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STUDY OF THE ADSORPTION CAPACITY OF DYES REMOVAL USING ORANGE AND LEMON PEELS

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Introduction:

Hazardous waste management is an emerging problem in the world these days. Metals are discharged into nature in various forms due to industrial progress, especially in the fields of electroplating, glass production, paint, tanning and mining. These heavy metals are the cause of various diseases and are non-biodegradable in nature and have a tendency to bioaccumulate in living tissues (1). The dyes currently used in the finishing and textile industries pose a risk to human health and the levels of exposure faced by workers. In general, exposure to them for a long time can cause health risks. (2) Therefore, chemicals must be handled with care and the most common risk from reactive dyes is respiratory problems due to inhalation of dye particles. (3) The textile industries produce large amounts of liquid waste and these textile wastes contain compounds Organic and inorganic. 4) One of the excellent materials for dyes is activated carbon, which is a synthetic material made of carbon fibers from some wooden objects or waste carbon fibers, which are treated either thermally or chemically. Activation methods determine the resulting specific surface and the chemical and physical properties of the membranes, as well as the number and dimensions of the pores. 5) The reactivation process is either by using heat or by alkaline or acidic solutions or by using different solvents. The use of activated carbon includes many uses, including its use in the adsorption of metals and vapors, as well as in the removal of colors and purification of liquids and its use in medical fields. The waste disposal process is carried out in various and inexpensive ways, including: - The adsorption process, as adsorption is a separation process in which the fluid phase is in contact with the solid porous particles phase with the selective property of taking or storing one or more of the components present in the fluid phase. Where the fluid dissolves in the solid material but sticks to the surface, and a balance occurs between the adsorbed fluid and what remains in the depth of the fluid phase. Adsorption is considered a basic property of matter possessing attractive forces between molecules, as the force field near the surface of the solid material creates low potential energy and as a result, the density of molecules near the surface is generally greater. From the gas mass.It has many important applications. Adsorption depends on selectivity (i.e. the difference in the surface response to different components. 6) The substance that suffers adsorption on the surface of the solid is called (the adsorbate) and the substance that performs the adsorption is called (the excellent surface). The adsorption process has several types, which are: 1- Physical adsorption or physisorption, which occurs when the intermolecular forces or van der Waals forces of attraction between the fluid

molecules and the surface of the solid are greater than the attractive forces between the fluid molecules themselves. Where the fluid molecules stick to the surface of the excellent solid and a balance occurs between the excellent fluid and which remains in the fluid phase. Note that any change in electrons or rather molecular attraction occurs between the preferred energy site and therefore does not depend on the electronic properties of the molecules involved. Physical adsorption is characterized by equal or similar overlapping energies. Condensation. The adsorbent material is held on the surface by relatively weak van der Waals forces and several layers of molecules can be formed at approximately the same adsorption temperature. The adsorption temperature of the physical adsorption is low per mole (mole/Kcal) and therefore this type of adsorption is stable only at temperatures below 150 °C, and physical adsorption allows its use in a continuous process. 2:- Chemical adsorption Chemical adsorption or chemisorptions It includes the chemical interaction between the adsorbent fluid and the adsorbent solid. In most cases, adsorption is irreversible and it is difficult to separate the adsorbent from the excellent fluid. It includes the transfer of electrons between specific surface sites or designated solute molecules and as a result the chemical image is formed. Adsorption is characterized by Chemical interaction cards between the surface and the adsorbent are similar or equal to the strength of chemical bonds and tens of kilocalories per mole) mole/Kcal and accordingly it is much stronger and more stable at high temperatures than physical adsorption and generally only a single layer of molecules is formed Activated charcoal: - Activated charcoal is called in English (carbon Activated) or (Activated charcoal) and activated charcoal can be defined as a substance consisting of carbon with a black color that has the characteristics of Muslims and is solid and tasteless. Activated charcoal is the name of a large family of carbon materials that do not have a specific chemical composition and each type of activated charcoal can be identified through its adsorption properties (adsorptive) or through its surface and porous properties and can be manufactured from several materials and in different ways. The history of activated charcoal dates back to the ancient Egyptians since the year (1550 BC) as it was used in

Water purification during surgical operations, as it was first used in 1990 as an alternative to animal charcoal in sugar refining operations, and it was also used in World War I by placing it in protective masks to protect against toxic gases, and its uses have increased until the present time. I am the growing interest in the adsorption process came as a result of its high efficiency in adsorbing toxins, dyes, and high pollutants, its low cost, as there are many types of materials used as an excellent material, as Al-Samarrai studied the ability of kaolin clay to adsorb the drug Paracetamol on its surface and found that it has high adsorption efficiency at low concentrations The adsorption thermodynamic functions were calculated and alwan studied the ability of palm fronds as a new feature of mefenamic acid, as it was found that palm fronds have the ability to adsorb mefenamic acid at low concentrations (9)

Chemical activation (from the point of view of kinetic studies) refers to the minimum possible amount of energy required to initiate a chemical reaction. According to the collision theory of chemical kinetics, all moving molecules are said to have a certain amount of kinetic energy. This means that the faster they move, the greater their kinetic energy. In this sense, a molecule that carries a fast movement cannot be divided into parts on its own, so a collision must occur between it and another molecule for a chemical reaction to occur (10). In this process, the carbon material is saturated with one or more types of chemical activation agents such as (zinc chloride, alkali carbonates, sulfur, sulfuric acid, phosphoric acid, alkali metal hydroxides, etc.) After that, the carbon material is treated with a thermal treatment, as this process leads to the removal of water and also leads to some changes in physical activation. This activation process is carried out by exposing the carbon material to temperatures ranging between (1000-600) in the presence of active gases Suitable as steam 2CO2 air This process leads to the opening of the carbon pores as a result of

Expelling the materials attached to its surface and excellent on its pores (11) ... This study included Preparation and diagnosis of a new absorbent material from natural plant sources, which is(pomegranate

peels),It was diagnosed by different techniques such as infrared spectroscopy ((-FTIR, X-ray diffraction ((XRD), atomic force microscope (AFM) (, and the prepared microscope that contains any active group, i.e. it is chemically inert 12) The results of each of ((XRD and(AFM) and (SEM) showed the crystal level of the prepared charcoal and the size of the particles and the shape of the pores (pores) on the surface of the prepared activated charcoal, in addition to Studying the adsorption capacity of the prepared charcoal for dyes with high molecular weights such as methylene blue dye and also calculating the moisture percentage, which reached (2.0%) and a high density 3, which is (495.0 g/cm) It was also found that the acidity function of activated carbon was neutral (1.7) with an ash content of 0.0112 g((, as the results showed that the prepared activated carbon has specifications that match the specifications of commercial or international activated carbon.

Tools needed for work:

1-Chemical balance.

2-Electric centrifuge

3-Pipette

4-Standard flask

5-Burette

6-Conical flask

7-Glass beaker (Becker)

8-Graduated cylinder or graduated scale

9-Test tube

10-Condenser

11-Watch bottle

12-Filter paper

13-Drying tubes

14-Bunsen lamp

15-Desiccant

16-Mortar

Devices used in the research: -

1. Xp 3000 syringe
2. Hp HEWLETT PACKARD SERiEs 1050
3. Spectroflow 400 solvent delivery system
4. Rheodyne valve 7010
5. G-chrome 15 version software

How to work:

1- We take the orange and lemon peels, wash them well with water, then put them in filtered water for 24 hours.

2- Then add filtered water after taking them out of the water, then put them in a strainer, then put them in an oven about 200-180 and leave them for 5 hours.

3- We take them out of the oven and let them cool, and use a mortar and start the process of crushing the dried peels using a grinder to obtain a fine powder.

4- We sift the result using special sieves to obtain special minutes within the required level.

5- We activate using activating materials (koH4-PO3H3-HNO) at concentrations of (-2M4) so that the powder is completely covered. Glassware is used for this purpose.

6- Now we put the powder with the solution over a heater or a heater to heat the solution close to the boiling point for an hour.

7- We leave the solution to cool Then we filter the product formed after activation using large filter paper

8- We wash the remaining material on the filter paper several times using filtered water to remove traces or residues of the activated materials 9- We put the product in a glass container and then put it in an oven for heating purposes and the time is an hour

9- We grind the product again using the mill and then sift again to obtain the powder for the natural activated material

After conducting the calibration curve for the formula under study to obtain the linearity of the calibration curve, we begin to experiment with some factors that affect the adsorption and removal process. These factors include:

The effect of the weight of the adsorbed water

We take several weights of the adsorbed and chemically activated material from each of the prepared and activated material and the activated carbon and chemically activated from each of the prepared and activated material and the activated carbon

We put these weights in 100 mm beakers or concave flasks and then add a concentration of The dye starts for an hour, then we filter it. We take the filtrate and measure its absorbance. Then we extract the concentration through the calibration curve, then we find the removal rate through the Lange-Meyer equation.

Results: -

1:- Determination of the maximum wavelength of the dye

Fuchsin dye

The basic Fuchsin dye has the chemical formula HCL3.N19H20C, it is a purple dye

Benzenamine,4-[(4-aminophenyl)(4-amino-2,5-cyclohexadien-1-)methyl-. metal2-

The dye becomes purple when dissolved in water, as a solid it forms dark green crystals, exposure, also repeated exposure to the dye may affect the nervous system with headache, dizziness, lethargy, and muscle contraction

Its molecular formula is 337.86 mol/g, the dye acidity function FU follows the following order:

- 3<10<7:- pH

The maximum wavelength of the dye is 490

2- Dye Green Methyl

Methyl green dye is a distinctive basic dye among the basic dyes with a positive charge

Its molar mass is 458.5 mol/g, covalent by having two positive charges, its general formula is 2Cl3N33H26C

The regularity of this dye is: - 4, 4-(dimethyl –l amino) phenyl-4-(di methyl iminio)- 2,5-cyclohexa-dien-1ylidene methyl-N, N,N-tri methyl benzene aminium ion.

It is an aromatic dye consisting of more than one united ring used in Methyl Green dye chemically staining and is generally not suitable for use in medical fields Maximum wavelength of the dye 498

3:- Preparation of standard solutions Calibration curve

Factors affecting the adsorption process:-

1: Effect of temperature

Temperature affects both the material and the adsorption rate that causes adsorption, as the adsorption rate increases with increasing temperature and decreases with decreasing temperature. However, adsorption processes are exothermic, and the extent of adsorption at low temperatures will increase and decrease with increasing temperature.

2: Effect of ionic strength

The adsorption process is affected by ionic strength. Adsorption may decrease or increase with increasing ionic strength of the electrolyte

Soluble in the solvent of the molecules of the adsorbed substance, added to the solution, because the electrolytes are more 27(and thus this will lead to increased adsorption. Strong electrolytes may also affect The adsorption process is through its competition with the adsorbent material, adsorption on the adsorbent surface.

3: Effect of the pH

Changing the acidity of the solution plays a role in the adsorption process, and this occurs mainly due to the effect of the pH on the adsorbent material, the adsorbent surface, and the solvent. This effect appears through the competition of the adsorbent, the adsorbent surfaces and the solvent on the ions (-OH)and (+H)on the adsorption isotherms and in the quantity or time of the adsorbent on the adsorption process and also affects the adsorbent surface from one compound to another.

4: The nature of the adsorbate

The adsorption process is affected by the nature of the adsorbent in terms of physical properties, as adsorption increases with the increase in the molecular mass of the adsorbent, as the adsorption process is affected by the chemical properties of the adsorbent in terms of the presence of active and polar groups in the composition of the adsorbent or their absence, as well as its solubility in different solvents, as the less the solubility of the adsorbent in the solution, the greater the adsorption capacity. All of these factors have an effective role in determining the interaction with the surface of the adsorbent and the efficiency of adsorption, and this the difference in the characteristics leads instead of the other, i.e. selective adsorption (to the occurrence of the adsorption of the two components especially in systems with multiple components Effect of equilibrium time is the time during which equilibrium occurs between the adsorbent and the adsorbent. In other words, it is the period or even the time after which there is no decrease in the concentration of the solution, and this time may be hours, days or weeks

5: Surface area of the adsorbent surface

Adsorption increases with the increase in the surface area of the adsorbent surface, and this leads to an increase in the adsorption capacity due to increasing the number of active sites on the adsorbent surface, therefore it is considered one of the important factors in adsorption

6: Concentration of the adsorbate of Concentration

With increasing concentration, the number of adsorbent increases, and this leads to an increase in the adsorption capacity due to the increase in the rate of diffusion and mass transfer on the surface

Conclusion: -

1. These materials used in this method are considered economical, natural, environmentally friendly materials
2. Using the effectiveness of orange and lemon peels in producing vitamin C
3. Orange and lemon peels contribute to delaying the appearance of signs of aging and advanced aging
4. Orange and lemon peels contribute to treating the appearance of acne
5. Protecting the heart from hardening of the arteries
6. These peels protect the digestive and respiratory systems from infections that cause cancerous diseases
7. Activated charcoal can be prepared from orange and lemon peels by drying the peels, grinding them, crushing them, and obtaining a powder
8. Testing the effectiveness of orange and lemon peels inside the body to treat colon bloating

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