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EFFECT OF THE U.V RADIATION ON THE ABSORBANCE OF SOME INDICATORS (ALIZARIN RED AND BROMOTHYMOL BLUE AND AT DIFFERENT TIMES)

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Abstract:-

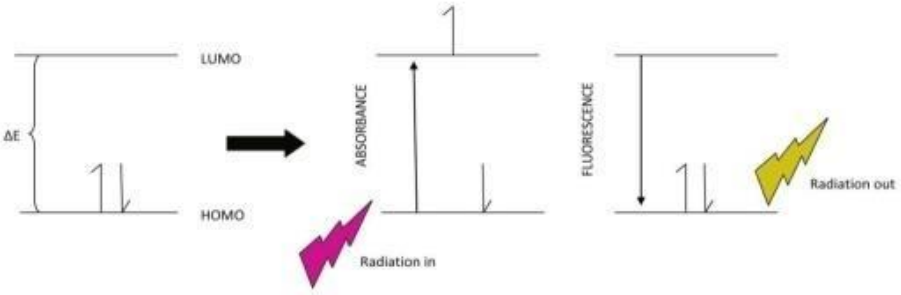
The effect of irradiation period on the λ_{max} and absorbance of some indicator including (Alizarin red and Bromothymol blue) was carried out. The main target of study is to evaluate the optimum time of irradiation which give high absorbance. The measurements were carried out by used U.V lamp in the range of (200-400 nm). The spectra of U.V was obtained by scanning the studied indicators by (spectrophotometer DU 800). The results showed that the absorbance value was increased according to the increasing the concentrations. On the other side the absorbance values showed variations of each period of U.V irradiation.

Keywords:- *U.V Irradiation, Alizarin red and Bromothymol blue.*

INTRODUCTION

Electronic Spectroscopy relies on the quantized nature of energy states. Given enough energy, an electron can be excited from its initial ground state or initial excited state (hot band) and briefly exist in a higher energy excited state. Electronic transitions involve exciting an electron from one principle quantum state to another. Without incentive, an electron will not transition to a higher level. Only by absorbing energy, can an electron be excited. Once it is in the excited state, it will relax back to it's original more energetically stable state, and in the process, release energy as photons.(1)

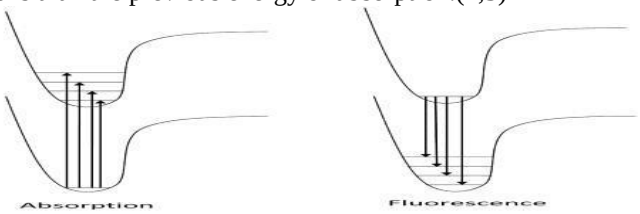
Often, during electronic spectroscopy, the electron is excited first from an initial low energy state to a higher state by absorbing photon energy from the spectrophotometer. If the wavelength of the incident beam has enough energy to promote an electron to a higher level, then we can detect this in the absorbance spectrum. Once in the excited state, the electron has higher potential energy and will relax back to a lower state by emitting photon energy. This is called fluorescence and can be detected in the spectrum as well.



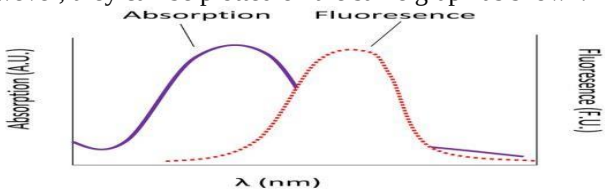
Embedded into the electronic states (n=1,2,3...) are vibrational levels (v=1,2,3...) and within these are rotational energy levels (j=1,2,3...). Often, during electronic transitions, the initial state may have the electron in a level that is excited for both vibration and rotation. In other words, n=0, v does not = 0 and r does not =0. This can be true for the ground state and the excited state. In addition, due to the Frank Condon Factor, which describes the overlap between vibrational states of two electronic states, there may be visible vibrational bands within the absorption bands. Therefore, vibrational fine structure that can be seen in the absorption spectrum gives some indication of the degree of Frank Condon overlap between electronic states. (2)

Fluorescence

Now that we have discussed the nature of absorption involving an electron absorbing photon energy to be excited to a higher energy level, now we can discuss what happens to that excited electron. Due to its higher potential energy, the electron will relax back to its initial ground state, and in the process, emit electromagnetic radiation. The energy gap between the excited state and the state to which the electron falls determines the wavelength of light that will be emitted. This process is called fluorescence. Generally, the wavelengths of fluorescence are longer than absorbance, can you explain why? Given the following diagram, one can see that vibrational relaxation occurs in the excited electronic state such that the electronic relaxation occurs from the ground vibrational state of the excited electronic state. This causes lower energy electronic relaxations than the previous energy of absorption.(1,3)



Here we see that the absorption transitions by default involve a greater energy change than the emission transitions. Due to vibrational relaxation in the excited state, the electron tends to relax only from the v'=0 ground state vibrational level. This gives emission transitions of lower energy and consequently, longer wavelength than absorption. When obtaining fluorescence, we have to block out the transmitted light and only focus on the light being emitted from the sample, so the detector is usually 90 degrees from the incident light. Because of this emission spectra are generally obtained separately from the absorption spectra; however, they can be plotted on the same graph as shown.(4)



n→π∗ transitions;

These transitions involve moving an electron from a nonbonding electron pair to a ant bonding orbital. They tend to have molar absorptivity less than 2000 and undergo a blue shift with solvent interactions (a shift to higher energy and shorter wavelengths). This is because the lone pair interacts with the solvent, especially a polar one, such that the solvent aligns itself with the ground state. When the excited state emerges, the solvent molecules do not have time to rearrange in order

to stabilize the excited state. This causes a lowering of energy of the ground state and not the excited state. Because of this, the energy of the transition increases, hence the "blue shift".

$\pi \rightarrow \pi*$ transitions:
These transitions involve moving an electron from a bonding orbital to an ant bonding orbital. They tend to have molar absorptivities on the order of 10,000 and undergo a red shift with solvent interactions (a shift to lower energy and longer wavelengths). This could either be due to a raising of the ground state energy or lowering of the excited state energy. If the excited state is polar, then it will be solvent stabilized, thus lowering its energy and the energy of the transition.[3 and 4]

EXPERIMENTAL

Apparatus:
Computirized spectrophotometer type DU 800.

Chemicals
Different types of dyes were selected in this project including the following: Alizarin Red and Bromothymole blue

Solutions preparation: 100 ppm of every dye was prepared by dissolved 0.01 g in 100 ml distilled water.

Standard solution preparation: Different volumes of (1, 2, 3, 4 and 5 ml) were transferred into 10 ml measuring flasks then diluted to the mark by distilling water.

The procedure: All the prepared solutions of the dyes were treatment by U.V radiation at different times (5, 10, 15, 20, 25 and 30 min) by using instrument. The absorbance was measured at each time .The effect of radiation was observe from the curve.

DISCUSSION

The standard curve of the alizarin red solution was shown in Figure (1). The results showed the maximum absorbance was recorded at 450 nm. After treatment the solutions by U.V radiation the λ max shifted to new λ max at 285 nm. Also the absorbance was varied from the original absorbance where the maximum absorbance was record for the time of 20 min (2.85) compared with the original value of the same solution at (1.6). This change attributed to the time and the electronic transitions of $\pi - \pi^*$ and $n - \pi^*$. On the side the solutions of 20 , 30, 40 and 50 ppm recorded different values of absorbance, where the absorbance was change to 1.15 at 450 nm (Decreased compared with the standard solution) for the concentration of 20 ppm (2ml of stock solution). For the concentration of 30 ppm (3 ml of stock solution) the maximum absorbance was 1.46 at 20 min, also decreased compared with the original standard solution. Whereas, there is relative increase in absorbance for the concentrations of 40 and 50 ppm (4 and 5 ml of stock solutions), where the absorbance was 1.51 and 2.10, respectively, but also at 20 min of U.V radiation, Figures (5 & 6).

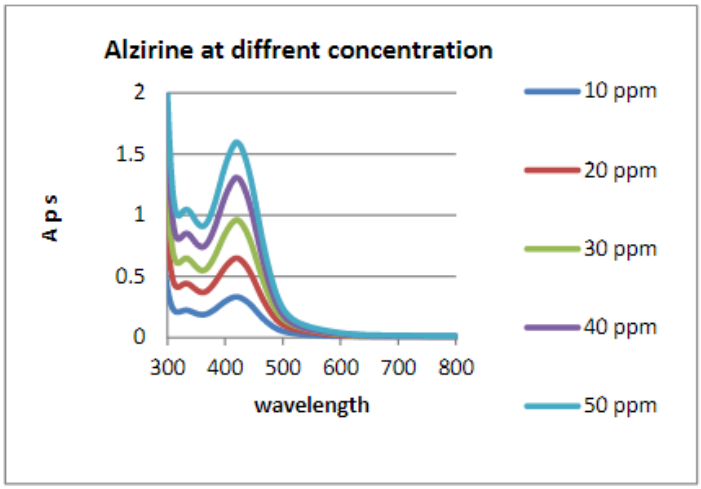


Figure (1): The standard curve of Alizarin red solutions.

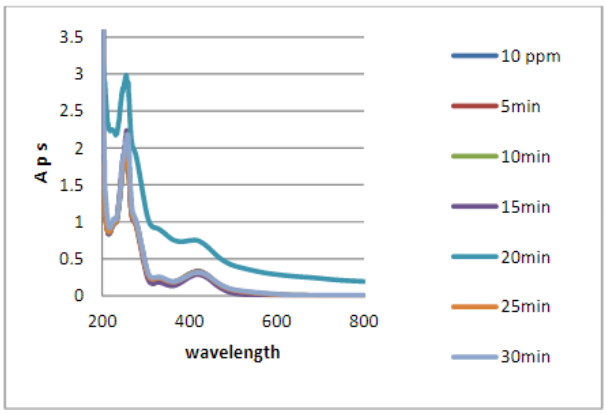


Figure (2): The absorbance curve of Alizarin red solutions (10 ppm) after U.V radiation treatment.

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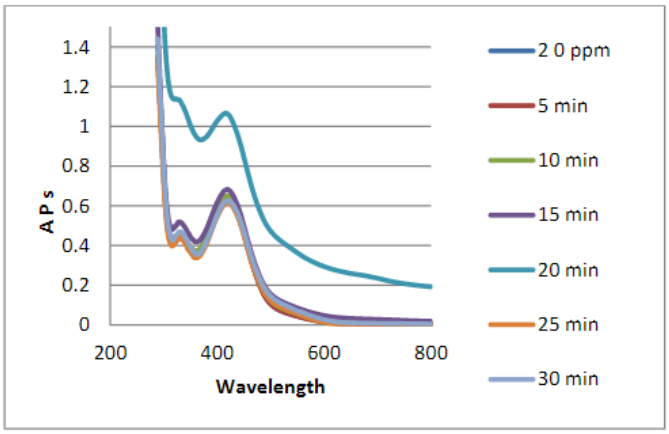

Figure (3): The absorbance curve of Alizarin red solutions (20 ppm) after U.V radiation treatment.

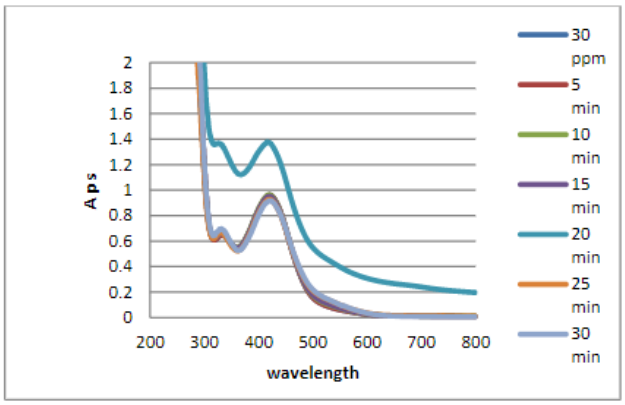

Figure (4): The absorbance curve of Alizarin red solutions (30 ppm) after U.V radiation treatment.

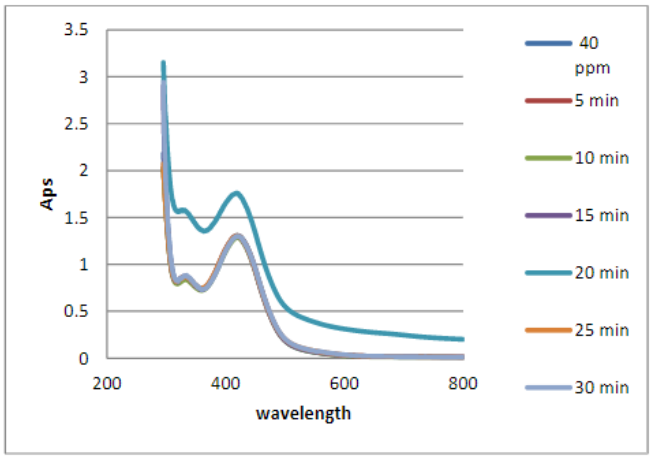

Figure (5): The absorbance curve of Alizarin red solutions (40 ppm) after U.V radiation treatment.

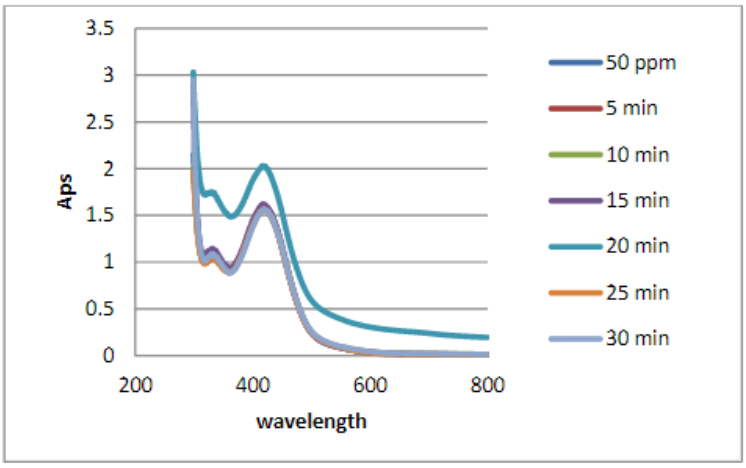

Figure (6): The absorbance curve of Alizarin red solutions (50 ppm) after U.V radiation treatment

Bromothymol Blue.

The standard curve of the Bromothymol Blue solution was shown in Figure (7). The results showed the maximum absorbance (λ max) at 490 nm. After treatment the solutions by U.V radiation the λ max gave new λ max at 610 nm. Also the absorbance was varied from the original absorbance where the maximum absorbance was recorded for the time of 25 min and 30 minutes (0.25 & 0.27), respectively compared with the original values of the same solutions at (0.39). This change attributed to the time and the electronic transitions of $\pi - \pi^*$ and $n - \pi^*$. While for the concentration 20 ppm the (λ max) was changed to 0.52 at 5 min radiation for the solution 20 ppm, also a new absorbance was appeared at 620 nm (Figure 8). On the side the solutions of 30 , 40 and 50 ppm recorded different values of absorbance, where the absorbance was change to 0.8, 1.2 and 1.4 at 490 nm (increased compared with the original standard solutions) for the. For the concentration of 30 ppm (3 ml of stock solution) the maximum absorbance was 0.8 at 25 and 30 minutes, also increased compared with the original standard solution. The results also showed that the absorbances at 610 nm were disappeared in 40 and 50 ppm concentrations and again were recorded after 25 and 30 minutes radiation treatments (Figures 10 – 12).

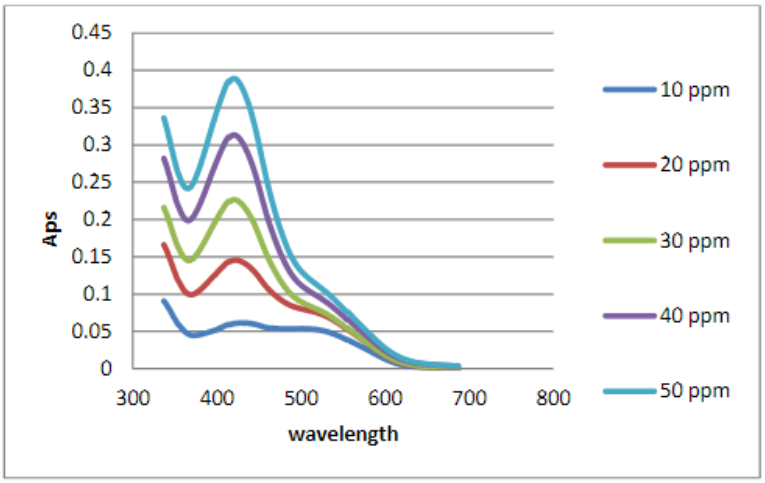

Figure (7): The standard curve of Bromothymol Blue solutions.

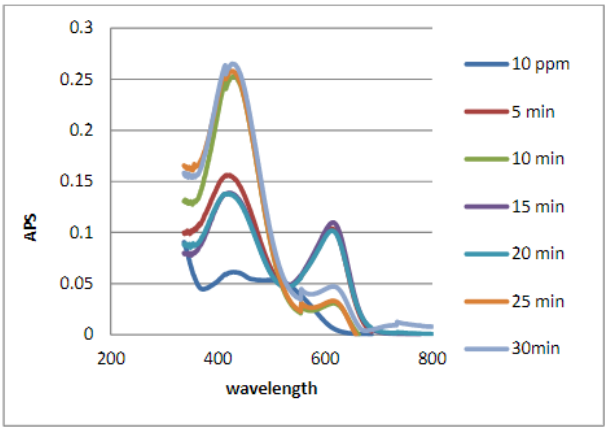

Figure (8): The absorbance curve of Bromothymol Blue solutions (10 ppm)

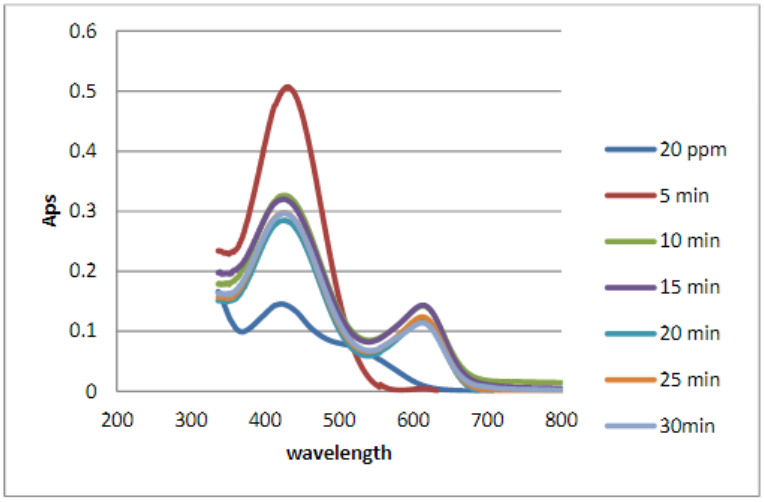

Figure (9): The absorbance curve of Bromothymol Blue solutions (20 ppm) after U.V radiation treatment.

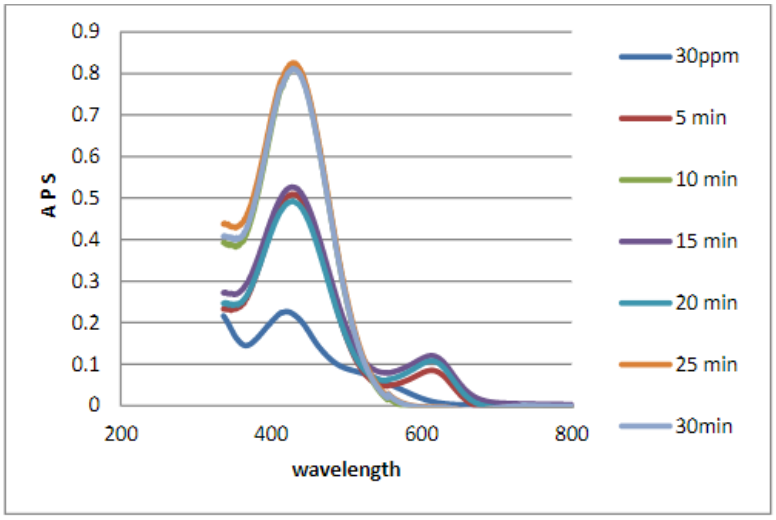

Figure (10): The absorbance curve of Bromothymol Blue solutions (30 ppm) after U.V radiation treatment.

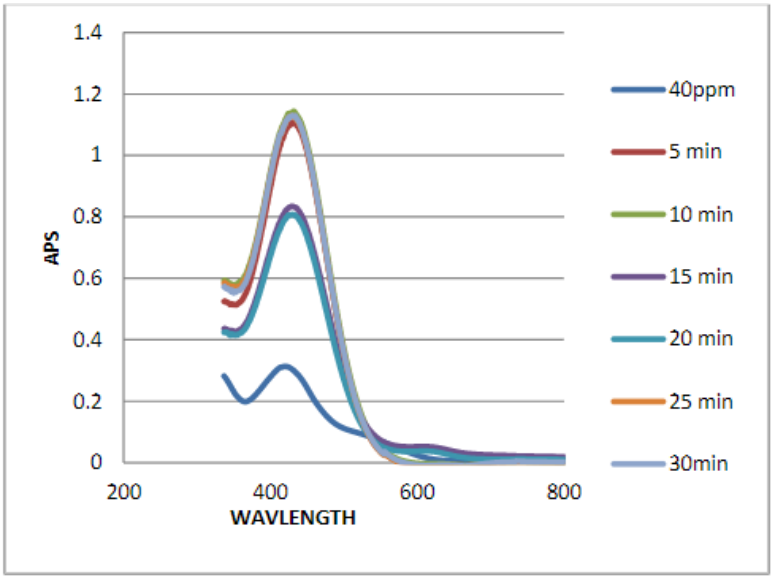

Figure (11): The absorbance curve of Bromothymol Blue solutions (40 ppm) after U.V radiation treatment.

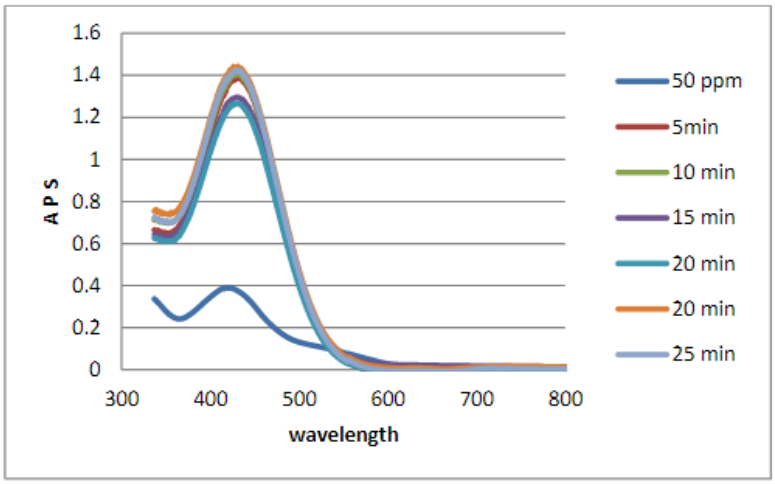

Figure (12): The absorbance curve of Bromothymol Blue solutions (50 ppm) after U.V radiation treatment.

CONCLUSION

The absorbance and λ_{max} of solutions were varied between the studied dyes solutions, the U.V radiation gave different values at different radiation tretment times, most of solution gave low vales of absorbance comparing with the original standrad solutions of Alizarine red and the λ max were chenged , while for the bromothmole blue the λ max were incresed comparing the standrd soltions. The study attributed those changes in absorbance are due to the effecting to U.V radiations.

REFERENCES

[1].Cotton, Albert. Chemical Applications of Group Theory. John Wiley & Sons, New York, 1990.
[2].Drago, Russell. Physical Methods for Chemists. Surfside Scientific Publishers, Gainesville, Fl, 1992.
[3].Harris, Daniel; Bertolucci, Michael. Symmetry and Spectroscopy. An Introduction to Vibrational and Electronic Spectroscopy. Dover Publications, Inc., New York, 1989.
[4].Miessler, Gary; Tarr, Donald. Inorganic Chemistry. Pearson Education Inc., New Jersey, 2004.
[5].Jump up to: [a] [b] The primary madder species from which alizarin historically has been obtained is Rubia tinctorum. See also Vankar, P. S.; Shanker, R.; Mahanta, D.; Tiwari, S. C. (2008). "Ecofriendly Sonicator Dyeing of Cotton with Rubia cordifolia 155
[6].Linn. Using Biomordant". Dyes and Pigments. 76 (1): 207–212. Doi:10.1016/j.dyepig.2006.08.023.
[7].UV-Vis Wikipedia Link