illustrated by Figure.4. We note: The band that spans between1600 - 1700 $cm^{-1}$ may be attributed to the valence vibrations of the OH group of the constituent water, in addition to the binding vibrations of the adsorbed water located at 1631$cm^{-1}$.An absorption band centered on

3624 $cm^{-1}$ is due to the valence vibrations of the OH groups bound to the octahedral Al cations (Al-OH-Al)( El KASSIMI,20211).The Si-O bond is characterized by: The intense band located between 900-1200 $cm^{-1}$ and center around 1008.9 $cm^{-1}$ corresponds to the valence vibrations of the Si-O bond (ADEL,2021). The bands at 768 $cm^{-1}$ and 411-500 $cm^{-1}$ are assigned to Si–O–Al and Si–O–Mg, Si–O–Fe and bending vibrations, respectively. The bands between 800 and 1008 $cm^{-1}$, coming from the Si-O-Al bond. Another characteristic band for bending vibrations of adsorbed water usually appears at 1600 – 1631$cm^{-1}$ as a medium band.

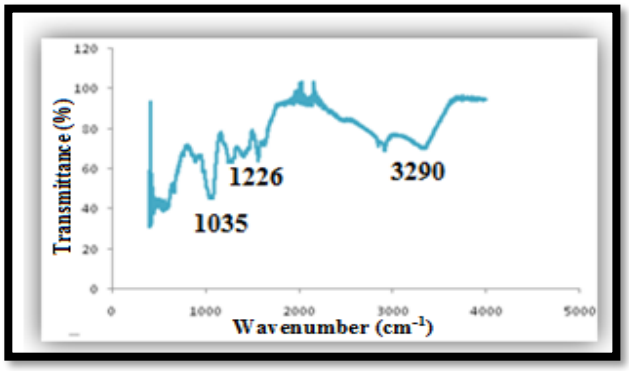
Figure 4. FTIR spectra for natural clay




Spectra for Eosin B

The FTIR spectrum of eosin b was recorded and compared in the range of 500 to 4000 $cm^{-1}$ in order to obtain information regarding the nature of the dye ion-adsorbent relationship. This interaction is shown in Figure 5. The peak obtained at 1035 $cm^{-1}$ due to strong or wide stretching of CO-O-CO (anhydride).The peak obtained at 1226 $cm^{-1}$ was attributed to the stretching frequency of the amine group (C-N). The peak obtained at 2850 $cm^{-1}$ was attributed to the stretching frequency of the amine salt(N-H).The resulting peak at 3290 $cm^{-1}$ was attributed to strong stretching of the amine hydroxyl (O-H) group( BUKHARI,2021).

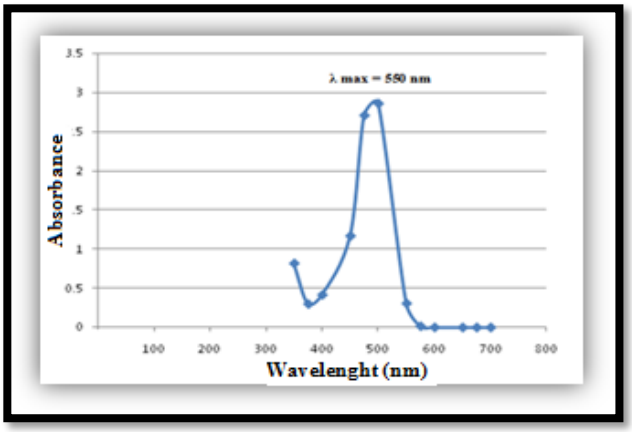
Figure 5. FTIR spectra for Eosin B



Ultraviolet-visible spectroscopy (Uv-visible)

Solutions with different concentrations (12-58 mg $L^{-1}$) were prepared from the standard stock solution. Using a spectrophotometer, the absorbance of the primary dye solution was measured, and the maximum wavelength was obtained, ʎmax = 550 nm (Figure 6). Then we measured the absorbance of the dilute standard solutions at the previous wavelength to obtain the calibration curve (LATIF, 2016).

Figure 6. Absorbance and calibration curves of eosin B

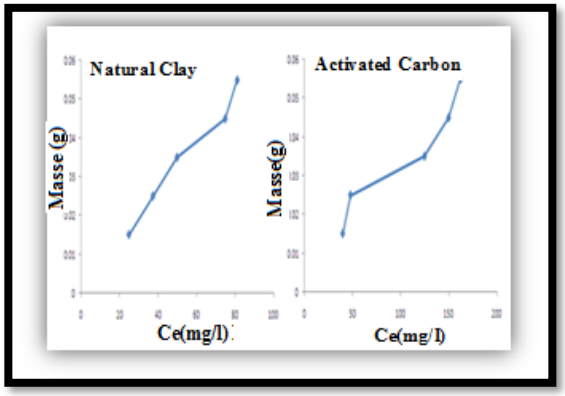



In this work, we are interested in the discoloration of eosin by two adsorbents in heterogeneous media. The first adsorbent is the raw clay, washed several times with distilled water and dried in the oven for 24 hours. The second adsorbent is activated charcoal, is a material consisting mainly of carbon material with porous structure. Elimination kinetics describe the reaction rates that determine the contact time taken to reach the adsorption equilibrium. This is an important step in any adsorption study. For this, we followed the adsorption kinetics of eosin, for an initial concentration of 100 $mgL^{-1}$, with raw clay masses and activated carbon.

Effect of adsorbent mass

The effect of natural clay mass and activated carbon was investigated by testing different values: 0.015g, 0.025g 0.035 g, 0.45g, 0.055 g. The experiments were conducted under the following conditions: 20 °C, 100 rpm and the different masses of the solid were put in contact with each time 50mL of the eosin solution at $1.6.10^{-4}$ mol $L^{-1}$. Figure 7 shows the variation of the concentration at equilibrium (Ce) according to the different masses. The following Figure 7 shows the results:

Figure 7. Initial concentration effect

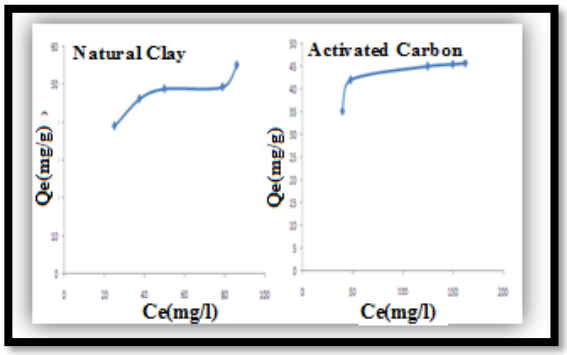



The results of the Figure 7 show that There is an important effect of the mass of the adsorbent on the adsorbed amount of dye, it appears through the result, that for the same concentration of 100 $mgL^{-1}$ of eosin during a contact time of 120 min, an increase in the mass of clay and activated carbon from 15 to 55 mg leads to an increase in adsorption of the adsorbed concentration expressed in mg of adsorbat.

Influence of initial concentration

The experiments were carried out at a constant temperature (20 ± 2 °C), in a series of 50ml bottles of solution of each dye of initial concentration equal to: 20, 25, 35$mgL^{-1}$ at acidic pH for activated carbon and basic pH for clay and with a variable mass .The adsorption rate, capacity, and heat decrease as the load (adsorbed fraction) of the adsorbent increases. When an adsorbent reaches saturation, it is usually regenerated, and to determine the adsorption isotherms. The resulting mixture was stirred using a magnetic agitator at a constant speed to ensure good contact of the mixtures and a great homogenization of the solutions for a time necessary to reach equilibrium. To determine the dye equilibrium concentrations for the different media, the samples are centrifuged for 10 minutes, and then the supernatants are immediately dosed by a UV-visible spectrophotometer at wavelengths of 550 nm.

Figure 8. Effect of initial concentration

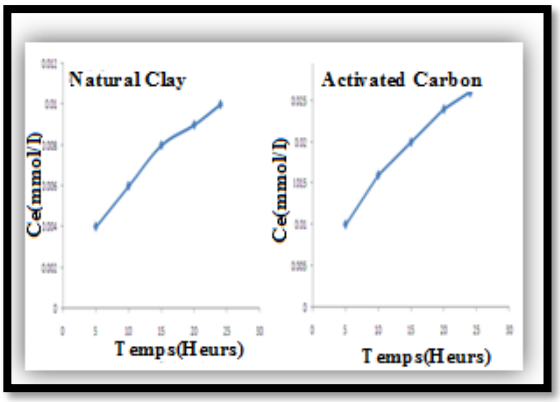


The Figure 8 shows that: The evolution of eosin holding capacity on different adsorbents used as a function of equilibrium concentration has the shape of saturation curves, but adsorption on these adsorbents manifests differently. For clay the kinetics corresponding to a very short phase, where the fixation of eosin is less rapid, which manifests for a second phase of saturation. For activated charcoal the fixation of the eosin is very fast and the saturation is total is the constant kinetic equilibrium.

Influence of contact time

To measure the effect of the contact time, we prepared the solutions in the same way as before, where we put a fixed mass of activated carbon and natural clay m = 100 mg with different concentrations of dye, pH value and constant temperature, and we took the results for different periods (5, 10,15,20,24 h), where the lowest concentration corresponds to the shortest period, and the same for clay. After placing the samples in a centrifuge, filtering them and measuring the absorbance, we obtained the results shown in Figure 9.

Figure 9. Effect of contact time

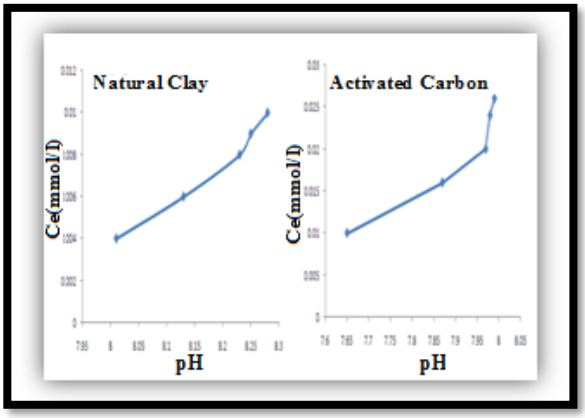



We concluded that under these pseudo-equilibrium conditions, the amount of dye adsorbed by the two adsorbents as a function of time increases each time the contact time between the adsorbent and the adsorbate increases. The diffusion of dye molecules in solution through the surface of the adsorbent is the origin of the increase in the concentration at equilibrium.

Influence of changing the pH

To do this, we put a fixed mass of activated carbon m = 0.025 g in 5mL of the dye solution at a constant concentration of 155 $mgL^{-1}$, at a constant time and temperature, and at different pH values (7, 8, 10) and in the same way for the clay. After placing the samples in a centrifuge, filtering them and measuring the absorbance, we obtained the results represented in the Figure 10.

Figure 10. The effect of changing the pH




Where for clay, we can observe an increase in the adsorption capacity with an increase in the pH value and that is in the range 7 and 9 and then tends to settle at a value close to $mgg^{-1}$ in the moderate and basic range, As for activated carbon, the adsorption capacity appears to be more stable with the change in pH (ROXANA, 2022). As the value of the adsorption capacity in the acidic, moderate and basic ranges is close to 30 $mgg^{-1}$, with a slight increase in it in the acidic range(GUEMACHE,2023). In addition, there is a discrepancy in the adsorption capacity between carbon activated and natural clay and that are in the acidic range where they are greater in carbon compared to clay (BADR, 2022). Since not all dyes are ionic acids, most adsorbents cannot reduce all dyes The reason for the weak adsorption capacity in the acidic field is due to the presence of hydrogen ions $H^+$ of a large amount that competes with the dye molecules for adsorption sites (SHAHINPOUR, 2022).In addition, clay is more affected by these ions due to the properties of clay that differ from activated carbon in terms of the nature of the charges on its surface (ADEYEMO, 2017). We note the absence of this effect with the absence of hydrogen ions in the moderate and basic range, where the adsorption capacity is large and more stable.

Decolorization Ratio (T %)

To determine the rate of decolonization of eosin dye on both supports (natural clay, activated carbon) we used the following Equation 2.The adsorption (the percentage) with the Ci and Ce was calculated in the following Equation 2.

$$\% \mathbf{T} = \left[\frac{(\mathbf{Ci}-\mathbf{Ce})}{\mathbf{C0}}\right] \text{x}100\% \qquad (2)$$

In order to identify the most efficient adsorbent material in removing color, is it activated carbon or clay (GABRIEL, 2021) .We will determine the percentage of color removal for both of them and then make a comparison, and in order to do this we will use the same data from the

experiment through which we determined the effect of the initial concentration and we get the following .

Figure 11. Figure .11. Decolorization

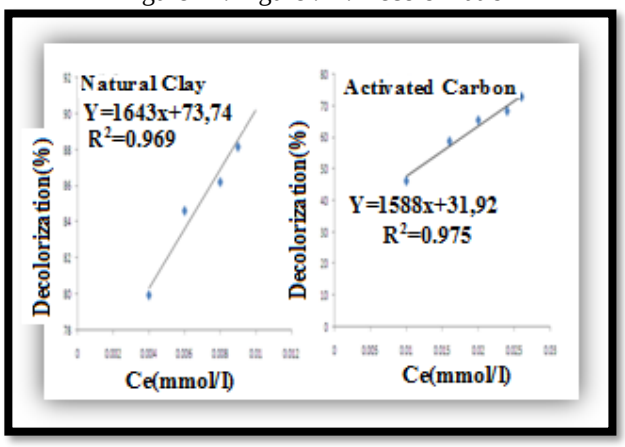



Figure 11 shows the removal yields of eosin on two adsorbents put in contact on a volume of 50 ml for a time interval (5, 10, 15, 20,24h). A high percentage of eosin B removal is observed on the natural clay support, a percentage of 92%, In part the elimination of eosin on activated charcoal is 80% but to envisage a high affinity of adsorption of the dye according to the coefficient of determination ($R^2$) from where: $R_{Activated\ carbon} > R_{Natural\ caly}$ .

Isotherm of adsorption

Adsorption isotherms are often used to determine the maximum binding capacities of organic pollutants and to identify the type of adsorption. The results, named according to the mathematical models of Langmuir and Freundlich, allowed us to calculate the maximum adsorption capacity as well as the adsorption parameters.

$$\text{Log Qe} = f(\log Ce) \quad (3)$$

$$\text{Qe} = f(1/Ce) \quad (4)$$

From the curves, we will get the values of the constants of the two adsorption isotherms that we will use:

- Freundlich equation :

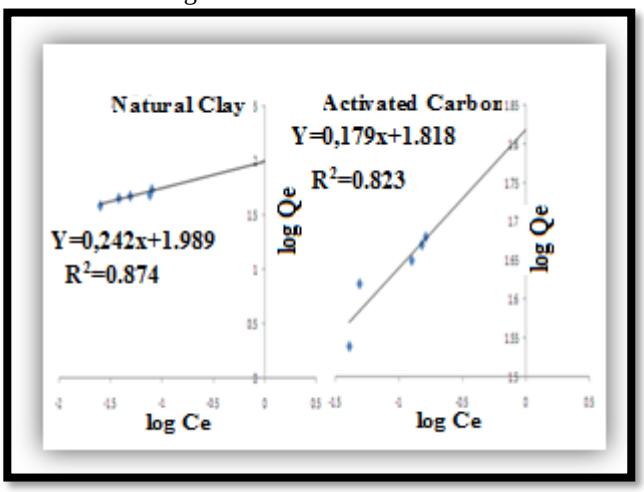
$$\text{Log Qe} = \log Kf + 1/n \log Ce \quad (5)$$

- Langmuir equation:

$$Qe = 1/Qm + 1/K * 1/Qm * 1/Ce \quad (6)$$

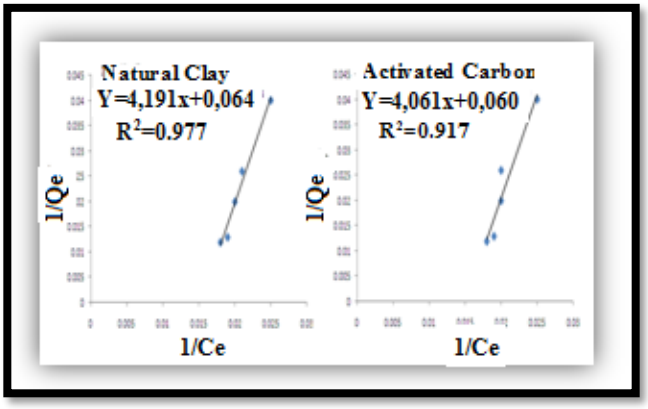
Ce: Equilibrium solute residual concentration ($mgL^{-1}$);$Q_m$: Maximum adsorption capacity ($mgg^{-1}$);$k_L$:Adsorption equilibrium constant for the solute/adsorbent($Lmg^{-1}$); $k_f$ and n: Constants characteristic of the efficiency of an adsorbent with respect to a given solute . Adsorption isotherms were studied by agitating a mass of two adsorbents in a colored solution, eosin b of different concentrations ranging from 25 to 100 mg/L. The adsorbent and adsorbent were put in contact for 5 hours under an agitation of 200 rpm. After analysis of the supernatant and determination of the concentrations at equilibrium, we followed, on the one hand, the evolution of log Qe as a function of log Ce according to the Freundlich model and on the other hand, the evolution of 1/Qe as a function of 1/Ce according to the Langmuir model. The results obtained are shown in Figure 11 and 12.Figure 12 shows The Freundlich model, predicting that dye concentration on the adsorbent will increase as long as there is an increase in dye concentration in the liquid phase. However, experimental evidence indicates that an isothermal plateau is reached at a limit value of the solid phase concentration. This plateau is not predicted by the Freundlich equation. Therefore, the equation itself has no real physical significance (MILLA.2021).

Figure 12. Freundlich isotherm




The Langmuir adsorption isotherm is used to describe the equilibrium between the adsorbent and the adsorbate system, where adsorption of the adsorbent is limited to a molecular layer at or before a relative unit pressure is reached. Although the isotherm initially proposed by Langmuir in 1918 (LANGMUIR,2018), is generally appropriate to describe the chemisorptions process when ionic or covalent chemical bonds are formed between adsorbent and adsorbate.

Figure 13. Langmuir isotherm




Through these curves, we were able to obtain the constants of the Langmuir and Freundlich isotherms, which are represented by the following values(BOUKHEMKHEM,2020).The linear representations of the experimental values of this adsorption process allowed us to determine the equilibrium parameters and the values of the Langmuir and Freundlich constants calculated by linear regression (Table2) (AHMED,2021).

Table 2. Isotherm parameters obtained from the fit of various equations

| Isotherm models | Activated Carbon | Natural Clay |
|---|---|---|
| **Langmuir** | | |
| Qe(mg/g) | 45 ± 0.05 | 50 ± 0.01 |
| $K_L$(L/mg) | 16.66 ±0.1 | 15.52 ± 0.05 |
| **$R^2$** | 0.91 | 0.97 |
| **Freundlich** | | |
| Qe(mg/g) | 45 ± 0.05 | 50 ± 0.01 |
| $K_f$(mg/g) | 0.05 | 0.20 |
| n | 12.50 ± 0.1 | 3.57 ± 0.1 |
| $R^2$ | 0.82 | 0.87 |

The values of the correlation coefficients reveal that the adsorption process of eosin dye by raw clay and activated charcoal, is described favourably by the Langmuir isotherm for natural clay with excellent linear regression coefficients of $0.97 < R^2 < 0.91$ and for the Freundlich isotherm $0.87 < R^2 < 0.82$. Don can say that from the results that these proven isotherms a presence of a horizontal plateau until saturation. This type of isotherm is characteristic of the micropore filling. It is essentially mono-molecular adsorption type II (SEKI, 2006).

## 4 CONCLUSIONS

In this research, a method of treatment of discoloration of a solution of eosin in a heterogeneous environment was experimented. Thevarious physico-physical analyses chemicals performed on eosin b as an antiseptic dye on two adsorbents namely raw clay and activated charcoal

studied as excellent materials used for the removal of organic pollutants from water have revealed the behavior of some descriptive parameters of adsorption quality. A comparison of the discoloration contents of eosin adsorbed by clay and activated charcoal shows a difference in the adsorption concentration between these two adsorbents. This difference is characterized by the inter-leaf space and crystalline structure of the clay and at the specific surface of the activated charcoal ($S = 2500\ m^2g^{-1}$). Physical factors, pH and time play a big role for the elimination of eosin B by the two adsorbents, which suggests that the raw clay removes the organic dye well in basic medium, in return activated charcoal removes eosin in an acidic medium. The plot of adsorption isotherms shows that the Langmuir and Freundlich model perfectly represent the adsorption of eosin. The results of isotherms adsorption tests on eosin b in the presence of clay and activated carbon obeying the adsorption equilibrium. This adsorption equilibrium is analyzed by applying the Langmuir and Freundlich models, which are commonly used by researchers for the study of adsorption isotherms of adsorption systems. The removal of the dye by the two adsorbents clearly shows the effectiveness of retention of eosin b supported in acid medium for activated carbon and basic medium carbon for clay, which means that raw clay and activated charcoal are excellent adsorbents. In addition, the natural abundance of these materials can offer new ecological supports that can participate in the decontamination of wastewater..

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