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ADSORPTION OF IONIC DYES METHYLEN BLUE AND ACID BLUE29 INTO POLYVINYLPYRROLIDONE/BENTONITE COMPOSITE FROM WASTEWATER

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INTRODUCTION

Removal of noxious dyes is gaining public and technological attention. The effectiveness of adsorption as a means of dyes removal has made it an ideal alternative to other more costly treatments. In this study, we were interested to :

- ✓ **synthesize a novel composite based with polyvinylpyrrolidone/sodic bentonite.**
- ✓ **applied this composite for the retention of cationic dye methylen blue and anionic dye acid blue29.**

I. PREPARATION OF PVP/Bt-Na

Bt-Na in distilled water
Stearing 24h

PVP in distilled water

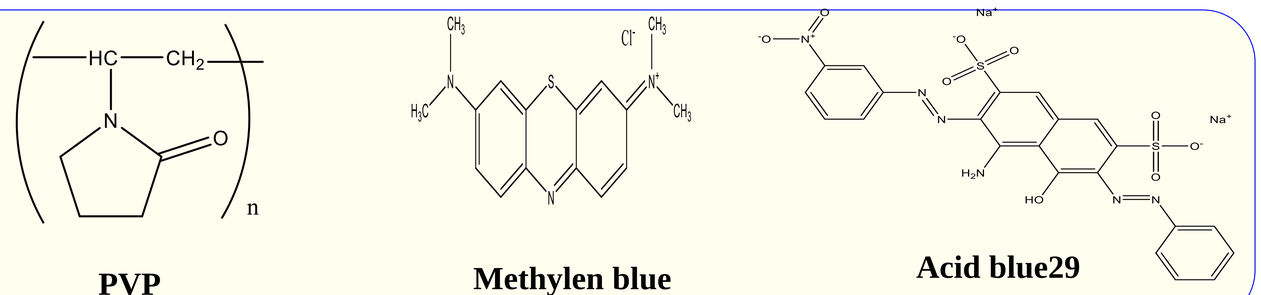
Added PVP drip on to a Bt-Na solution

Stearing 24h

Washing

drying 24 h

Grinding



PVP **Methylen blue** **Acid blue29**

II. CHARACTERIZATIONS

1. FTIR analysis

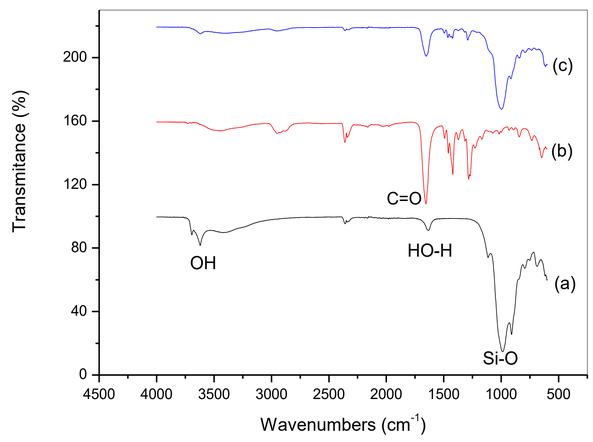


Figure 1: FT-IR spectrum

Table 1: Characteristic bands of Bt-Na

1/λ (cm^{-1})	1000	917	3648 - 3801	3620
Group	Si-OH	Al-OH	R-OH (libre)	R-OH

Table 2: Main bands of PVP

1/λ cm^{-1}	358 6 - 3801	2855 -2924	1180	1642
Group	OH (H_2O)	C-H	C-N	C=O

2. XRD analysis

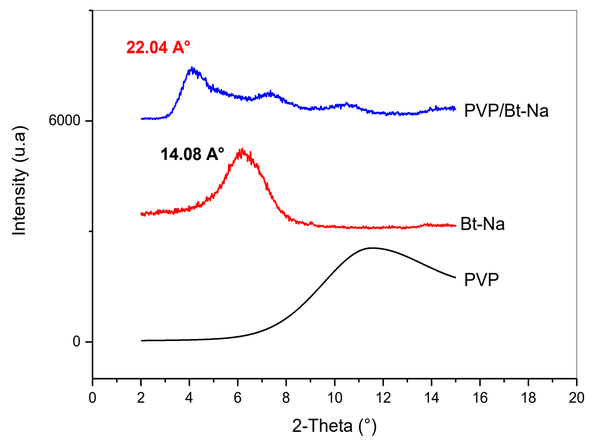


Figure 2: Diffractogramme of the Bt-Na, PVP and PVP/Bt-Na

Intercalation structure of PVP/Bt-Na with d_{001} = 22.04 Å

3. TGA analysis

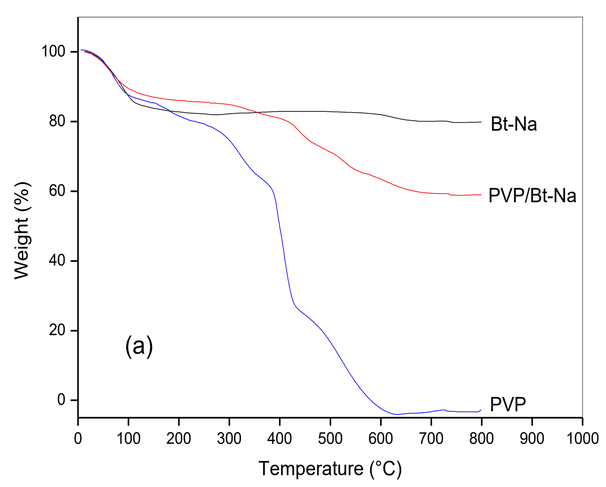


Figure 3: TGA analysis

Table 3. Percentage of intercalated polymer in Bt-Na.

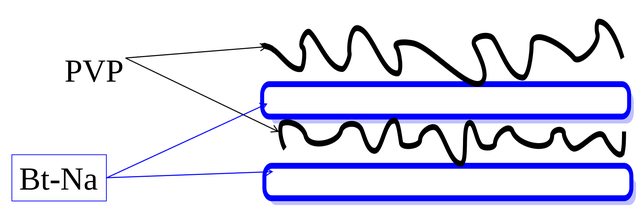
materials	temperature range		
	0 - 200 °C	200 - 700 °C	% Intercalation polymer
Bt-Na	17.2	2.7	/
PVP	15	85	/
PVP/Bt-Na	14	26.55	23.85

4. Zeta potential analysis

Table 4:alues of zeta potential

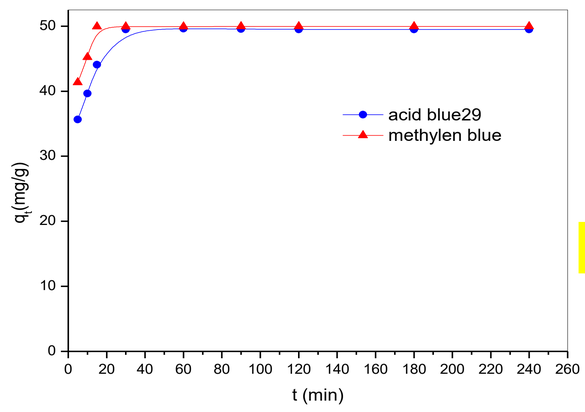
	Bt-Na	PVP/Bt-Na
ζ (mV) (à pH= 6,15)	- 2,84	- 0,493

Reduction of the negative charge of Bt-Na



III. ADSORPTION RESULTS

1. Effect of contact time



q_t (BM)= 49,98 mg/g

q_t(AB 29) = 49,51 mg/g

Figure 4: Effect of the contact time

Table 5: Parameters of the pseudo-first order and pseudo-second order models for the adsorption of dyes on PVP/Bt-Na

		Pseudo premier ordre			**Pseudo deuxième ordre**		
BM	**q_e, exp (mg/g)**	k_1 (min^{-1})	q_e calc (mg/g)	R^2	k_2 (min.g.mg^{-1})	**q_e calc (mg/g)**	R^2
	49,98	0,09	12,74	0,98	0,01	**49,18**	**0,99**
AB 29	**49,51**	0,22	78,41	0,94	0,01	**49,92**	**0,99**

3. Effect of concentration

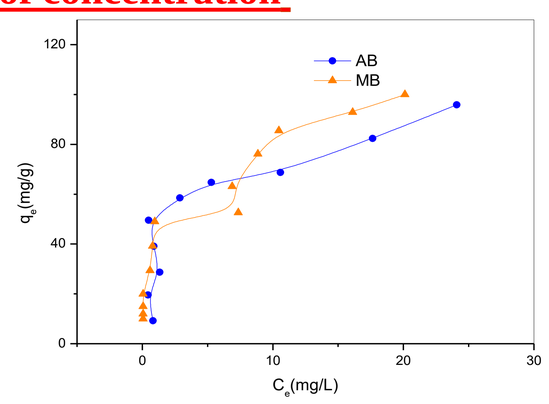


Figure 5: Effect of the initial concentration on the capacity of adsorption

Table 6:Coefficients for the adsorption isotherm of dyes on PVP/Bt-Na

	Coefficients de Freundlich			Coefficients de Langmuir		
	n	K_F	R^2	q_m (mg.g^{-1})	K_L (L.mg^{-1})	R^2
BM	3,44	38,46	**0,98**	64,93	4,25	0,95
AB 29	4,34	24,53	**0,99**	47,93	0,04	0,93

3. Effect of temperature

Table 7:Thermodynamic data for adsorption of dyes onto PVP/Bt-Na

	ΔH (KJ/mol)	ΔS (KJ/mol.K)	R^2	ΔG (kJ/mol) 296 K	Δ (kJ/mol) 308 K	Δ(kJ/mol) 318 K	Δ(kJ/mol) 328 K
BM	- 73,32	-0,186	0,99	-18,26	-16,032	-14,17	-12,31
AB 29	-69,50	-0,195	0,99	-11,78	-10,98	-9,08	-7,18

spontaneous and endothermic process

CONCLUSION

- ✓Composite based with PVP and sodic bentonite was prepared as new adsorbent for ionc dyes.
- ✓ The intercalation of polymer in the bentonite was confirmed by DRX and TGA analysis.
- ✓Kinetic data of adsorption of dyes were well fitted by the pseudo-second-order kinetic model, while the isotherm data were well represented by the Freundlich model.
- ✓The adsorption of dyes was spantaneous ans endothermic nature.
- ✓ The study of the adsorption of **methylen blue and acid blue29** by the **PVP/Bt-Na** showed that the latter is a good candidate of adsorbing materials.