Morocco Journal of Chemistry

Kinetic study of surface water treatment by the active olive grignon (Natural Resin)

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Received 29 Sept 2015, Revised 10 Jan 2016, Accepted13 Jan 2016

Abstract

The industries of textile reject big quantities of waste waters highly presenting a risk of toxicity. There are already treatments such as the adsorption on the natural resin which is an effective but expensive process and which produces a mud which constitutes itself an environmental threat. In this work, we handled surface waters by the technique of adsorption by using the active olive grignon (natural resin) as adsorbing. The results show on the one hand that blue Telon was fixed to the powder natural resin for a duration of 110 mn. And on the other hand, the experiments of adsorption of the coloring agent Blue Telon on the natural resin gave the best result in the pH acid conditions, in 200 mg of RN, and the temperature of 80°C.

Keywords: *Industries Textile, Blue Telon, Adsorption, Natural Resin, Olive Grignon.*

1. Introduction

The environmental protection [1] became a major economic [2] and political issue [3]. All the countries of the world are concerned by the protection of soft water resources, either because they are lacking water, or because they pollute it. The disparity between needs and availability of the water obliges us to imagine new ways of routing and treating [4] the latter, and to increase the availability of these resources. This calls out to reflect and evoke the diversified means to protect the water and so to be able to supply the necessary quantity in the domestic and industrial consumption [5], by favoring recycling waste waters as much as possible [6] before rejecting them in the natural environment. The industry of textile [7, 8] and dye at the same time consume big quantities of water and produces big quantities of waste water which come from various stages of the dye and refinement. Waste water of printing and dye in textile industry is often rich by residues of coloring agents and reactive chemicals, which requires a suited treatment before being rejected in the environment. The technique of adsorption [9, 10] is the most used in the waste water treatment of textile industry as well for the recycling of valuable components from flow of waste as well as for the re-use of the aqueous flow. Indeed, a number of studies were led in the waste water treatment generated by the various stages of the textile dye and the refinement. The origin of our works tends to evaluate the olive grignon (natural waste / low cost) in the field of the purge of the effluents of textile ennoblement [11]. This type of waste possesses all the convenient characteristics so that it benefits from undergoing beforehand the

chemical treatments. That is why we intended to apply this type of adsorbing in the field of the purge of the liquid effluents. For that purpose, we suggested studying the adsorption of the coloring agent (blue Telon (TB)) by using the activated olive grignon (natural resin (RN)). For that purpose again, we made an experimental study of the kinetics of adsorption by studying the effect of certain important parameters on the bleaching power of the used material in particular, the speed of agitation, the pH of the solution, the temperature and the initial concentration in the coloring agents.

2. Materials and methods

2.1. The studied Coloring agent (blue Telon)

Salt disodic 4-Amino-5-Hydroxy-3-((3-Nitrophenyl) AZO)-6-(PhenylAzo)-2,7-Naphthalene disulfonic Acid has a mass molar equals 616,49 g / mol and has the following raw formula $C_{22}H_{14}N_6Na_2O_9S_2$

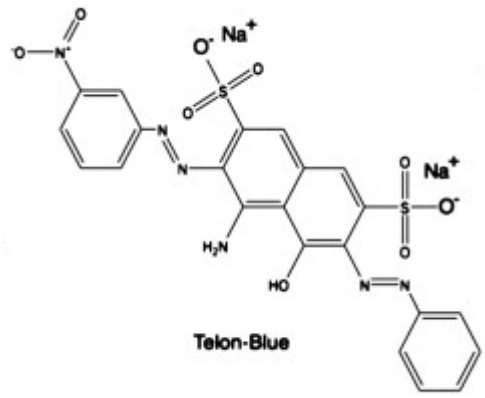

Figure 1. Blue Telon

2.2. The used Adsorbants materials (Natural Resin)

The type of grignon which we used is the consumed one of manufacturing which was gracefully offered to us by the Graduate School of Agriculture (ENSA) of Meknés.

2.2.1. The experimental protocol of the olive grignon activation:

In one container of 500 ml, we mix 50 % of the olive grignon with 50 % of sulphuric acid 1N with the duration of impregnation of one hour. After boiling of 15 min, the material is washed by decantation then dried in 120°C. The grignon is then placed in the device of heat treatment by means of a cartridge, and then we activated the boiling point of the solvent. At the end of activation, we let it cool until the ambient temperature during more than two hours.

3. Results and Discussions

3.1. Influence of the parameters of adsorption on the kinetics of adsorption

3.1.1. Influence of the mass of RN on the adsorption of the couple TB / RN

The kinetics of adsorption was studied for four masses (50, 100, 150, 200 mg) in 250ml of the solution by applying a speed of agitation of 500 tours / min, pH = 6 and a temperature equal to 25 °C.

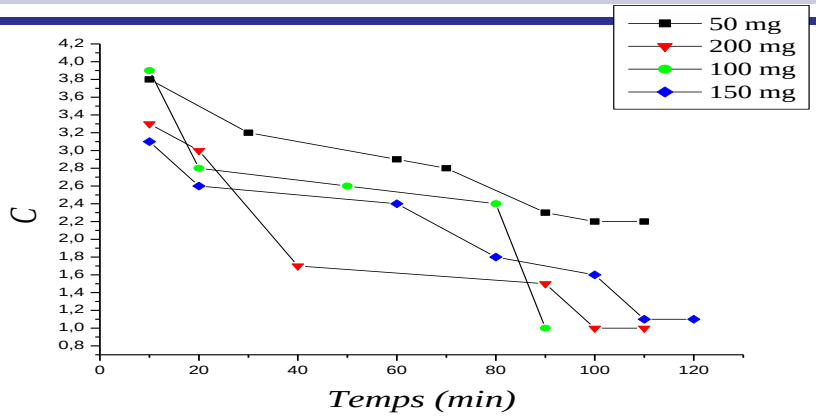

Figure 2. Influence of the mass of RN on the adsorption of couple TB/RN

According to figure 2, we observed that the kinetics of adsorption are more important when the mass of RN increases. On the other hand, these results show that the time in which we obtain a pseudo-balance remains practically equal to an average value of 110 minutes.

3.1.2. Effect of pH on the kinetics of adsorption of the couple TB/RN:

In this work, we have studied the effect of pH (2, 3, 6, 9 and 10) on the kinetics of adsorption of the couple TB / RN. The mass of RN is equal in 150mg; the speed of agitation is of 500 Tr/min; and the temperature is equal to 25 °C.

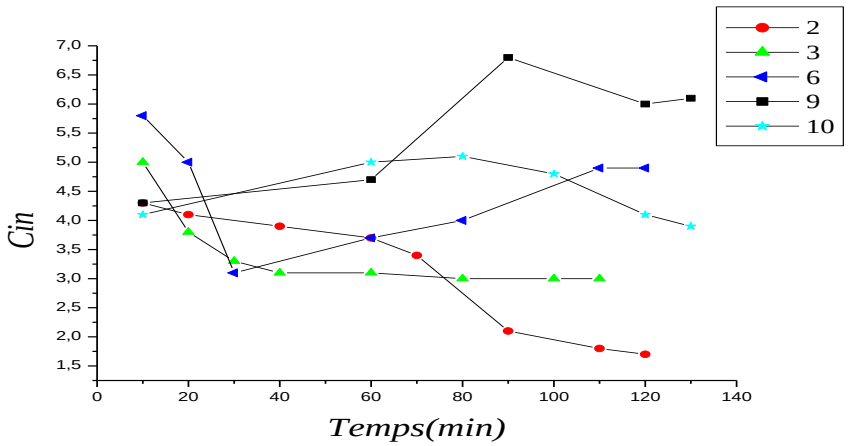

Figure 3. The influence of pH on the kinetics of adsorption of the couple TB/RN:

Besides, the experimental results concerning the effect of pH (Figure 3) show that the adsorption is more marked for the pH acid. Because, the coloring agent has a natural acid which is a basic environment, it loses its acidity and consequently its adsorption on the surface of RN. In other words, the RN loses its efficiency of adsorption. This is most probably due to the presence of fatty acids inserted into the matrix of RN after the activation.

3.1.3. Effect of the agitation on the kinetics of the adsorption of the couple TB/RN:

During this study, we tested four values of agitation (250, 500, 750 and 1000 Tr/min). The mass of RN is equal in 150mg, pH is 6 and the temperature is equal to 25 °C.

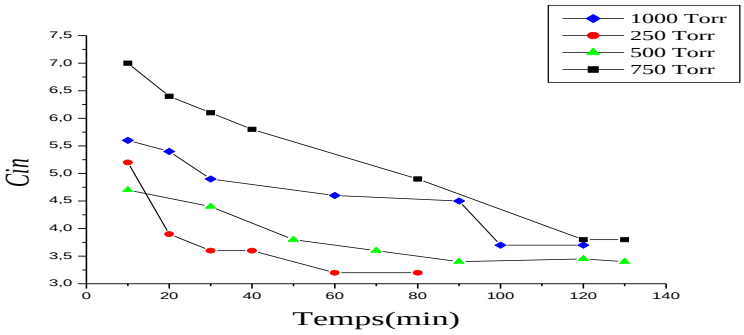

Figure 4. Influence of the speed of agitation on the adsorption of the couple TB/RN

The effect of agitation (figure. 4) shows that the act of lowering the speed of agitation of 1000 Tr/min in 250tr / min causes a light decrease of the residual concentration. This one goes from 4,13 for 1000 Tr/min in 3,16tr / min to 250tr / min. This can be due to an increase of the desorption of the molecules of TB when the speed of agitation increases, which in its turn increases the residual concentration of the coloring agent.

3.1.4. The effect of the temperature on the kinetics of adsorption of the couple TB/RN:

In this part, we studied four values of the temperature (25, 40, 65 and 80 °C). The mass of RN is equal in 150 mg, the speed of agitation is 500 Tr/min and the pH is 6. The influence of the increase of the temperature (figure 5) which passes from 110min for T = 25°C to 40 min for T = 40°C can be explained by the decrease of the viscosity of the liquid when the temperature increases. It is most probably bound to the speed of the distribution of the molecules of TB on the RN.

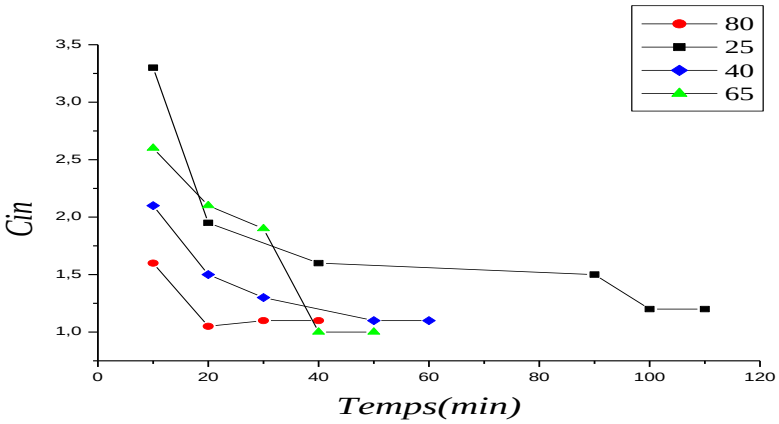

Figure 5. Influence of the temperature on the adsorption of the couple TB / RN

3.2. Kinetics of adsorption:

The kinetics of retention describes the speed reaction which allows determining the time of contact put between the adsorbate and adsorbing to reach the balance. It is an important stage in any study of adsorption.

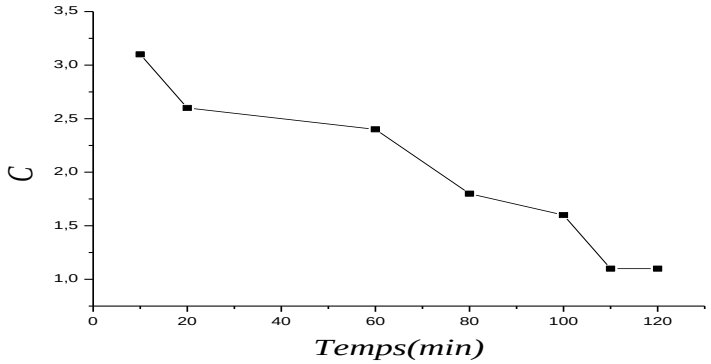

Figure 6. The kinetics of the adsorption of the couple TB/RN

According to figure 6, we observed that the Blue Telon was fixed on natural powder resin for duration of 110 mn. These results can be explained by the saturation of the active sites of the substrata.

3.3. Isotherms of adsorption

The most known adsorption kinetics of adsorption isotherms were given by Langmuir [12, 13, 14, 15] and Freundlich [16, 17]. They play an important role in determining the maximum capacity and identifying the type of adsorption that can occur before. The Langmuir isotherm has been given by the following equation: Qe = Q0aCe/1+ aCe and by the Freundlich equation: Qe = KfCe1/n.

These are represented by 1/Qe = f(1/Ce)=1/(Q0) LnQe and LnQe = f(LnCe) = LnKf + 1/(nLnCe)

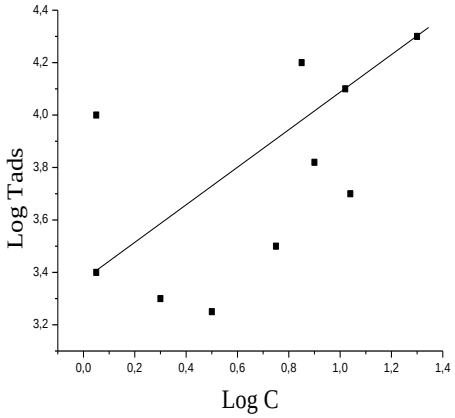

Figure 7. Isotherm of Freundlich TB-RN

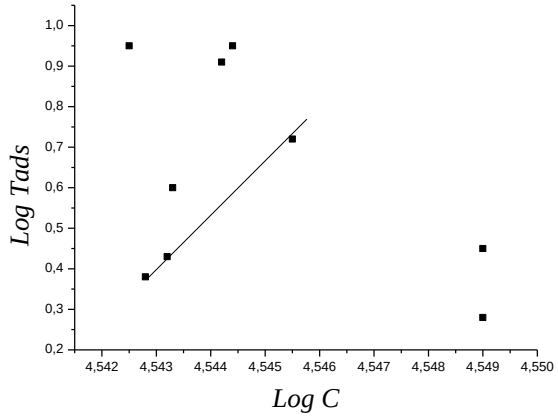

Figure 8. Isotherm of Langmuir TB-RN

From figures 7 and 8, we deducted the parameters of the equation of Langmuir and Freundlich which are grouped in the table 1.

Table 1. The parameters of the equation of Langmuir and Freundlich

	Equation de	Freundlich	Equation de	Langmuir
	n	k	K’	Tads
Telon Bleu/RN	1	3,02	30	0.972

The isotherms of adsorption of the Blue Telon on natural resin in aqueous solutions follow the laws of Langmuir and Freundlich. According to these values, we notice that the parameter k of Freundlich who represents the affinity of the adsorbate to the considered surface is equal to 3,02.

4. Conclusion

The adsorption of the coloring agent Blue Telon on the natural resin in aqueous solution varies according to the mass of the adsorbing agent, the pH, the temperature and the agitation.

The results show on the one hand that the blue Telon was fixed to the natural powder resin during 110 min and on the other hands the experiences of adsorption of the coloring agent Blue Telon on the natural resin, were made in the conditions of PH acid, 200mg of RN, and a temperature of 80°C. In these intervals of the conditions, we noticed a good adsorption which is improved in pH acid, varied speed of agitation and the high temperature.

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