

1-7-2021

## Studying The Possibility Of a New AZO Dye On Raw Fabric Surface And The Methods of Dying Process

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### Recommended Citation

Kamal, Noor Mustafa and Abed Al-Ghreeb, Hana Khazal (2021) "Studying The Possibility Of a New AZO Dye On Raw Fabric Surface And The Methods of Dying Process," *Al-Qadisiyah Journal of Pure Science*: Vol. 26: No. 1, Article 17.

DOI: 10.29350/qjps.2021.26.1.1243

Available at: <https://qjps.researchcommons.org/home/vol26/iss1/17>

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Al-Qadisiyah Journal of Pure Science

# Al-Qadisiyah Journal of Pure Science

ISSN(Printed): 1997-2490

ISSN(Online): 2411-3514

DOI: /10.29350/jops.

<http://qu.edu.iq/journalsc/index.php/JOPS>


## Studying the Possibility of a New AZO Dye on Raw Fabric Surface and the Methods of dyeing Process

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| <p><b>Authors Names</b><br/> a. Noor Mustafa Kamal<br/> b. Hana Khazal Abed AL-Ghreeb</p> <p><b>Article History</b><br/> Received on: 18/11/2020<br/> Revised on: 28/11/2020<br/> Accepted on: 5/1/2021</p> <p><b>Keywords:</b><br/> adsorption , new dye AZO white cloth , NaOH , HCl .</p> <p><b>DOI:</b> <a href="https://doi.org/10.29350/jops.2021.26.1.1243">https://doi.org/10.29350/jops.2021.26.1.1243</a></p> | <p><b>ABSTRACT</b></p> <p>The current research describes the synthesizing of a new dye AZO 4-antipyl azo (benzoic acid) that is used in the dyeing process . The possibility of adsorption of the water solution to this dye was studied on a raw white cloth surface where the cloth was treated and the impurities removed before conducting adsorption experiments. The results showed that the suitable conditions for the adsorption process were in the acidic medium of the water solution of the dye. whereas in the neutral and basal medium, the adsorption process was not induced. Moreover, the effect of temperature on the adsorption process was considered in the preparation of the dye.</p> |
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### 1. Introduction

#### 1.1. History introduction of dyes.

Dyes were not new in their concept, they have been known since ancient times , These dyes were laboratory known only in the nineteenth century and specifically in 1857 [1] , When Birkin created the coal mine Movie factory. After years of laboratory research, he was able to prepare it from the reaction of potassium dichromate and concentrated sulfuric acid with aniline ore [2]. It obtained a colored dye dyeing the purple fiber in the hot solution. It also has pigment properties in terms of purity and color stability compared to natural used dyes that have the same degree of color, After the Movie factory was developed by Birkin and his staff, it became suitable for dyeing cotton and treating it with tannic acid and dyeing fabrics. [2]

Many natural dyes known since ancient times have been obtained from animal and vegetable sources. Today, the dyes are industrial dyes and are made from aromatic organic compounds.

There are certain conditions that the dyeing materials must meet, which are :

1. A specific and stable color.
2. Ability to dye the fabric in a direct or indirect manner.
3. Keeping its ephemeral when it is fixed on the fabric , meaning that the color must be fixed towards the light, and must be resistant to the effect of water, This however , gives a better status for dilute and alkaline acids especially the latter because washing soda has the alkaline nature .

### 1.2. Dyes

Colored materials are capable of absorbing visible light 400-700 (nm). There are two groups of organic and inorganic matter discovered by the Birkin 1865, which is the beginning of the manufacturing the synthetic dyes. [1]

Dyes are usually organic compounds that absorb light in a particular area of the visible spectrum other than organic compounds [3].

Dyes are colored because they possess:

1. In a little one set of color carriers, known as chromophores.
- 2 - A system of succession, i e succession of double bonds, and individual bonds.
- 3 - Electrons in the system of Rosunas , which gives the stability of organic compounds.

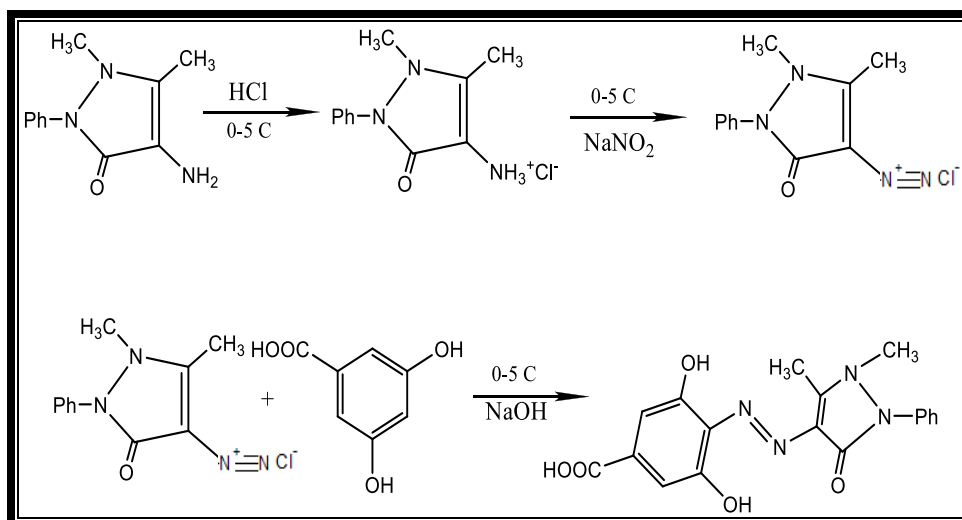
In the absence of one of these properties in the molecular structure, the color is lost. The dyes also have groups called Auxochromes. These groups are not responsible for color but are displacing color (shifting to higher wavelengths) and making the dyes soluble.

### 1.3. AZO dyes.

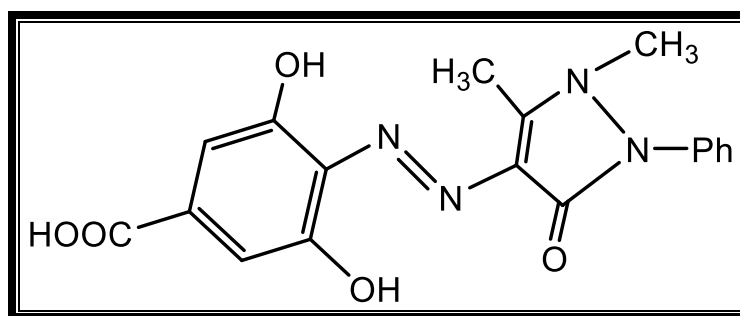
AZO dyes are an organic material consisting of two organic groups that are connected by coupling reactions to the AZO group to give colored compounds absorbed in the visible and ultraviolet region. They first discovered by Peter in 1888 [4] within various dyes Furthermore, AZO dyes are the largest and most diverse color group used in the industry. AZO dyes do not occur in nature but are produced only through chemical analysis.

AZO compounds are well known for their medicinal importance and are recognized for their applications such as antidepressants, antiseptics, antimalarial plastics, anti-bacterial [5,6], antitumor anti-inflammatory [7] and other beneficial chemical agents [8 ,9].

The dye (APABA) was prepared by adding 2.5 dihydroxy benzoic acid with 4-amino antipyrine diazotate in alkaline solution. A diazonium solution was prepared by taking 1 gm of 4-amino antipyrine in 25 ml of ethanol and concentrated hydrochloric acid with 6 ml distilled water and adding NaNO<sub>2</sub> solution at (0-5 C<sup>0</sup>) . 1 gm 3.5 dehydroxybenzoic acid was dissolved in 25 ml of ethanol and 30 ml of sodium hydroxide was added (0-5 C<sup>0</sup>). Then mixture was left for 24 hours. As shown in Figure 1 and Figure 2 the solid product is filtered and reconstituted using ethanol [10], This preparation represents the chemical composition of the pigment .



*Figure -1- Preparation of dye (APABA)*



*Figure -2- Synthetic form of dye (APABA)*

## 2. Experimental procedure

### 2.1. Chemicals and instruments.

in this study the experimental instruments used are : UV- Visible Spectrophotometer , double Beam , Spectrophotometer, Single Beam, UV-Visible / VIS 9200, Electric Centrifuge , Electrical magnetic stirrer and Water bath vibrator .

the Chemical used are 4-(4- antipyryl azo ) 3,5dihydroxy benzoic acid ( $C_{18}H_{17}O_5N_4$ ) , Sodium hydroxide and Hydrochloric acid.

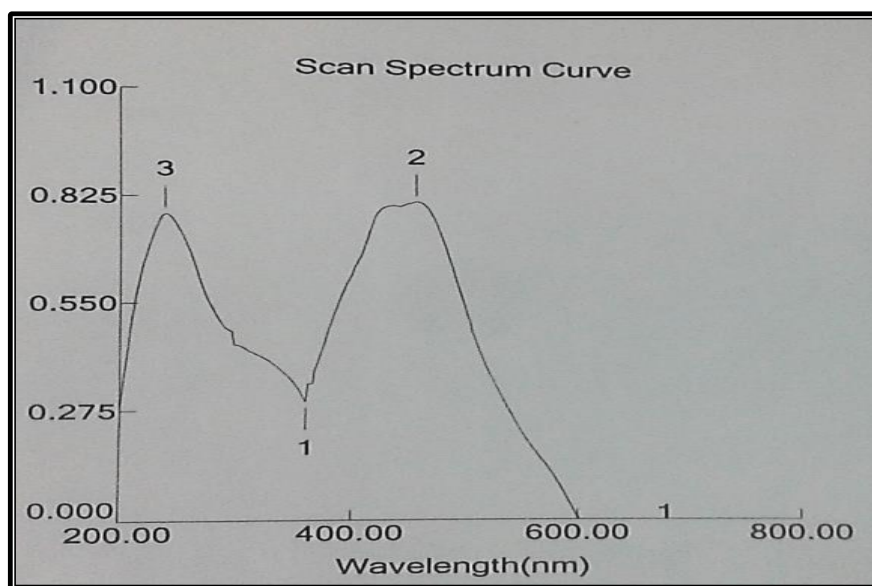
### 2.2. Preparation of solutions:

The solution of dye was prepared by dissolving 0.1gm of the dye in 200 ml of distilled water to prepare a solution of 500 ppm. From this solution diluted solutions (50 ,75 ,100 ,125 ,150 ,75 ,200 and 225) ppm were prepared by diluting after extracting the desired volume from the original solution and adding distilled water to the volume required .

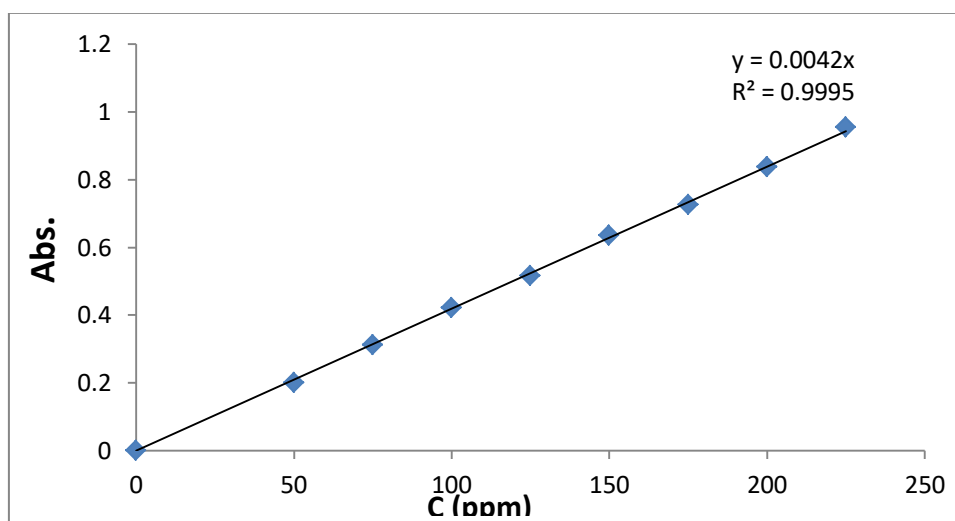
### 2.3.The maximum wavelength $\lambda_{max}$ and the standard calibration curve:

The wavelength at which the highest absorption ( $\lambda_{max}$ ) of the dye solution under study was determined by recording the absorption spectra using UV and UV spectra within the range ( 190-100) (nm) and the use of a quartz cell with a cross-sectional length of 1cm as shown in( Figure 1 ). The

standard calibration curve, which represents the relationship between absorption and concentration, was determined using the prepared solutions as indicated in ( 3 ). The absorption of these solutions was measured at the maximum wavelength ( 456 nm ), as in Figure 4 .



*Figure ( 3 ) Maximum wavelength max  $\lambda$  for dye (APABA)*



*Figure ( 4 ) The standard calibration curve for dye (APABA)*

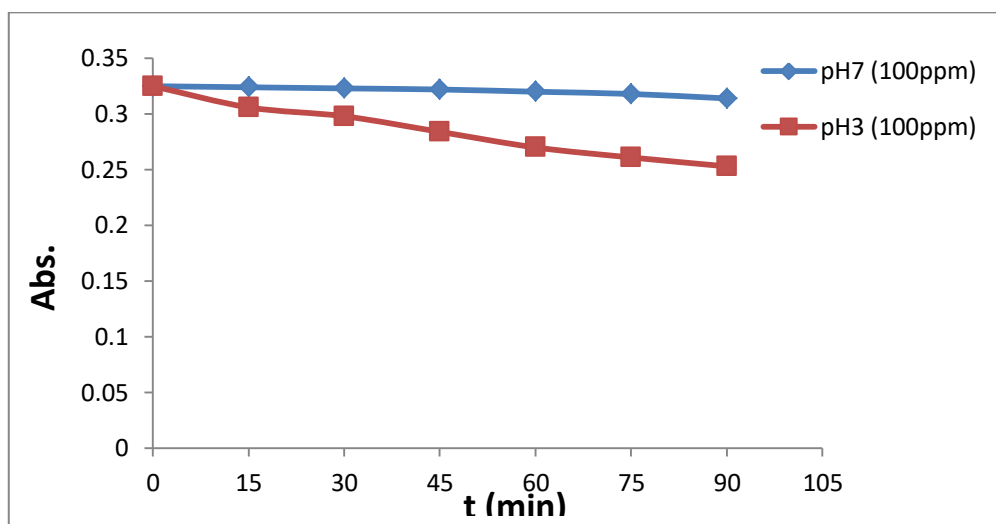
### 3. Experiments:

These experiments were conducted to determine the necessary conditions for dye adsorption under study to be used in the dyeing process. All experiments were conducted at laboratory temperature, with concentration, temperature and acidic and basal effect.

A piece of white cloth was used for adsorption. The piece was treated before use. The piece was washed twice with distilled water and soap with boiling once and then only with water and for one hour for each case.

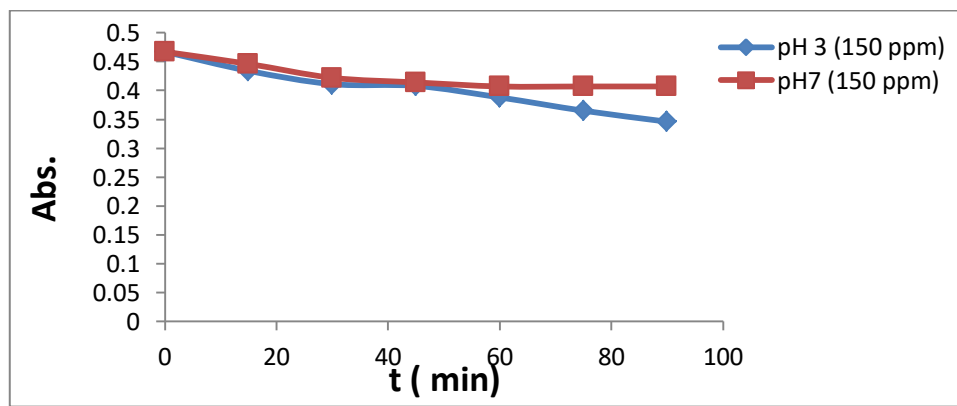
The possibility of adsorption of the dye prepared on the surface of raw white cloth was studied, taking 100 mL of the dye solution by using different concentrations

First : the concentration of 100 ppm (pH = 7) was used with the addition of a yellow cloth. The reaction vessel was placed on a magnetic stirrer. The absorbance was measured at the maximum wavelength of the dye for 15 minutes and for 90 minutes. The absorption was very low or almost (pH = 3), However, it was found that absorbance changes over time, as shown in figure ( 5).



*Figure (5) represents the change in absorption of the dye under study over time*

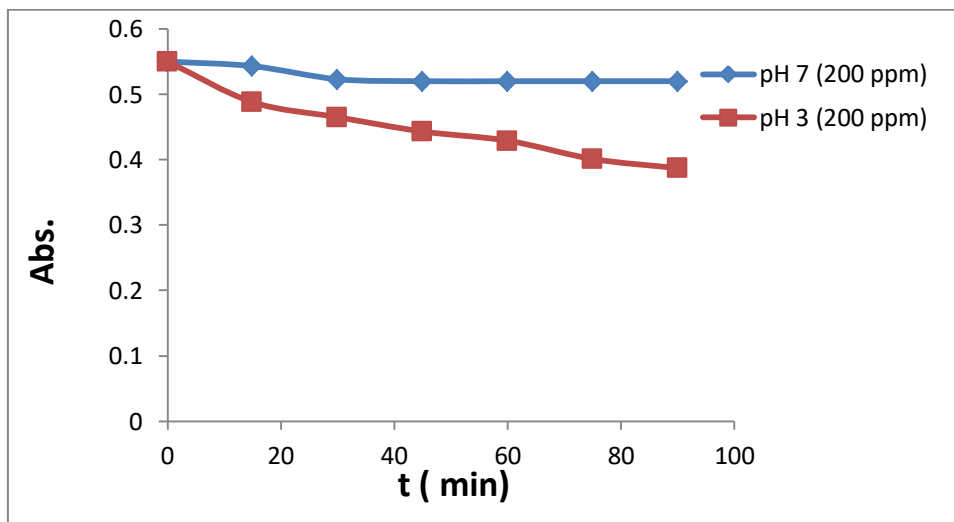
Second :- the concentration of 150 ppm was used at (pH = 7) with the addition of a yellow cloth. The reaction vessel was placed on a magnetic stirrer and the absorbance was measured at the maximum wavelength of the dye for every 15 minutes and for 90 minutes and found that absorption was very low as well. The first case and the second were almost equal for all time, The same experiment was repeated, but in the acidic medium (pH = 3) and it was found that the absorbance changes over time, as shown in Figure (6).



*Figure (6) represents the change in absorption of the dye under study over time.*

The concentration of 200 ppm was used at ( pH =7 ) with the addition of a yellow cloth. The reaction vessel was placed on a magnetic stirrer. The absorbance was measured at the maximum wavelength of the dye for every 15 minutes and for 90 minutes and found that absorption was very low as well. The first and second cases were almost equal for all time. The same experiment was repeated, but in the acidic medium (pH = 3) and it was found that the absorbance changes over time, as shown in Figure ( 7 ).

The results obtained from these experiments indicate that the dye has the ability to adsorption on the surface of the raw cloth .



*Figure ( 7 ) represents the change in absorption of the dye under study over time.*

Fourth: the same experiments were repeated in paragraphs 1, 2 and 3, but this time by using the basal function, ( pH = 11 ) , It was found that absorption did not change at all Based on the results obtained above, it is concluded that dye can be used only when dye is acidic and they cannot be used when it is neutral or basic.

Fifth :- the effect of temperature on the adsorption of pigment was found on the surface of the white cloth used in the dyeing process. The concentration of 100 ppm of the dye was used at ( pH = 3 ) with the addition of a yellow cloth. The reaction vessel was placed in the water bath. (30-50) C°. The absorbance was measured at the maximum wavelength of the dye for every 15 minutes and for 90 minutes. It was found that the process of adsorption of the dye increased as the temperature increased, as in Figure (8).

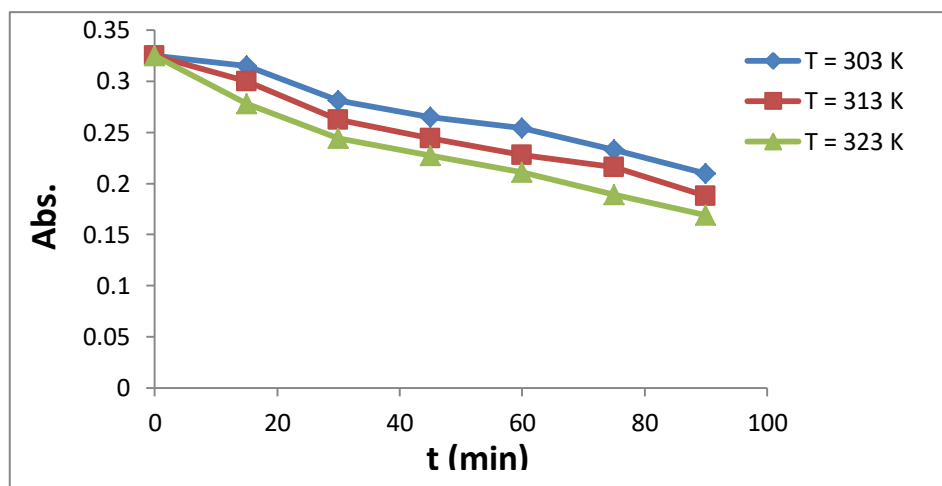


Figure ( 8 ) represents the effect of temperature on Absorption

### Recommendations:

After examining the possibility of adsorption of the pigment prepared above and finding suitable conditions for adsorption, the researchers recommended using it in the dyeing process.

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