CONTRIBUTIONS VIEWING THE REDUCTION OF THE POLLUTING DEGREE FOR SULPHATE WASTE WATERS THROUGH THE PROCESS OF LIGNIN FLOCCULATION WITH PHOSPHORIC ACID AND DIAMMONIUMPHOSPHATE

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ABSTRACT: The following technological stages, naming: the wood griding, washing and screening as well as the recovery of the sodium salts, generate sulphate waste waters which are characterized by a highly polluting chemical composition and high biodegradable because of the presence of lignin components.
The reduction of the polluting degree is possible because of the flocculation technologies applied in acid medium with a mixture of reacting substances like phosphoric acid and diammonium phosphate.

KEYWORDS: sulphate water, depollution, lignin flocculation

INTRODUCTION

The methods of obtaining the pulp from the pine softwood and hardwood highly pollute components such as: water, air, soil.
The use of the sulphate method for the wood grinding in highly alkaline environment is much known. While the use of components of active alkalis type (NaOH and Na_2S in proportion of 20%) causes the lignin solving as well as the pulp dissociation. 33% from the wood mass is represented by the lignin which also exists in the waste waters.

If we don't take into consideration the possibility of exploiting lignin as a combustion agent in the sodium salts recovery stage, the secondary ingredients of the product: the alkali and the tiolignin in the waste waters, resulted in the washing and screening stages, inevitably pollute the sources of surface waters.
The methods applied up to the present for reducing the pollution degree through the process of retention components of lignin from waste waters have the disadvantage of some partial results characterized by the preservation of the blackish colour, the existence of the highly biodegradable components with negative implication in the development of fauna and flora of the surface waters and of the rivers in which they are flowed.

MATERIALS AND METHODS

The technological principle on which the research programme based upon consists of lignin flocculation in the acid medium using a reactive mixture of phosphoric acid and diammonium phosphate.
The presence of diammonium phosphate added has the advantage of a flocculation process at a slight acid pH.
From an economic point of view, specialists considered the suggested solution as being opportune through the exploitation of the reactive surplus as a nourishing environment in the process of biochemical depollution.
In order to establish the necessary technological conditions for the development of the discoloring process through the lignine flocculation present as a polluting product in sulphate waste waters constituted in a programme in the rotator centred system of order of type II, having four independent variables.
The variation of decisive reaction parameters is shown in table 1.

Table 1. Experimental reaction conditions

Independent variables	**Variation range (ΔX=cst.)**				
	-2	**-1**	**0**	**1**	**2**
H_3PO_4 (mg/100 ml water) X_1	3	5	7	9	11
DAP (mg/100 ml water) X_2	12	14	16	18	20
Temperature (^{0}C) X_3	10	15	20	25	30
The time of reaction (minutes), X_4	8	10	12	14	16

The range of absolute values for the temperature and duration was presented having in view the limit situations which can appear in the case of some technical accidents and when the temperature of the waste waters reaches the values of 25-30^{0}C and the time of reaction increases up to 14-16 minutes.
In table 2 there is a presentation of the regression equations defined after the experimental programme was achieved.
The student test was used in order to validate the most significant coefficients of equations.

Table 2.

The label of dependent variables, Y_i	**The equations of regression $Y_i = f(X_i)$ characterized by the general form**
Y_1 – the colour index expressed through the photometric value of absortion (%)	$Y_1 = 2,93+1,07X_1+0,92X_1X_2-1,20X_3X_4$
Y_2 – the chemical consumption of oxigen expressed in CCOMn (mg/L)	$Y_2 = 64100+2,17X_1X_2-0,72X_2X_3$
Y_3 – fixed residue at 100 ± 5^0C (%)	$Y_3 = 18+2,17X_1X_2+0,71X_2X_3-0,52X_4X_1$
Y_4 – the organic substance in fixed residue at 100 ± 5^0C	$Y_4 = 87+0,47X_1+0,97X_1X_2-1,15X_2X_3$
Y_5 - pH	$Y_5 = 6,27+5,23X_2+0,18X_3X_1-0,39X_3X_4$

The graphical method was chosen in order to analyze the results.

RESULTS AND DISCUSSIONS

The influence of X parameters against the Y dependent variables were pointed out in 1 the graphical representation.
The discoloring of waste waters expressed in colour index (figure 1) reaches minimal variables under the conditions of a flocculation reaction realized with an addition of 11 mg of H_3PO_4 and 20 mg of DAP within 100 ml waste water at a temperature of 20^0C and a time of reaction of 12 minutes.

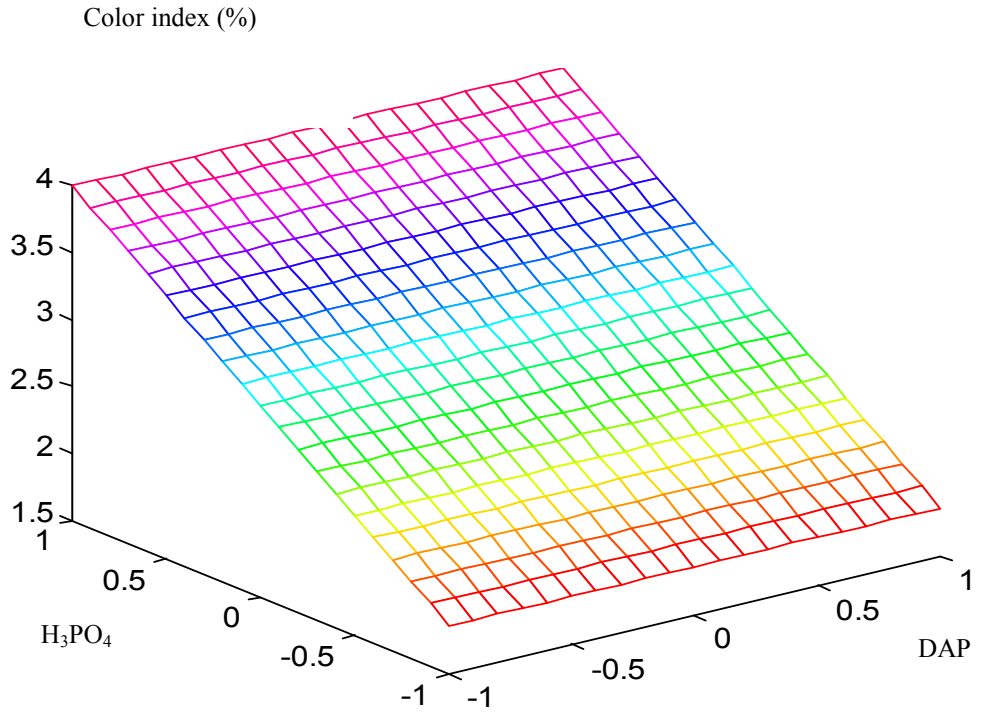

Figure 1. The influence of H_3PO_4 and DAP addition on the discoloring process when the temperature and the duration are kept within the centred range

The positive conditions of this method are confirmed by the content of organic substances in the residual flocculated structure having variables of 93,5% (figure 2) and of fixed residue after flocculation having values between 0,15-0,16% (figure 3).
We had in view the reduction of the polluting degree through the chemical oxygen consumption expressed through CCOMn (figures 4 and 5).
The CCOMn measured after the lignine flocculation presented some reduced values under 10000 mg/L while the depolluting yield expressed dependent on this qualitative parameter in of 98,88%.

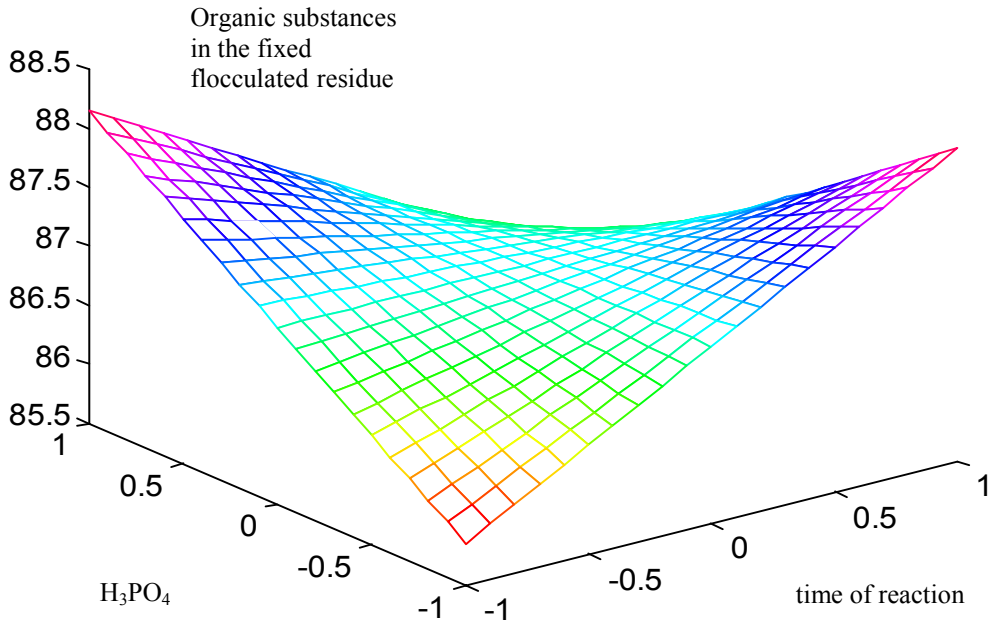

Figure 2. Organic substances in the fixed flocculated wastes dependent on the addition of H_3PO_4 and the time of reaction when keeping of the temperature and the DAP addition in the centred range within

CONCLUSIONS

The depollution of the sulphate waste waters through discoloring was made possible because of the lignin flocculation which is highly biodegradable polluting agent which colors the waste waters in dark brown towards black.
We made use of a mixture of phosphoric acid and diammonium phosphate for the flocculation reaction.
An addition of 7 up 11 mg of H_3PO_4 and 20 mg of DAP leads to some depolluting yields ranged between 93,5-98,8% under the conditions in which the reaction temperature is of 15-20^{0}C while the time of reaction is up to 12 minutes.
The use of H_3PO_4 and DAP for depollution represents a viable economic solution through the constant exploitation of the surplus of reactive as nutrients in the biochemical depolluting process.

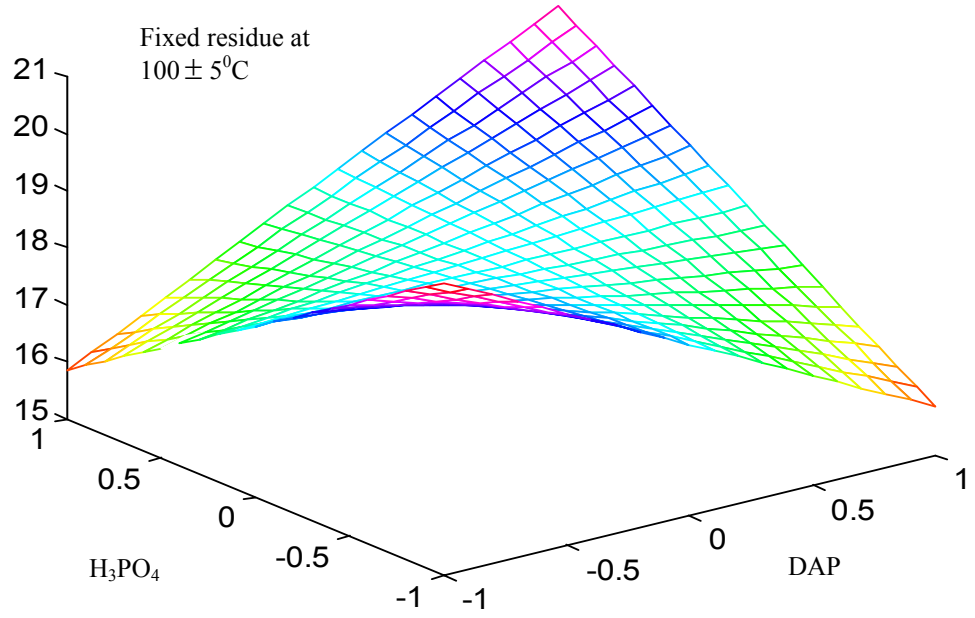

Figure 3. Fixed residue at 100± 5^{0}C measured in the waste waters after flocculation dependent on H_3PO_4 and DAP addition when maintaining the temperature and the time of reaction within the centred range

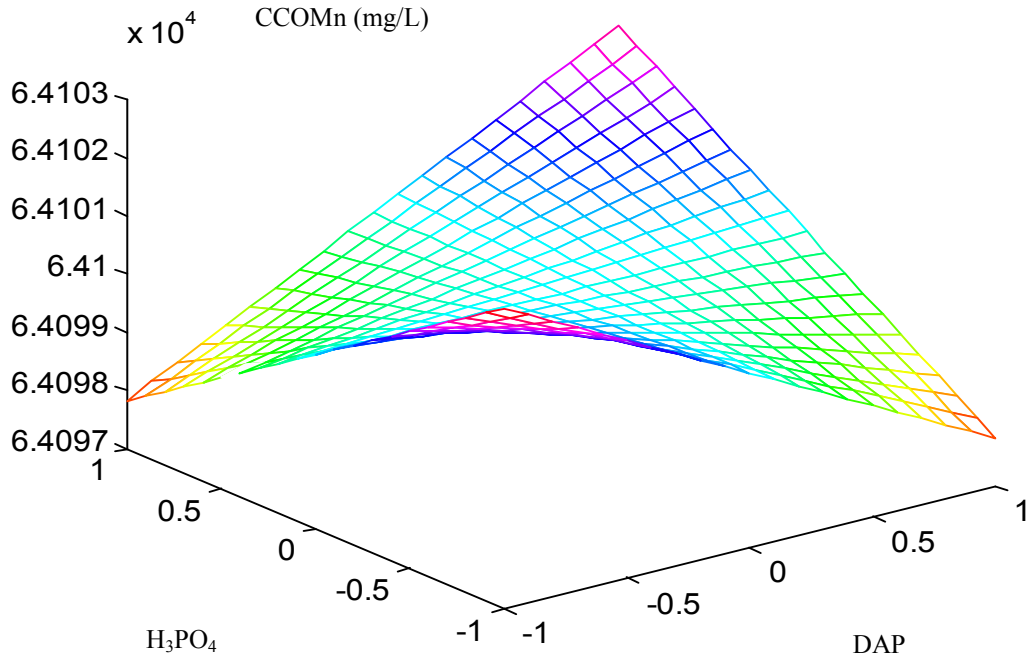

Figure 4. The CCOMn dependent on the H_3PO_4 and DAP addition of when maintaining the temperature and time of reaction within the centred range

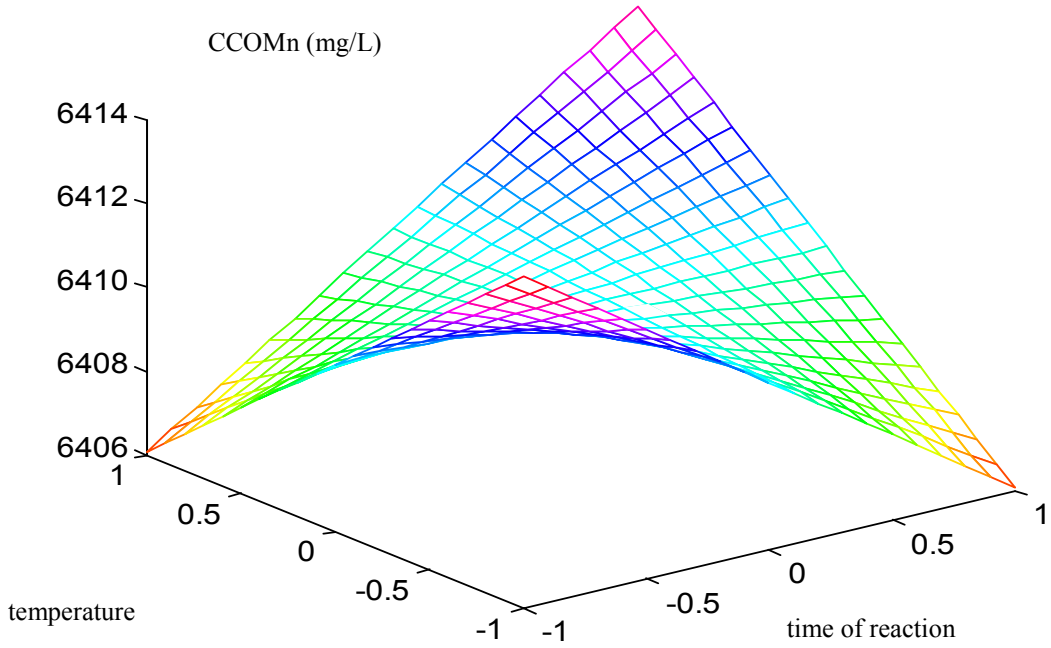

Figure 5. The CCOMn dependent on the temperature and time of reaction when maintaining the addition of H_3PO_4 and DAP addition within the centred range

REFERENCES

1. CIPLEA, L.I., CIPLEA, Al., *Poluarea mediului ambiant*, Ed. Tehnică, Bucureşti, 1981;
2. ŞCHIOPU, D., *Ecologie şi protecţia mediului*, Ed. Didactică şi Pedagogică, Bucureşti, 1997, p. 210;
3. ABDENNADHER, M.N., BORREDON, M.E., DELMAS, M., GASET, A., *Lignines et Chimie Fine*, Information Chimie, 310, 1989, p. 249-256;

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