Histidine-Bentonite: The Prospective Adsorbent for Pesticides in Drinking Water

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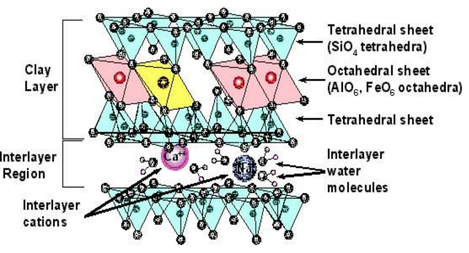
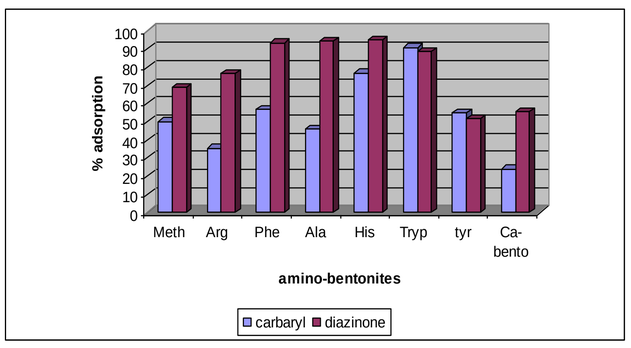


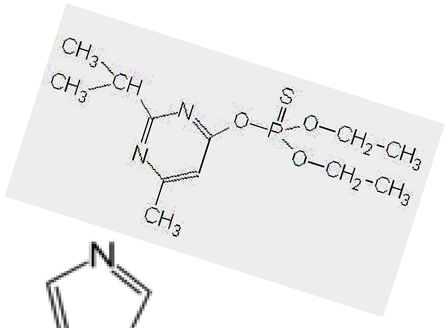
Ca-bentonite Structure



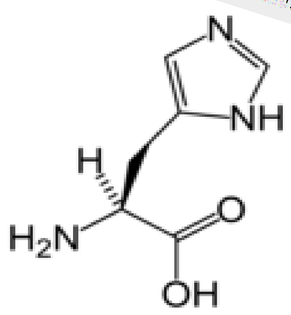
The efficiency of carbaryl and diazinone adsorption onto some amino-bentonites, compared with Ca-bentonites.

Introduction

From the previous study, Histidine-bentonite is founded as the most powerful adsorbent for pestisides residues in water. It is very interesting to know more over about kinetics, mechanism, and capacity of adsorption.



Diazinone



Histidine

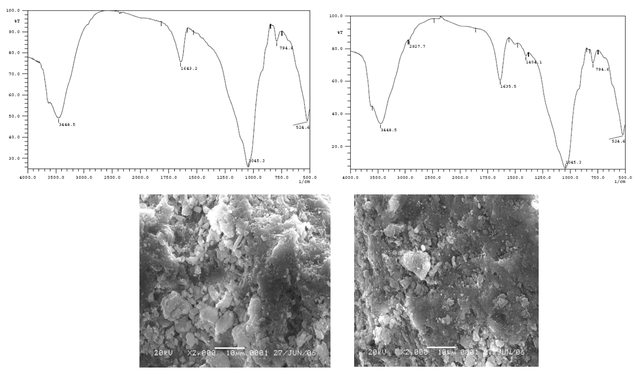
Methods

Kinetics of adsorption of diazinon → Determination of rate and equillibrium constant → **Measured by Spectrometer UV**

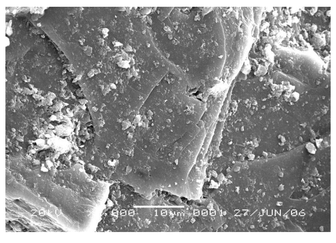
Mechanism of adsorption of diazinone → Learned by continue desorption process: Trapping, complex formation, ion exchange, and hydrogen bonding → **Measured by Spectrometer UV**

Capacity of diazinon adsorption → Langmuir and Freundlich approaches → Measured by Spectrometer UV

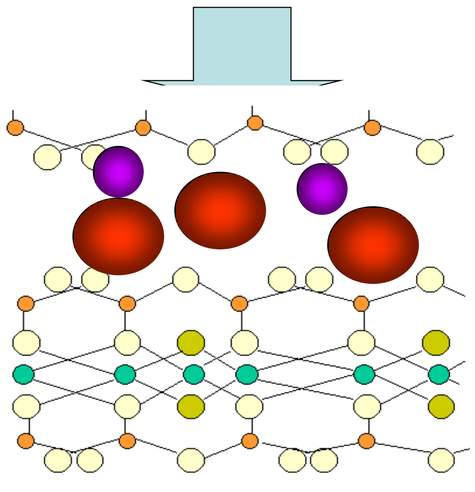
Result and Discussion



No change in surface character of bentonite before and after histidine modification



Surface of histidine-betonite became smoother after diazinone adsorption



- Histidine cation exchanges calsium ion from inner layer
- Diazinone interact with adsorbent in surface

FTIR Spectra of Ca-bentonite (a) and histidine bentonite (b). Weak peaks of histidine observed at

2927,7 cm^{-1} and 1404,1 cm-1 from (b) are the C-H strecth and bend vibrations, and characteristic for histidine.

Adsorbents	Parameter Kinetics	
	k ($minute^{-1}$)	K$(mol/L)^{-1}$
Ca-Bentonite	2,1 x 10^{-7}	1,7943 x 10^{4}
His- bentonite	20,7 x 10^{-7}	26,998 x 10^{4}

Adsorption of diazinon is faster by histidine-bentonite rather than Ca-bentonite. It is because of the different character before and after bentonite modification.

Study on adsorption mechanism of diazinone onto histidine-bentonite adsorbent

No.	Interaction Mechanism	[Diazinon] (mg/L)	% Contribution
1	Trapping	0	0%
2	Complex formation (Na-citrate)	0,41	3,83%
3	Ion exchange (NaCl)	1,485	13,88%
4	Hydrogen bonding (NaOH)	6,12	57,20%
5	Other mechanism	2,684	25,09%
	Sum	**10,699**	**100%**

Adsorption of diazinone onto histidine-bentonite through the chemical interaction. This is due to the adsorption energy as much as 21,854 kJ/mol, larger than minimum chemical adsorption energy (20,82 kJ/mol)

Diazinone Adsorption Capacity

Langmuir				Freundlich		
K(ads) (L/mol)	q_m (mg/g)	E (kJ/mol)	R^2	q_m (mg/g)	1/n	R^2
2,10E-02	6,660	21,854	0,9716	1,4856	0,898	0,9757

The adsorption process is depend on Langmuir Isoterm adsorption. Every active site is content of a molecule adsorbate.

Conclusion

The mechanism of diazinone adsorption onto histidine-bentonite adsorbent was dominated by hydrogen bonding (chemisorptions). This is deal with the adsorption energy that was found as much as 21.854 kJ/mole. The chemisorptions phenomena has good relation to the great capacity of adsorption that has found to be 6,660 mg/g (Langmuir approach) and 1,487 mg/g (Freundlich approach), larger than adsorption by raw bentonite.

Literature:

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