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Photodegradation of toxic synthetic food coloring: The Tartrazine.

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ABSTRACT

Tartrazine is the most consumed food coloring in the Moroccan market, its elimination by photodegradation was investigated under UV light 25watt and 220 volts. The process was carried out at a different pH, the catalyst dose TiO2 (rutile and anatase), the concentration of the dye, the effect of H202 and the effect of metal ions Al3 + and Cu2 +. It was found that under the effect of H202 in%, the color of the dye solution became colorless after 80 min with a loss of 99% of .the molecule observed phenomenon is described by a pseudo-first order kinetics . In order to determine the quality of waste water, a measurement of the chemical oxygen demand was performed both before and after treatment and a significant reduction of values was observed, implying good potential for this technique to suppress tartrazine aqueous solutions.

Keywords: Photo ; Catalysis ; Dégradation ; Tartrazin ; Artificiel Food Coloring.

INTRODUCTION

The food industry consumes considerable amounts of synthetic dye during operations preparation and finishing of food products to attract consumers' attention. Because of their aromatic molecular size and complex structure, dyes are resistant to degradation photocalatylique, thermal and biological. Colored effluents are highly visible, even in low concentrations and severely affect the aesthetic quality and transparency of water bodies, damaging the aquatic ecosystem. [1]

Synthetic dyes when they are ejected into the wastewater the aqueous modify water chemistry, changing the pH of the solution, the color, chemical oxygen demand that hinders the growth of microbial organisms. [2]

Under the action of microorganisms, dyes release of nitrates and phosphates in the environment, these ions can become toxic to fish life and alter the production of drinking water; consumption by the aquatic plants accelerated their uncontrolled growth and leads to oxygen depletion by inhibiting photosynthesis. The species found at the top of the food chain, including man finds himself exposed to toxic levels of a bioaccumulation even at the base of low concentration that we had. [3]

There are few studies in the literature regarding the degradation of tartrazine. Salem Gemeay [4] have reviewed the kinetic Tartrazine oxidation using peroxydisulfate in the presence and absence of Ag (I) and catalyst Fe (III) and observed a high conversion in alkaline medium. Faragoso et al. [5] have studied the degradation of tartrazine by oxidation with hydrogen peroxide in alkaline solution. Mittal et al. [6] studied the adsorption of tartrazine using poultry feathers; Patel and Suresh [7] studied the decolorization of azo using palladium-magnesium system, Gupta et al. [8] and Tanaka et al. [9] removed the dye tartrazine with TiO2 and photo-degradation by Matsui et al. [10] show that the azo dyes tended to be easily decomposed with ozone and the dye decomposition was accelerated significantly when ozonation was accompanied by ultraviolet irradiation.

In this study, a photodegradation reactor was prepared by using materials of low cost but capable of optimizing the

photodegradation reaction. The photocalatylique degradation experiments of several batches were made using synthetic solutions of tartrazine, the effects the operating parameters, such as the initial dye concentration, pH of the solution and the contact time were studied. However, only the relevant results have been noted in this document.

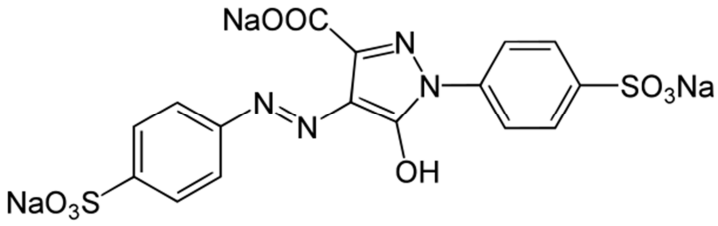

Figure 1: molecular structure of tartrazine

MATERIALS AND METHODS

2. lAnalytical method

Ultrapure Water Aurora Crysta was used for the deionized water to prepare all the solution and all chemicals were of analytical grade, unless otherwise-against. All chemical used (Table. 1) were of analytical grade.

Table 1 :Chemicals used and their brands

t (min)	A (%)	B (%)
0	100	0
2	100	0
22	47.5	52.5
37.6	0	100
40	0	100
41	100	0
43	100	0

Chromatographic analyzes were performed with the liquid chromatograph Agilent 1100 Series HPLC equipped with a quaternary gradient pump Agilent 1200 Series capable of mixing four solvents. A series of sample Autosampler Agilent system 1100, a manual injector (MI) 100 µL of detector and a variable wavelength detector G1314A (VWD) with standard flow cell (10 mm path length, 14-µl volume, maximum pressure 40 bar) diode array. The chromatographic data were collected and processed using a personal computer running Agilent ChemStation. A pH meter equipped with a combined glass calomel electrode was used for pH measurements. The determination of the purity of the 11 dyes (fig 1) was performed with a double beam spectrophotometer UV-1601 UV / Vis SHIMADZU AX200 with 1 cm quartz cells (Shimadzu)[11].

Standard solutions containing 100 mL of each dye were prepared with 1000 ppm of pure dye in deionized demineralized water. The solutions were maintained in flasks. The working standards of each color solutions were prepared by appropriate dilution of the stock solutions with deionized water to give concentrations of between 0.10 and 50 mg.L-1 (PPM). Mixed standard solutions containing all dyes in concentrations between 0.10 and 10 mg.L- 1 were also prepared by mixing and diluting the appropriate aliquots of each standard substance solution. All solutions were stored at 3◦C in the dark are stable for at least 3 months.

Chromatographic conditions:A column (250 mm x 4.6 mm) fully end-capped with 5- spherical particles _M and with a load of 12 % of carbon (3 µmol m-2) was used with C18 (25 mm × 4.6 mm, 5 µm) guard column (Supelco). AC18 column is the type of column used as laboratories for routine analysis.

The mobile phase is an aqueous ammonium acetate solution solution1 % (m / v) at pH 7.5 by adding a few drops of a sodium hydroxide solution 10% (m / v) (mobile phase A) and a mixture of methanol : acetonitrile (80:20 v / v) (mobile phase B) . The mobile phase A was filtered by suction through a membrane filter with a pore diameter of 0.45µm.

The eluent flow rate was kept constant at 1.5 mL min-1 and the injection volume was set at 20 µL . The gradient program used, is given in Table.2. All experiments were performed at room temperature.

The diode array detector is programmed to monitor the dyes on the next wavelength: 435 (yellow), 530 (red) and 620 nm (blue). The chromatographic system was initially conditioned by passing the mobile phase through the column until a signal A of stable base line was obtained.

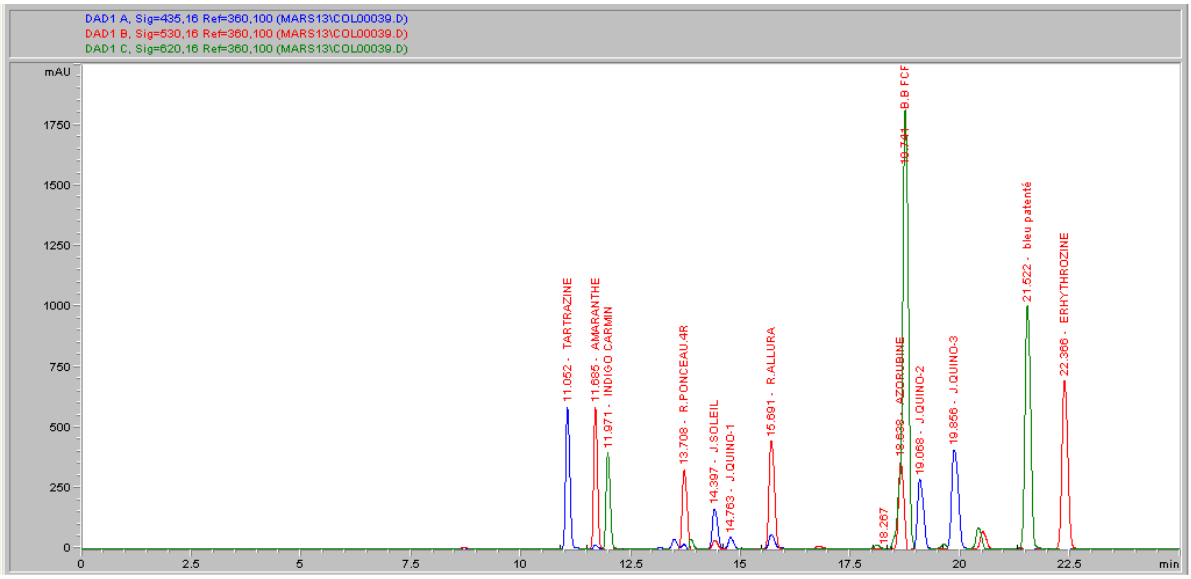

Figure 2 :the chromatogram of the separation of the 11 food dyes by HPLC DAD

2.2 photodegradation reactor.
The reactor (Figure 2) was mounted in our laboratory with the following elements:

1. Sampling point
2. reactor
3. Magnetic Bar
4. Magnetic Stirrer
5. Water thermostatically
6. Solution irradiating
7. quartz sheath
8. Low-pressure mercury vapor lamp (λ = 254 nm) 25 Watt to 220 volts

2.2 Le réacteur de photodegradation.

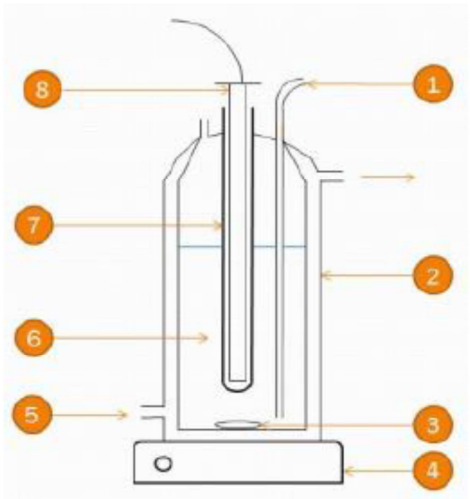

Figure 3 :UV photodegradation Reactor

The photodegradation tests were carried out on 10-3 to 25 g / l solutions of tartrazine , Prepared with ultrapure water, was added the various elements in order to study the influence of catalysis (rutile TiO2 and anatase TiO2), H202 (1%); of metal ions (Al3 +, Cu2 +) and finally the pH (HNO3 and NaOH) and subsequently placed in the reactor for 80 minutes by making samples for performing kinetics.

RESULTS AND DISCUSSION

Before studying photocalatylique degradation, we observed experimentally that direct photolysis of tartrazine very slowly in the sunlight. A solution of 25 × 10-3 g / L exposed to sunlight in a Pyrex bowl. During one month 1.5% (equivalent to 3.75x 10-4 g / l) has disappeared.

The results of experiments carried out within the reactor we mounted laboratory have demonstrated that the most significant effects are those of the Tartrazine solution doped with H202 (Figure 3) and TiO2 anatase (Figure 4) with 99% and 89 % degradation after 80 min of radiation.

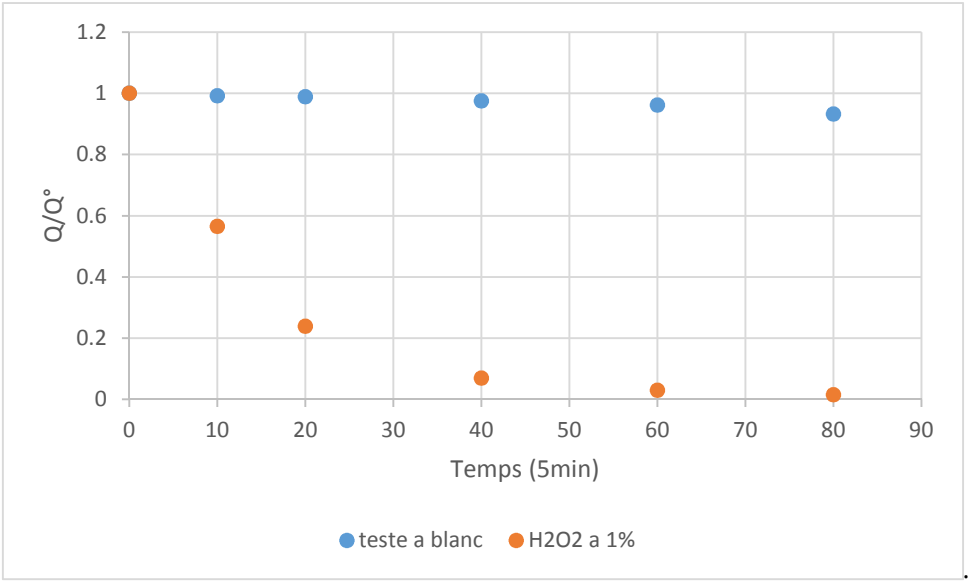

Figure 3:Effect of H202 (1%).

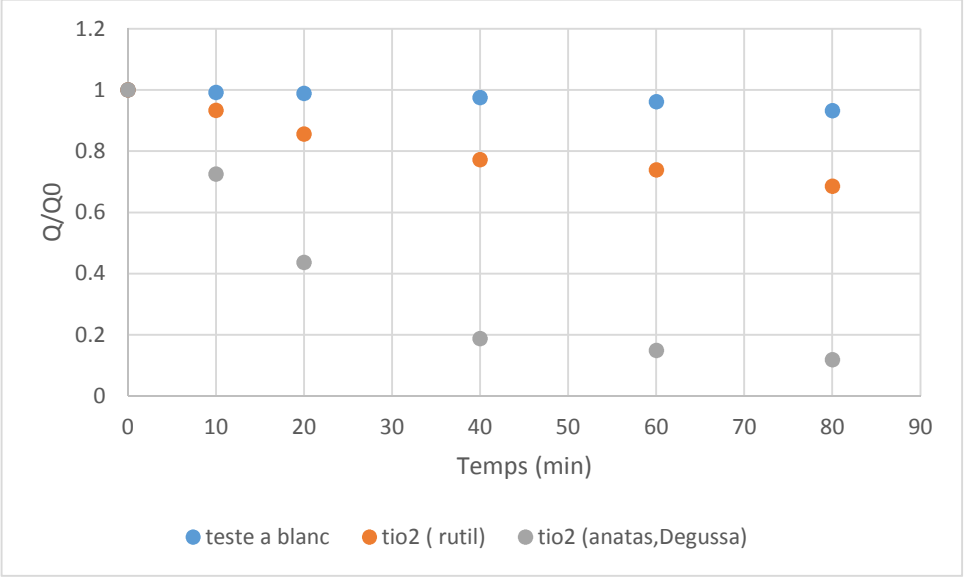

Figure 4: Effect of TiO2

The addition of two metal ions separately experimentally observed a slight inhibition of the photodegradation of tartrazine under the influence of UVC irradiation, all of the removal rate as a function of the dopants has been demonstrated (Figure 3) for demonstrate that oxygenated water is good accelerator.

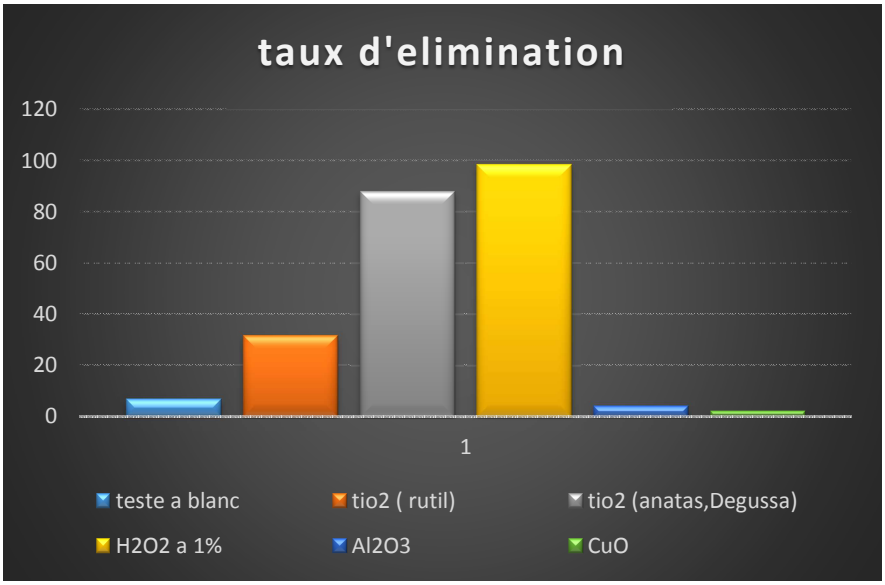

Figure 5 :Elimination rate of Tartrazine in various dopant

CONCLUSION

H202 The effect is larger than that of TiO2 anatase, rutile TiO2 other hand has a smaller effect of anatase but despite this there is a danger due to the presence of rutile TiO2 (white food coloring) and tartrazine in the food product.

Cu 2+ and Al 3+ have no significant influence. Apparently the presence of Niro group in the aromatic ring reduces the photocatalytic oxidation.

REFERENCES

[1] P.K. Gautam, et al., *J. Environ. Chem. Eng*. (**2015**),
[2] K.V Subba Rao, B. Lavédrine, P. Boule, *Journal of Photochemistry and Photobiology A: Chemistry* 154 (**2003**) 189–193.
[3] P.SERVAlS . Press de l'école national des ponts et chausses, octobre 1999.49 (**l999**).
[4] Salem MA, Gemeay AH. *Monatsh Chem* **2000**;131:117–29.
[5] Faragoso CT, Battisti R, Miranda C, De Jesus PC. *J Mol Catal A Chem* **2009**;301:93–7.
[6] Mittal A, Kurup L, Mittal J. *J Hazard Mater B* **2007**;146:143–8.
[7] Patel R, Suresh S. *J Hazard Mater B* **2006**;137:1729–41.
[8] Gupta VK, Jain R, Nayak A, Agarwal S, Shrivastova M. *Mater SciEng* C **2011**;31:1062–7.
[9] Tanaka K, Padernpole K, HisanagaT.*Water Res* **2000**;34:327–33.
[10] Matsui M, Kimura T, Nambu T, Shibata K, Takase Y. *J Sci Dyers Colourists* **1984**;100:125–7.
[11] Ouezzani, A Falaq , I Elfadil , S El Hajjaji , A El Hourch , and M El Azzouzi1 *Research Journal of Pharmaceutical, Biological and Chemical Sciences* 6(6) Page No. 1036.**2015**.