

## Use of Multi Media Chemical Compounds for Removing Murexide from Wastewater

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**Abstract:** Study depending on using of multi media of chemical compounds consists of activated carbon, sand and hydrogen peroxide in order to treatment wastewater which contained of many dyes. Raw effluents passed through multi media of chemical compounds to study its efficiency in removal of pollutant from wastewater. The highest and lowest value of organic load value of the waste have been chosen for treatment from 30min. to 6 hrs. Comparison was carried out between activated carbon, sand and used H<sub>2</sub>O<sub>2</sub> in order to find the most effective of removal. The results showed that a mixture of activated carbon and sand is more effective than sand alone. Also, chemical method using H<sub>2</sub>O<sub>2</sub> is more effective than sand.

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### 1. Introduction

Quartz sand, which is called silica sand, is widely used in the construction of glass ceramic and foundry industry is a common non-metallic mineral materials. It also plays an important role in many new and high technological industries, such as semiconductor technology, SiO<sub>2</sub> thin-film material, atomic energy, optical fiber communication cable material and national defense science technology and others [(Niu *et al.*, 2001.; Tala, 2003.; Weige, 2001; Wu *et al.*, 2010,)]. Activated carbon (AC) filter removes some harmful organic chemicals present in quantities above the Health Advisory Level (HAL). Included in these categories are pesticides, industrial solvents (halogenated hydrocarbons such as polychlorinated biphenyls PCB's) and polycyclic aromatic hydrocarbons (PAH's). THM's (Marawski, Kalenezuk (2000). Adsorption of trihalomethanes (THMs) on to carbon spheres. Desalination; 130: 107-112). are a byproduct of the chlorination process that most public drinking water systems use for disinfection. Chloroform is the primary THM of concern. The EPA(examine in halation and dermal studies in developing the drinking water health goal for chlora amine) does not allow public systems to have more than 100 parts per billion (ppb) of THMs in their treated water. Some municipal systems have difficulty in meeting this standard activated carbon (AC) works by attracting and holding certain chemicals when water passes through it [USEPA, "Stage 1 Disinfectants and Disinfection by – products rule", office of water (EPA). Viessman, (W. Hammer, M. Water supply and pollution control. Harper collies College Publishers. 15th edition. 1993: 485-488)]. Because of AC is a highly porous material having an extremely high surface area for

contaminated adsorption. The carbon source is a variety of materials, such as peanut shells or coal. The raw carbon source is slowly heated in the absence of air to produce a high carbon material. The carbon is activated by passing oxidizing gases through the material at extremely high temperatures. The activation process produces the pores that result in such high adsorptive properties. The adsorption process depends on many factors: Firstly, physical properties of the AC, such as pore size distribution and surface area; secondly, the chemical nature of the carbon source, or the amount of oxygen and hydrogen associated to it; thirdly, chemical composition and concentration of the contaminant; Fourth, temperature and pH of water; and fifth, the flow rate or time exposure of water to AC[ (King *et al.* 2000).

### Physical properties

Forces of physical attraction or adsorption of contaminants to the pore walls is the most important AC filtration process. The amount and distribution of pores play key roles in determining how well contaminants are filtered. The best filtration occurs when pores are barely large enough to admit the contaminant molecule. Because contaminants come in many different sizes, they are attracted differently depending on pore size of the filter. In general, AC filters are most effective in removing contaminants that have relatively large molecules most organic chemicals[ (Aziz *et al.* 2010). The type of raw carbon material and its method of activation will affect the types of contaminants that are adsorbed. This is largely due to the influence that raw material and activation have on pore size and distribution.

### Chemical properties

Processes other than physical attraction also affect AC filtration. The filter surface may actually interact chemically with organic molecules. Also, electrical forces between the AC surface and some contaminants may result in adsorption or ion exchange. Adsorption, then, is also affected by the chemical nature of the adsorbing surface. The chemical properties of the adsorbing surface are determined to a large extent by the activation process. AC materials of different activation processes will have chemical properties that make them more or less attractive to various contaminants. For example, chloroform is better adsorbed by AC (Wietlik *et al.* (2002). having a least amount of oxygen associated with the pore surfaces. The consumer can't possibly determine the chemical nature of an AC filter. Different types of AC filters have varying levels of effectiveness in treating different chemicals. The manufacturer should be consulted to determine if their filter will adequately treat the consumer's specific water problem.

### Contaminant properties

Large organic molecules are the most effectively adsorbed by AC. A general rule of thumb is, similar materials tend to associate. Organic molecules and activated carbon are similar materials; therefore there is a stronger tendency for most of organic chemicals to associate with the activated carbon in the filter rather than staying dissolved in a dissimilar material like water. Generally, the least soluble organic molecules are most strongly adsorbed. Often the smaller organic molecules are held tightly because they fit into the smaller pores. The concentration of organic contaminants can affect the adsorption process. One AC filter may be more effective than another type at low contaminant concentrations, but may be less effective than the other filter at high concentrations. This type of behavior has been observed with chloroform removal (Wietlik *et al.*, 2002). The filter manufacturer should be consulted to determine how the filter will perform for specific chemicals at different levels of contamination.

According to the former researches [Dye wastewater with deep chromaticity and high chemical oxygen demand (COD), is one of industrial wastewater (Wietlik *et al.*, 2002) which is difficult to deal. Thus, the elementary task is decoloration. However, owing to the second pollution caused by the physicochemical and the biochemical methods, we should not abuse it. Actually the multistage series-connection dealing method of flocculent condensed precipitation-biological oxidation cannot meet the emission standard. Therefore, it seems a wrathful issue to try to put forward a economical, efficient and effective treatment. The experiment

investigated decoloration rate of the mixed solution under visible light, which was consisted of hydrogen peroxide and the dye solution. Then, our research work had focused on influence factors. The successful conclusion will provide a reference for making use of waste circularly for environment comprehensive management.

## 2. Experimental

### A. Instruments and Reagents

Spectrophotometer, Model U-2910 UV-VIS spectrophotometer

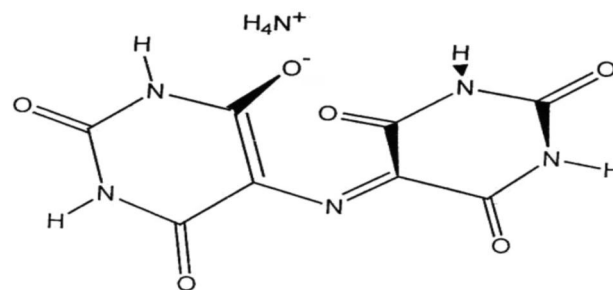
Quartz, sand, Murexide, hydrogen peroxide, activated carbon all compounds are analytical grad

### B. Experimental Procedure

1) Preparation of silica sand

Weight 5g silica sand, and heat them for 10 min. at 50°C

2) Decoloration of Murexide



Structure of Murexide

i- Preparation of 0.005M Murexide solution

Add 5 ml of H<sub>2</sub>O<sub>2</sub> (30%) to 20 ml of Murexide solution and measure the absorbance of upper clear solution at 530 nm wavelength.

ii- Measure the absorbance changes of solution after left it in the visible light for 1, 2, 3, 4, 5, 6, 22, and 36 hr.

iii-Preparation of five solutions of 0.005 M Murexide, then stir each of them at different time at 25°C.

Take 20ml of this solution and add 5 g of quartz sand then measure the absorbance of upper clear solution at 530nm wavelength. Measure the changes of solution after left them in visible light for 1, 2, 3, 4 hr.

iv- Preparation of five solutions of 0.005 M Murexide then stir them at different time . To 20mL of these solutions, 5 g of quartz sand and 5g of activated carbon were added then, the absorbance of upper clear solution was measured at 530nm wavelength.

Measure the changes of the absorbance of solutions after left them in visible light for 5, 10, 15, 30 min.

### 3. Results and discussion

#### A. Decoloration of Murexide by hydrogen peroxide

From Fig.(1) decoloration of the mixture is increased with the increasing the time. The maximum decoloration was about 100%. This is because hydrogen peroxide formed free hydroxyl radical ( $\text{OH}^\bullet$ ), which make fast degradation of the dye. The detailed mechanism of the dye degradation is the formation of reactive intermediate, which is responsible for the degradation is hydroxyl radical ( $\text{OH}^\bullet$ ). It is either formed by the decomposition of  $\text{H}_2\text{O}_2$  which is an extremely strong, non-selective oxidant ( $E = +3.06 \text{ V}$ ) and leads to the partial or complete mineralization of several organic chemicals [Sakthivel, 2003]:

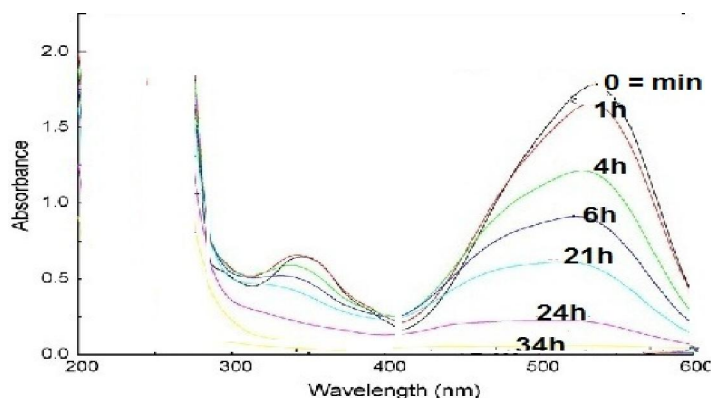
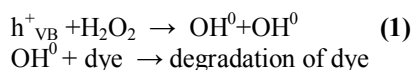


Fig.(1) Effect of time on decoloration of [Murexide] = 0.005M,  $[\text{H}_2\text{O}_2] = 30\%$  at day light.

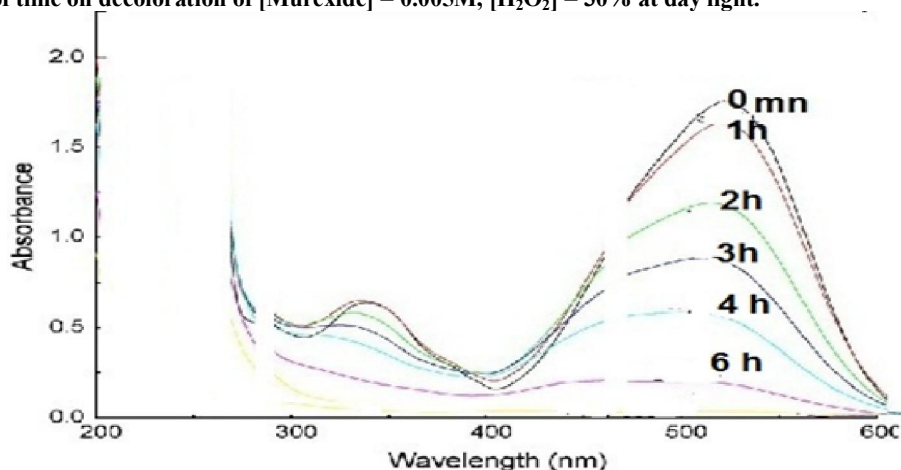


Fig.(2) Effect of time stirring on decoloration of [Murexide] = 0.005M, in present of silica sand.

#### B- Effect of time of stirring on treatment Murexide by silica sand

Fig. (2) Showed that in the initial stages, the decoloration rate is increased with increasing the time of stirring, decoloration of mixture is increased with the increasing of the time [Deng *et al.*, 1998, Wu *et al.*, 1998; Zheng, *et al.*, 2006).

#### C- Effect of time of storing on treatment of Murexide with silica sand

Fig.(3) showed that in the initial stages, the decoloration increased with the increase of the time store [GB 11914-89, Omran, *et al* 2009) Solid waste].

#### D- Exposure time of stirring on treatment of Murexide with silica sand and activated carbon.

Fig.(4) showed that in the initial stages, the decoloration is increased with the increase of the time. The process of adsorption is also influenced by the length of time that the AC is in contact with the contaminant in the wastewater. Increasing contact time allows greater amounts of contaminant to be removed from the water.

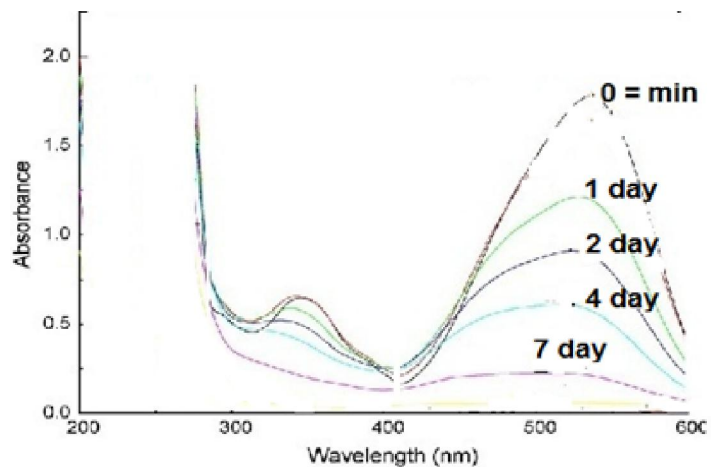


Fig.(3) Effect of time store on decoloration of [Murexide] = 0.005M in present silica sand at day light.

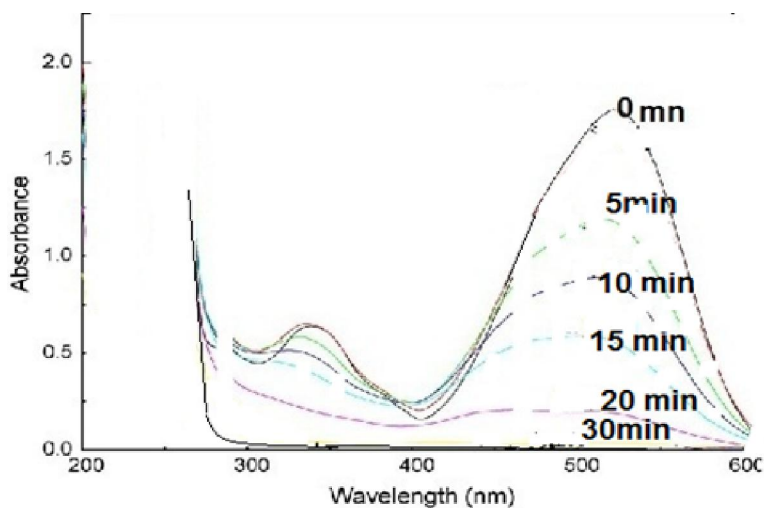
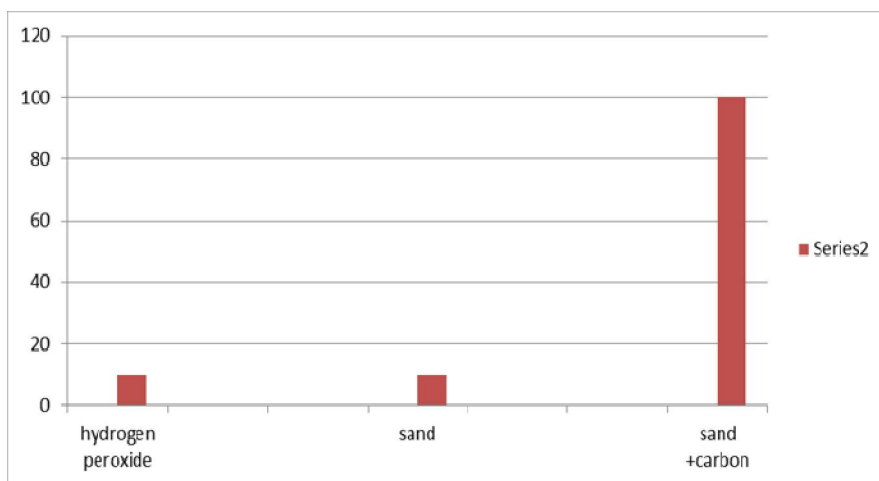


Fig.(4) Effect of time stirring on decoloration of [Murexide] = 0.005M, via silica sand and activated carbon at day light.



Fig(5). Effect of multi media of chemical compounds in removing Murexide ( 0.005M)after 30 min. of treatment.

The effect of activated carbon and sand give highest maximum decoloration was about 100% Fig.(5) explain that, the percentage of degradation was calculated from the following equation:

$$\text{Degradation}\% = [1 - A_t/A_0] \times 100$$

Where  $A_0$  initial absorbance and at  $A_t$  final absorbance [Rashed *et al.*, 2007].

Activated carbon(AC) is extremely porous with a very large surface area. Certain contaminants accumulate on the surface of the AC in a process called adsorption. The two main reasons that chemicals adsorbed on the AC are a "dislike" of the water, and attracted to the AC. Many organic compounds, such as Murexide can be adsorbed by AC. AC also removed metals that are bound to organic molecules. It is important to note that carbon is not necessarily the same as AC. AC removes vastly more contaminants from water than does ordinary carbon [AL- Imarah *et al.*, 2006, Omran *et al.* 2009]

### References

- AL- Imarah F. J., Sahil M. K. (2006), "Pollutions in the effect of Dairyand" Pollutants in the effluents of Dairy and soft drinks Industries in Basra city: there effect upon water of Shatt al Arab by column filled with sand and charcoal", Scientific research, SRO 4, Basra-Iraq.
- Aziz, H.A.; Foul, A.A.; Isa, M.H.; Hung, Y-T. Physico-chemical treatment of anaerobic landfill leachate using activated carbon and zeolite Batch and column studies. *Int. J. Environ. Waste Manage.* **2010**, 5, 269-285.
- Deng Nansheng, Wu Feng, Luo Fan *et al.* (1998), Photochemical oxidation and degradation of dyes by Fe(III)-hydroxy complexes, *Environment and Exploitation*, 12, 16-18 (In Chinese).
- King W, Doddas L, Allen A (2000). Relation between stillbirth and specific chlorination by-products in public water supplies. *Envi Health Pers;* 108(9): 67-78.
- Marawski A W, Kalenezuk R (2000). Adsorption of trihalomethanes (THMs) onto carbon spheres. *Desalination*; 130: 107-112.
- Niu Fusheng, Xu Xiaojun, Gao Jianguo, XU Jinqiu (2001), Study on purifying quartzite by mineral processing, *Yunnan metallurgy*, Vol.30(1), 18-21 (In Chinese).
- Omran, A.; El-Amrouni, A.O.; Suliman, L.K.; Pakir, A.H.; Ramli, M.; Aziz, H.A. Solid waste management practices in Penang State: A review of current practices and the way forward. *Environ. Eng. Manage. J.* **2009**, 8, 97-106.
- Rashed, M. N., El-Amin, A. A. (2007), Photocatalytic degradation of methyl orange in aqueous TiO<sub>2</sub> under different solar irradiation sources, *Int. J. Phys. Sci.*, 2(3), 73-81.
- Sakthivel S., Neppolian B., Shankar M. V., Arabindoo B., Palanichamy M., Murugesan V. (2003), Solar photocatalytic degradation of azo dye: comparison of photocatalytic efficiency of ZnO and TiO<sub>2</sub>, *Solar Energy Materials and Solar Cells*, 77(1), 65-82.
- Tala Suwa (2003), Used oxalic acid leaching and photocatalytic wastewater treatment to produce glass sand, *Foreign metal mineral processing*, 40, 40-43 (In Chinese).
- The People's Republic of China national standards, Determination of water quality- chemical oxygen demand by potassium dichromate method, GB 11914-89.
- USEPA, "Stage 1 Disinfectants and Disinfection by – products rule", office of water (EPA).Viessman, W. Hammer, M. Water supply and pollution control. Harper collies CollegePublishers. 15th edition. 1993: 485-488.
- Weige Liao (2001), Used oxalic acid leaching to produce high-purity silica sands, *Foreign metal mineral processing*, 38, 33-36 (In Chinese).
- Wietlik J, Stanis R, Bodzek M (2002). Adsorption of natural organic matter oxidized with ClO<sub>2</sub> on granular activated carbon. *Wat res*; 36(9): 2328-36.
- Wu Feng, Deng Nansheng, Luo Fan *et al.* (1998), Study on discoloration of water soluble dyes induced by photolysis of Fe(III)-oxalate complexes, *Environmental pollution contamination*, 20(1), 17-20, (In Chinese).
- Wu Huating, Xie Lishan, Xu Yafang, Chen Jiannan, Lin Gucheng, Zheng Xiaoan, Yan Guiyang (2010), Study on purification methods of removing impurity from quartz. Highlights of science paper online, 3(17), 1752-1756, (In Chinese).
- Zheng Xiao-hong, Wang Yan, Wu Dang-lan, Chen Zhen, Lin Yu-man (2006), Studies on treatment of dyeing wastewater with polysilic aluminium ferric flocculants. *Journal of Fujian Normal University (natural science)*, 22(4), 58-62, (In Chinese).

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