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Adsorption Efficiency of Diatomaceous Earth for Mycotoxin

R.M. Natour and S.M. Yousef

Department of Biological Sciences, Faculty of Scinece, University of Jordan, P.O. Box 13126, Amman 11942, Jordan

ABSTRACT. Thirty one diatomaceous earth samples (sediments), belonging to Pliocene-Pleistocene era, taken from different pore holes at different depths from Azraq depression, were obtained from Jordan Authority for Natural Resources. After activation, the samples were tested for their ability to adsorb six potent mycotoxins (Aflatoxin B_1, Aflatoxin M_1, Sterigmatocystin, Zearalenone, T-2 toxin and Ochratoxin A). Adsorption tests were carried out by placing 0.05 to 0.2 g of the activated sediments into 100 ml water-methanol solution (1:4 v/v), containing a mycotoxin level ranging from 0.25 to 5.0 ppm.

The sediments of 45-63 μm dia, showed significant rates of adsorption for all mycotoxins, reaching 100% for aflatoxin B_1. Maximum adsorption was achieved with particle size of 45-63 μm, incubated at 25° C for 15 to 25 minutes. Moreover, adsorption efficiency of sediments was found to be directly proportional to the number of diatom frustules (valves). Incubation of solutes for periods longer than 25 minutes, often did not cause significant increase in adsorption of aflatoxins. The sediments manifested significant adsorption of all mycotoxins in the following order: B_1 > Sterigmatocystin > M_1 > T-2 > Zearalenone and Ochratoxin A.

Diatomite deposits are known to have an excellent potential for pollution control in liquids. Diatomite filters were used by the allies, during the second world war, for filtering potable water (Anon 1987). Also, clay deposits were successfully used for pollution control in liquids. Addition of activated Kaolin, at the rate of 3% to groundnut oil contaminated with aflatoxins, and heating for 15 minutes at 80 °C, gave satisfactory results in ridding the oil of the aflatoxins (Miller *et al.* 1985).

Moreover, it was found that clay soils could act as barriers against dispersion of toxic metals, detergents and dyes in liquids (Raymahashay 1987). Illite and Kaolinite types of clay were found to be suitable for the production of ceramic filters which are highly efficient in trapping bacteria (Ja'ffar *et al.* 1990).

Extensive deposits of diatomaceous earth was discovered by the Natural Resources Authority of Jordan in 1990, in Azraq area in east Jordan (Qarará and Aláli 1990). Up to 96 percent of diatom frustules are made of polymerized opaline silica, $Si_2.nH_2O$ (Pritchard and Bradt 1984). Samples of such earth were investigated for the possible use of such sediments as detoxifying agents for some potent mycotoxins. Accordingly, this study was carried out to investigate: 1) the efficiency of these deposits for adsorbing mycotoxins, 2) the relationship between number of diatom frustules in the deposits and their adsorption efficiency and 3) to optimize experimental conditions for mycotoxin adsorption.

Materials and Methods

Thirty one samples of diatomaceous earth, taken from different bore holes, at different depths were obtained from Azraq area, east Jordan by the National Natural Resources Authority. The samples were ground, washed three times with distilled water and kept in an oven at 80° C for twenty four hours for activation. Except for one sample (BT-38; taken at 33-36 m depth) which was sieved through 45, 63, 250 and 500 μm pore size, the rest of samples were used without sieving. This sample contained maximum number of diatom frustules.

For diatom counts and recognition, the samples were examined under 40 x objective and 10 x ocular of a compound light microscope (Olympus). Average number of diatoms in each sample was calculated by counting the number of frustules in ten microscopic fields using five slides prepared from 10% suspension of the sample.

Adsorption tests of sediments under study, using some of the most potent mycotoxins, were made on standard solutions of the toxins. Standard solutions of aflatoxin B_1, aflatoxin M_1, Sterigmatocystin, Zearalenone, T-2 toxin and Ochratoxin A were prepared in methanol-water (4:1 v/v) solutions, at concentrations ranging between 0.25 and 5.0 ppm. These solutions were kept at 4° C in 250 ml Erhlenmeyer flasks covered with aluminum foil until use within one to two days.

Adsorption tests were carried out by adding 0.1 or 0.2 g of each sediment into the appropriate flask, each containing 100 ml of a mycotoxin solution. The flasks

were capped and sealed with paraffin film and immediately placed in a water bath shaker (45 rpm) at 25° C. All treatments were prepared in triplicate. One flask of each treatment was removed at 5 minutes intervals for a cumulative interval of 180 minutes. After removal from the shaker, the flasks were left for two minutes to settle, then small amounts of their aliquots were pipetted in small vials which were sealed with paraffin film and covered with aluminum foil. The vials were kept at 4° C pending analysis for their mycotoxin concentration the following day. Adsorption tests of aflatoxin B_1 were carried out at various temperatures. Such tests were made by using various amounts of diatomite sediments of each of various particle sizes of the BT-38 sample (taken at 33-36 m depth). The sediment fractions were placed in the Erhlenmeyer flasks containing various levels of the aflatoxin.

Thin layer chromatography was made on aluminum sheets (13.5 x 10.0 cm) coated with silica gel. The plates were developed in chloroform-acetone-distilled water (88:12:0.4) until the solvent front has ascended to about 11 cm from the starting line, using a 22 x 21 x 8 cm glass tank, which was kept in the dark (Schuler *et al.* 1973).

After development, the plates were left for 5 minutes to dry at room temperature in the fumehood, then the intensity of mycotoxin spots were scanned with a German densitometer, manufactured by Desaga GMBH Company, Heidelburg, model C60, Germany.

Chromatograms for standard solutions of aflatoxin B_1, containing the toxin at levels of 0.02 to 2.0 ppm were parepared in methanol-water (4:1 v/v). After development, the chromatograms were scanned with the densitometer at 383 nm excitation wavelength. The peak areas were plotted as a function of concentration and the resulting curve (Fig. 1) was used to determine the unknown concentrations for this toxin; as outlined by Bechtold and Johnson 1989. Concentrations of other mycotoxins were determined according to Egon and Moller 1977. The resulting spots were scanned with the densitometer at the following wavelengths: Sterigmatocystin at 360 nm; aflatoxin M_1 at 365 nm; Ochratoxin A at 333 nm; Zearalenone at 274 nm and T-2 toxin at 366 nm. The data obtained were analyzed according to ANOVA test (Davis 1972).

Results and Discussion

Diatomaceous earth sediments added to mycotoxin solutions in methanol-water (4:1), at the rate of 1-2 grams per liter, resulted in high rates of mycotoxin adsorption, reaching 100% after incubation for 15 minutes or more at 25° C and

shaking at 45 rpm (Talbe 1). Moreover, adsorption rate of mycotoxins was directly proportional to the number of diatom frustules (valves) in the sediments. Maximum adsorption (100%) was achieved with sediments containing 300 or more frustules per microscopic field (Table 2).

Upon testing the effect of sediment particle size on the efficiency of adsorption, it was found that particle size of 45-63 μm, which is comparable with the size of most diatom frustules in sediments, to be the most efficient in adsorbing aflatoxin. Adsorption by this particle size exhibited significant difference from that achieved with the smaller or larger particles (Table 3).

As to the effect of incubation temperature on adsorption, the results indicated maximum adsorption of aflatoxin B_1 to occur at 25° C. However, adsorption at either 15 or 35° C did not differ significantly from that at 25° C (Table 4).

Adsorption of the other mycotoxins (sterigmatocystin, aflatoxin M_1, T-2 toxin, Zearalenone and Ochratoxin A) with the diatomaceous sediments, under the optimum adsorption conditions, was far less than aflatoxin B_1. However, significantly more adsorption of these mycotoxins took place in solutions containing them at the level of 0.75 ppm and after 30 minutes of contact. Also, among these mycotoxins, maximum adsorption was achieved for aflatoxin B_1, M_1 and Sterigmatocystin which are biogenetically related. Significantly lesser amounts of Ochratoxin A and Zearalenone were adsorbed. Considering the time factor in mycotoxin adsorption by the sediments, the results indicated that significantly higher adsorption occurred at 15 minutes of incubation or more. Moreover, adsorption of the mycotoxins did not increase significantly after incubation for more than 30 minutes (Table 5).

Using the diatomaceous sediments of 45-63 μm particle size, at the rate of 0.1 g in 100 ml solution, maximum adsorption aflatoxin B_1 (reaching 100%) was achieved in solutions containing the aflatoxin at rates up to 1.25 ppm, after incubation for 25 minutes or higher. Adsorption of the aflatoxin B_1 was more efficient in solutions contining it at levels of 1 ppm or less, than at higher concentrations (Table 6).

Multiple regression analysis of adsorption on incubation time and mass revealed the followings:

1. The multiple regression equation of adsorption rate (Y) on incubation time (T) and mass (M) is:

$$Y = 0.154 - 0.000114\ T - 0.725\ M$$

which indicates that time has no significant effect on the adsorption rate, while the mass has a significant effect on it.

2. The regression model is significant with r^2 value of 43.7%.

Multiple regression analysis of adsorption rate on incubation time and concentrations revealed the followings:

1. The regression equation of adsorption rate (Y) on incubation time (T) and concentration (X) is:

$$Y = -0.065477 + 0.232951\ X - 0.000437\ T$$

which indicates that time has no significant effect on adsorption rate, while the mycotoxin concentration has significant effect.

2. The regression model is significant with r^2 value of 83.03 %.

The results obtained indicated that diatomaceous sediments have great efficiency for adsorbing mycotoxins in solutions and that their adsorbing efficiency is directly proportional to the number of diatoms in the sediments, which indicate the capability of diatoms to adsorb mycotoxins. A previous report (Grim 1982) demonstrated the ability of diatom frustules to interact with certain cations and anions. Due to their silicate sieve-like structures, diatom frustules have the ability to hold, by physical or chemical interactions, various contaminants, such as cysts, coliform bacteria, dyes and other materials (Schuler and Gosh 1990).

A recent study on the stratification and identification of diatom frustules in the sediments, revealed that frustules contain four major types of diatoms. Three of these, which constituted more than 99% of the diatom flora, are representatives of *Aulacosira, Actinocylus* and *Cyclotella* spp of the centric (sieve-like) diatoms. The fourth group is represented by several pennate diatom spp. Moreover, most of the centric diatoms have a diameter of 45-60 µm dia. which may explain why the 45-63 µm dia. particles of the sediments were found to be most efficient in mycotoxin adsorption.

Conclusions

This study revealed that diatom frustules have a strong potential for adsorping

mycotoxins, particularly aflatoxin B_1 and the related mycotoxins, at ambient temperatures and within a short time of incubation (15-25 min.).

Significant adsorption rates of all mycotoxins tested was attained with diatomite sediments (45-63 μm particle size) rich with diatom frustules.

The mycotoxins tested, particularly aflatoxin B_1 and M_1, are of frequent occurrences in certain human food and animal feed stuffs. Accordingly, diatomite sediments may be considered for utilization in the treatment of mycotoxin contaminated materials of importance, particularly animal feed stuffs.

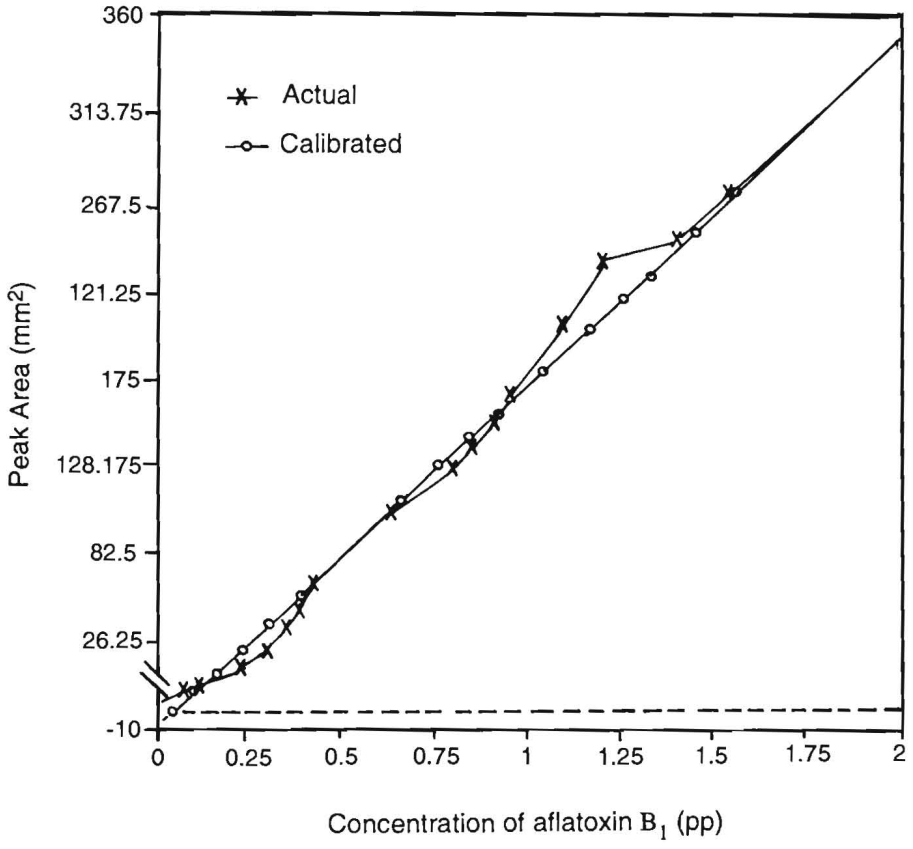

Fig. 1. Actual and calibrated concentrations of aflatoxin B_1 standard solutions (ppm).

Table 1. Adsorption of Aflatoxin B_1 (0.5 ppm) with different masses of BT-38 sediment (33-36 m depth) in 100 ml methanol solutions

Masses	0.05 g		0.075 g		0.1 g		0.125 g		0.150 g		0.175 g		1.00 g	
Time (minutes)	Recov. Conc. (PPm)	Adsorp-tion (%)	Recov. Conc. (PPm)	Adsorp-tion (%)	Recov. Conc. (PPm)	Adsorp-tion (%)	Recov. Conc. (PPm)	Adsorp-tion (%)	Recov. Conc. (PPm)	Adsorp-tion (%)	Recov. Conc. (PPm)	Adsorp-tion (%)	Recov. Conc. (PPm)	Adsorp-tion (%)
5	0.16 Ca	68	0.06 Ba	88	0.05 Aa	90	0.10 Aa	80	0.03 Aa	94	0.06 Aa	88	0.07 Aa	86
10	0.17 Ca	66	0.08 Ba	84	0.03 Aa	94	0.08 Aa	84	0.03 Aa	94	0.06 Aa	88	0.09 Aa	82
15	0.18 Ca	64	0.04 Ba	82	0.04 Aa	92	0.05 Aa	90	0.04 Aa	92	0.03 Aa	94	0.00 Aa	100
20	0.15 Ca	70	0.08 Ba	84	0.06 Aa	88	0.01 Aa	92	0.06 Aa	88	0.00 Aa	100	0.02 Aa	96
25	0.17 Ca	66	0.07 Ba	86	0.00 Aa	100	0.00 Aa	100	0.05 Aa	90	0.05 Aa	90	0.00 Aa	100
30	0.18 Ca	64	0.09 Ba	82	0.04 Aa	92	0.04 Aa	92	0.04 Aa	92	0.05 Aa	90	0.03 Aa	94
60	0.18 Ca	64	0.07 Ba	86	0.03 Aa	94	0.03 Aa	94	0.00 Aa	100	0.04 Aa	92	0.03 Aa	94
90	0.17 Ca	62	0.08 Ba	84	0.05 Aa	90	0.02 Aa	96	0.02 Aa	96	0.03 Aa	94	0.02 Aa	96
120	0.20 Ca	60	0.09 Ba	82	0.00 Aa	100	0.00 Aa	100	0.03 Aa	94	0.00 Aa	100	0.03 Aa	94
150	0.19 Ca	62	0.07 Ba	86	0.00 Aa	100	0.00 Aa	100	0.00 Aa	100	0.00 Aa	100	0.04 Aa	92
180	0.17 Ca	62	0.07 Ba	86	0.00 Aa	100	0.03 Aa	94	0.00 Aa	100	0.03 Aa	94	0.03 Aa	94

Footnote: Means within the same column having similar letters are not significantly different.

Table 2. Adsorption of Aflatoxin B_1 after 90 minutes of treatment with 0.1 gm of different diatom sediments

Parameter Measured* / Sample and depth (M)**	Remaining Concentration (ppm)	Adsorption (%)	Number of diaom frustules
BT-2			
27-30	0.00	100	320
33.37.1	0.00	100	330
37.1-40	0.62	38	0
40-43	0.34	66	10
43-46	0.35	65	10
46-49	0.74	26	0
49-50.5	0.36	64	6
50.5-51.5	0.52	48	0
51.5-54	0.56	44	0
BT-12			
25-26.8	0.36	64	6
26.8-28	0.45	55	3
28-29	0.66	34	0
BT-30			
25-27	0.12	88	170
BT-31			
33-36	0.67	33	0.00
BT-39-41	0.12	88	140
BT-38			
30-33	0.25	74	100
33-36	0.00	100	150
37-39	0.15	85	200
39-42	0.29	71	10
45-47	0.11	89	220
47-50	0.00	100	350
50-53	0.49	51	0
53-65	0.84	16	0
BT-42			
27-30	0.22	78	80
30-33	0.41	59	3
37-37.5	0.79	21	0
40.5-41	0.86	14	0
42-43	0.88	12	0
43-45	0.29	71	10
BT-44			
28.5-29.5	0.00	100	300
39.5-42	0.17	83	140

* Average of 50 readings.

** Footnote: The BT-2, BT-12 *etc.* represent the bore hole from which samples were taken; other numbers *i.e.* 27-37, 33-37.1 *etc.* refer to the depth at which the sample was taken. The sample BT-38 taken from 33-36 m depth which was the richest in diatom frustules was used for all experiments, the rest of the samples in this table which contained lesser amounts of frustules were excluded.

Table 3. Adsorption of Aflatoxin B_1 with 0.1 gm of BT-38 of various particle sizes in 100 ml methanol solutions

Particle Size	< 45 μm		45-63 μm		63-125 μm		125-250 μm		250-500 μm		> 500 μm		Mean	Standard deviation
No diatom frustules*	130		250		130		150		50		30			
Time (minutes)	ppm	Adsorp-tion (%)	ppm	Adsorp-tion (%)	ppm	Adsorp-tion (%)	ppm	Adsorp-tion (%)	ppm	Adsorp-tion (%)	ppm	Adsorp-tion (%)		
5	0.17Bb	66	0.05 Ab	90.	0.23 Bb	54	0.13 Cb	38	0.32 Db	36	0.36 Db	28	0.24	0.11
10	0.13 Bb	74	0.03 Ab	94	0.19 Bb	67	0.03 Cb	40	0.31 Db	38	0.36 Db	28	0.22	0.13
15	0.14 Bb	72	0.04 Ab	92	0.15 Bb	70	0.03 Cb	40	0.28 Db	44	0.34 Db	32	0.21	0.12
20	0.15 Ba	70	0.06 Aa	88	0.07 Ba	82	0.26 Ca	48	0.30 Da	40	0.36 Da	28	0.20	0.12
25	0.14 Ba	72	0.00 Aa	100	0.06 Ba	88	0.25 Ca	50	0.34 Da	32	0.36 Da	28	0.19	0.15
30	0.13 Ba	74	0.04 Aa	92	0.06 Ba	88	0.25 Ca	50	0.34 Da	32	0.31 Da	38	0.20	0.13
60	0.13 Ba	74	0.03 Aa	94	0.07 Ba	86	0.18 Ca	64	0.31 Da	38	0.33 Da	34	0.18	0.12
90	0.13 Ba	74	0.05 Aa	90	0.08 Ba	84	0.15 Ca	70	0.33 Da	34	0.34 Da	32	0.18	0.12
120	0.16 Ba	68	0.00 Aa	100	0.07 Ba	86	0.16 Ca	68	0.33 Da	34	0.31 Da	38	0.18	0.12
150	0.15 Ba	70	0.00 Aa	100	0.07 Ba	86	0.18 Ca	64	0.31 Da	30	0.32 Da	36	0.18	0.11
180	0.11 Ba	72	0.00 Aa	100	0.08 Ba	84	0.17 Ca	66	0.31 Da	30	0.33 Da	34	0.18	0.11

Footnote: Means within the same column having similar letters are not significantly different.
*Average frustule count of 50 readings.

Table 4. Adsorption of Aflatoxin B_1 (0.5 ppm) with 0.1 g sediment of BT-38 (45-63 μm particle size) from 100 ml methanol - water solutions, at different temperatures during 180 minutes

Temp. (C°)	15		25		35		45		45		Mean	Standard deviation
Time (minutes)	Conc. (ppm)	Adsorp-tion (%)	Conc. (ppm)	Adsorp-tion (%)	Conc. (ppm)	Adsorp-tion (%)	Conc. (ppm)	Adsorp-tion (%)	Conc. (ppm)	Adsorp-tion (%)		
5	0.08 Ab	84	0.05 Ab	90	0.09 Ab	82	0.20 Bb	60	0.22 Bb	56	0.13	0.08
10	0.05 Ab	90	0.03 Ab	94	0.07 Ab	86	0.18 Bb	64	0.21 Bb	58	0.11	0.08
15	0.05 Ab	90	0.04 Ab	97	0.00 Ab	84	0.16 Bb	68	0.20 Bb	60	0.11	0.07
20	0.06 Ab	88	0.60 Ab	88	0.07 Ab	86	0.17 Bb	86	0.19 Bb	62	0.11	0.06
25	0.04 Aa	92	0.00 Aa	100	0.03 Aa	94	0.14 Ba	72	0.15 Ba	70	0.07	0.07
30	0.06 Aa	88	0.04 Aa	92	0.06 Aa	88	0.14 Ba	72	0.17 Ba	66	0.09	0.06
60	0.04 Aa	92	0.03 Aa	94	0.04 Aa	92	0.16 Ba	68	0.16 Ba	68	0.09	0.07
90	0.05 Aa	90	0.05 Aa	90	0.06 Aa	88	0.15 Ba	70	0.18 Ba	64	0.09	0.06
120	0.04 Aa	92	0.00 Aa	100	0.04 Aa	92	0.18 Ba	64	0.20 Ba	60	0.09	0.09
150	0.04 Aa	92	0.00 Aa	100	0.05 Aa	90	0.14 Ba	72	0.21 Ba	50	0.09	0.08
180	0.05 Aa	90	0.00 Aa	100	0.07 Aa	86	0.18 Ba	64	0.17 Ba	66	0.09	0.09

Footnote: Means within the same column having similar letters are not significantly different.

Table 5. Adsorption of mycotoxins in 0.2 g of BT-38 (45-63 µm particle size) in 100 ml methanol solution, containing mycotoxins at levels of 0.75, 2 and 5 ppm, after 50 and 30 minutes of incubation at 25° C and shaking at 45 rpm

Conc. (ppm)	0.75				2				5			
Incubation time (minutes)	15		30		15		30		15		30	
Mycotoxins	Recovered Conc. (ppm)	Adsorption (%)	Recovered Conc. (ppm)	Adsorption (%)	Recovered Conc. (ppm)	Adsorption (%)	Recovered Conc. (ppm)	Adsorption (%)	Recovered Conc. (ppm)	Adsorption (%)	Recovered Conc. (ppm)	Adsorption (%)
Ochratoxin A	0.53 Cb	29.30	0.42 Ca	44.00	1.50 Cb	25	1.30 Ca	35	4.20 Cb	16	3.50 Ca	30
1-2 toxin	0.44 Cb	41.30	0.40 Ca	46.70	1.40 Cb	30	1.20 Ca	40	4.10 Cb	18	3.50 Ca	30
Zearalenone	0.51 Cb	32.00	0.43 Ca	42.00	1.50 Cb	25	1.30 Ca	35	3.90 Cb	22	3.30 Ca	34
Sterigmatocystin	0.11 Ab	85.30	0.03 Aa	89.30	0.40 Ab	80	0.30 Aa	35	1.50 Ab	70	1.10 Aa	78
Aflatoxin B_1	0.00 Aa	100	0.00 Aa	100	0.25 Aa	87.50	0.25 Aa	87.5	1.30 Ba	74	1.28 Ba	74
Aflatoxin M_1	0.18 Bb	76	0.14 Ba	81.30	0.60 Bb	70	0.40 Ba	80	1.90 Bb	62	1.30 Ba	74

Footnote: Means within the same column having similar letters are not significantly different.

Table 6. Adsorption of Aflatoxin B_1 (0.25-200 ppm) with 0.1 gm of BT-38 sediment (particle size 45-63 μm), from 100 ml methanol-water solutions at 25° C

Aflatoxin conc.	0.25 ppm		0.5 ppm		0.75 ppm		1 ppm		1.25 ppm		1.5 ppm		2.5 ppm		Mean
Time (minutes)	Recov. Conc. (PPm)	Adsorp-tion (%)	Recov. Conc. (PPm)	Adsorp-tion (%)	Recov. Conc. (PPm)	Adsorp-tion (%)	Recov. Conc. (PPm)	Adsorp-tion (%)	Recov. Conc. (PPm)	Adsorp-tion (%)	Recov. Conc. (PPm)	Adsorp-tion (%)	Recov. Conc. (PPm)	Adsorp-tion (%)	
5	0.03 Ac	88	0.05 Ac	90	0.07 Ac	90.7	0.27 Bc	73	0.25 Bc	80	0.40 Cc	67.3	0.59 Dc	70.5	0.25
10	0.04 Ab	84	0.03 Ab	94	0.05 Ab	93.3	0.22 Bb	78	0.17 Bb	86.4	0.33 Cb	76.7	0.50 Db	75	0.19
15	0.03 Ab	88	0.04 Ab	92	0.00 Aa	100	0.13 Bb	87	0.19 Bb	84.8	0.34 Cb	77.3	0.54 Db	73	0.18
20	0.04 Ab	84	0.06 Ab	88	0.04 Ab	94.7	0.14 Bb	86	0.11 Bb	91.2	0.30 Cb	80	0.41 Db	79.5	0.16
25	0.01 Aa	96	0.00 Aa	100	0.03 Aa	96	0.09 Ba	91	0.12 Ba	90.4	0.28 Ca	85.3	0.38 Da	81	0.13
30	0.02 Aa	92	0.04 Aa	92	0.04 Aa	94.7	0.10 Ba	90	0.11 Ba	91.2	0.24 Ca	84	0.34 Da	83	0.13
60	0.02 Aa	92	0.03 Aa	94	0.00 Aa	100	0.12 Ba	88	0.12 Ba	90.4	0.18 Ca	88	0.34 Da	83	0.12
90	0.00 Aa	100	0.05 Aa	90	0.04 Aa	94.7	0.08 Ba	92	0.12 Ba	90.4	0.21 Ca	86	0.35 Da	82.5	0.12
120	0.01 Aa	96	0.00 Aa	100	0.00 Aa	100	0.09 Ba	91	0.09 Ba	92.8	0.23 Ca	84.7	0.38 Da	81	0.11
150	0.02 Aa	92	0.00 Aa	100	0.00 Aa	100	0.12 Ba	88	0.11 Ba	91.2	0.22 Ca	85.3	0.34 Da	83	0.12
180	0.00 Aa	100	0.00 Aa	100	0.00 Aa	100	0.09 Ba	91	0.13 Ba	89.6	0.18 Ca	88	0.36 Da	82	0.11

Footnote: Means within the same column having similar letters are not significantly different.

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كفاءة تربة الدياتومات في إدمصاص السموم الفطرية

رشاد مصطفى صالح الناطور و سوسن محمد يوسف

قسم العلوم الحياتية - كلية العلوم - الجامعة الأردنية
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أجري هذا البحث على ترسبات دياتومات من العصر المايوسيني - البلايوسين التي وجدت في منطقة الازرق بالاردن والتي تحتوي على أعداد مختلفة من هذه الكائنات . أخذت العينات من آبار مختلفة من منخفض الأزرق بواسطة سلطة المصادر الطبيعية الاردنية . بعد تنشيطها ، تم الكشف عن مقدرتها على إدمصاص السموم الفطرية في المحلول المكون من الماء والايثانول بنسبة ١ : ٤ ، باضافة الترسبات الدياتومية إلى المحاليل التي تحتوي على السموم بتراكيز تتراوح ما بين ٢٥ , ٠ إلى ٥ جزء في المليون ، بمقدار ٠٥ , ٠ إلى ٢ , ٠ جم لكل ١٠٠ مليلتر . كما أجريت تجارب على إدمصاص الافلاتوكسين ب١ تحت درجات حرارة مختلفة ، ابتداء من ١٥°م وإلى ٥٥°م باستعمال ترسبات غنية بالدياتومات ، احتوت على ٣٥٠جدار خلوي في المجال المجهري الواحد ، تحت عدسة شيئية ٤٠x وعدسة عينية ١٠x ، تم طحنها للحصول على حبيبات بحجم ٤٥-٦٣ ميكرون إلى ما يزيد على ٥٠٠ ميكرون .

تبين من هذا البحث أن الترسبات ذات الحبيبات بحجم ٤٥-٦٣ ميكرون ، قد تمكنت من إدمصاص كميات كبيرة من السموم الفطرية ، بلغت

في اقصاها ١٠٠٪ في المحاليل التي احتوت على الأفلاتوكسين ب١ بمقدار جزء في المليون أو أقل ، خلال ٢٥-١٥دقيقة أو أكثر ، على درجة حرارة ٢٥° م ، وذلك باضافة الترسبات بمقدار ١,٠ جم لكل ١٠٠ مليلتر من محلول السم .

كما تبين أيضاً أن مقدرة الترسب الدياتومي على إدمصاص السم ، تتناسب تناسباً طردياً مع عدد هياكل الدياتومات ، وأن أعلى نسب إدمصاص لسم الأفلاتوكسين ب١ على درجات حرارة ١٥° ، ٢٥-٣٥°م تختلف معنوياً عن تلك عند درجة حرارة أعلى من ذلك .

وبالنسبة للسموم الأخرى ، فلقد تمكنت الترسبات من إدمصاص الافلاتوكسين م١ والسترجماتوسيستين بنسب أكثر معنوية بكثير عن تلك للاكراتوكسين والزيرالينون . ومع ذلك ، فقد تم إدمصاص كافة السموم بكميات معنوية .