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BIOSORPTION OF LEAD BY *Pleurotus sajur- CAJU* FROM WATER AND ITS EFFECT ON LAYING QUAILS PERFORMANCE

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ABSTRACT

The removal of lead as heavy metal from polluted water by alginate beads of both immobilized live and heat killed fungal mycelia of *Pleurotus sajur-caju* and Ca alginate beads were investigated to determine the effect of treated and untreated water on laying Japanese quails performance . A hundred of 13 weeks old laying Japanese quails were divided into five groups, each group contained 20 birds divided into two replicates (10 hens for each) . Group 1 (T1) was allowed to drink water treated by immobilized live fungal mycelia , group 2 (T2) allowed to drink water treated by immobilized heat killed fungal mycelia , group 3 (T3) allowed to drink water treated by calcium alginate , group4 (T4) allowed to drink water contaminated by 0.3025 mg/L lead acetate and group5 (T5) allowed to drink tap water (control) . The treatments were continued for 4 weeks after which all groups allowed to drink tap water for another 4 weeks. Lead acetate at concentration 0.3025 mg/L was added to water and the polluted water was treated by alginate beads of both immobilized live and heat killed fungal mycelia of *Pleurotus sajur-caju* and calcium alginate beads. The concentration of lead in water after treatments decreased to 0.0082, 0.0014 and 0.008 mg/L when the water treated by alginate beads of both immobilized live and heat killed fungal mycelia of *Pleurotus sajur-caju* and Ca alginate beads respectively.. The results indicated that water contaminated by lead acetate increased lead concentration in liver at T4 compared with other treatments .The treatments had insignificant effects on eggs quality parameter, plasma total protein, albumin (A), globulin (G) and A/G ratio while the treatments had significant effect on GPT and GOT, total cholesterol and creatinine , also the weight of spleen decreased insignificantly due to T4 treatment.

Keywords: Pb, Alginate beads, Biosorption, *Pleurotus sajur-caju* , drinking water and Japanese quail performance

INTRODUCTION

The presence of heavy metals in aquatic environments is known to cause severe damage to aquatic life. Lead as heavy metal in nature and highly used in industry, is one of the toxic elements for live structure . Most of heavy metal salts are soluble in water and form aqueous solution and consequently can not be separated by ordinary physical means of separation. Physico-chemical methods such as chemical precipitation, chemical oxidation or reduction, electrochemical treatment, evaporative recovery, filtration,

ion exchange and membrane technologies have been widely used to remove heavy metal ions from industrial waste water. These processes may be ineffective or expansive especially when the heavy metal ions are in solutions containing on order of 1 – 100 mg dissolved heavy metal ions for liter (Volesky, 1990a and Volesky 1990b). Biological methods such as biosorption, bioaccumulation for the removal of heavy metal may provide an attractive alternative to physico-chemical methods (Kapoor and Viraraghavan, 1995) . Microorganisms uptake metal either actively (bioaccumulation) and / or passively(biosorption) as reported by many authors (Andres and Hubert, 1992; Fourest and Roux, 1992 and Hussein, *et al.* 2003) Several researchers have reported that during heavy metal biosorption using heat killed or live fungal cells, the biosorptive capacity of heat killed cells might be greater , equivalent to or less than that of living cells (Okino,*et al.*2000 and Guibal, *et al.* 1992) . Fungi have been attracting a growing interest for biotreatment (removal or destruction) of waste water ingredients such as metals, inorganic nutrients and organic compounds (Field, *et al.* 1993; Feijoo and Lema; 1995 and Palma, *et al.* 1999) . Jian and Zhi (2005) used fungal biomass of *Aspergillus niger* to remove cadmium from aqueous solution while Arica *et al.*(2003) used Ca alginate beads and both immobilized live and heat killed fungal mycelia of *Pleurotus sajur-caju* and *Trametes versicolar* for biosorption of mercuric ions and found that heat killed *T. versicolar* and *P. sajur-caju* removed 73% and 81% of Hg ions respectively from synthetic waste water samples .Pb is a ubiquitous environmental contaminant that cause a variety of toxicological responses in laboratory animals and humans, Goyer (1996). Morgan *et al.*(1975) reported that Pb acetate added to the diet resulted in toxicity at the level of 500 ppm for the Japanese quail and the relative weights of the bursa, spleen, liver and heart were not significantly affected in five wk old male Japanese quail fed a diet contaminated with Pb up to 1000 ppm, Bakalli, *et al.*(1995) demonstrated that dietary lead concentration as low as 1 ppm resulted in decreased weight gain and feed to gain ratio in chickens while Vodela et al.(1997) found that low (0.8,5.0,6.7ppm) or high(8.0,50,67ppm) levels of heavy metals (arsenic, cadmium and lead) in drinking water would affect body weight in chickens. On the other hand Stone *et al.* (1977) showed that the Japanese quail fed on a diet containing 25 ppm of Pb/kg of feed for two weeks were not significantly different from control in tibia weight. This study aims to investigate the removal of lead as heavy metal from water by alginate beads of both immobilized live and heat killed fungal mycelia of *Pleurotus sajur-caju* and determine the effect of treated and untreated water on laying quails performance .

MATERIALS AND METHODS

Pleurotus sajur –caju was maintained by sub culturing on malt dextrose agar slants. The growth medium was prepared using deionized double distilled water, the final pH at 25°C was adjusted to 4.5. Composition of growth medium per liter D- glucose 10 gm, KH_2PO_4 20 gm, $MgSO_4.7H_2O$ 0.5

gm, NH_4Cl 0.1 gm, $CaCl_2.7H_2O$ 0.1gm, thiamine, 0.001 gm, nitrilotriacetate 1.5 gm, NaCl 1.0 gm, $MnSO_4 .H_2O$ 0.5 gm, $FeSO_4.7H_2O$ 0.1gm, $ZnSO_4$ 0.1 gm, $CaSO_4$ 0.01 gm, $CuSO_4.5H_2O$ 0.01 gm, H_3BO_4 0.01gm and $NaMoO_4.2H_2O$ 0.01gm. Inocula were obtained from seven days agar slant culture and used to inoculate 50 ml of medium in 250 ml flasks, and the flasks were incubated on a shaker (150 rpm) for 5 days at 30° C. After this period, the biomass was harvested by filtration from the growth medium and washed several times with distilled waterArica *et al.* (2003).

Immobilization of *Pleurotus sajur-caju*

The immobilization of *P. sajur-caju* mycelium via entrapment was carried out as follows: Na alginate 2.0 gm was dissolved in distilled water and then mixed with the fungal mycelium (50 ml, containing 0.5 fungal biomass). The mixture was introduced into a solution containing 0.1 mol $CaCl_2$ with burette and the solution was stirred to prevent aggregation of the fungus entrapped Ca-alginate beads. The fungus entrapped beads were cured in this solution for 1 hour and then washed twice with 200 ml sterile distilled water. The beads with immobilized mycelia were then transferred to growth medium (50 ml) in 250 ml flasks and were incubated on shaker (150rpm) at 30°C for 3 days. The mycelia growth in/on the beads was followed during the incubation period by using a microscope. After a 3 days incubation period, the Ca-alginate beads with immobilized fungal mycelia were removed from the medium by filtration and washed twice with distilled water. This washed biomass called immobilized live fungus. Immobilized live fungus was heated in 5 mmol $CaCl_2$ solution at 90°C for 10 min; it will be referred to as immobilized heat killed fungus. The immobilized preparations were then stored at 4 °C in 5 mmol $CaCl_2$ solution until use (Arica *et al.*, 2003).

Preparation of drinking water :-

Lead acetate at a concentration of 0.3025 mg/L was dissolved in water and treated with immobilized live fungus (T1), immobilized killed fungus (T2) and Ca alginate beads (T3) while the treatment four (T4) was water containing lead acetate at concentration 0.3025 mg/liter and T5 was tap water (as control). Lead was measured before and after treatments .

Experimental Design :-

Thirteen weeks old Japanese quail laying hens as a commercial strain from Cairo University were used in this experiment. Equal numbers of hens were randomly distributed into five treatment groups. Each group contained 20 birds divided into two replicates (10 hens for each) and raised in wire cages for 8 weeks in an open system house. They were given the diets and treated water *ad libitum* during the experimental periods. The experimental groups were drinking treated water for 4 weeks after that birds drank tap water for 4 weeks too. In this study, diet was formulated (Table 1) to meet the nutrients requirements of laying Japanese Quail according to NRC (1994) .

Productive performance:-

Live body weight, egg number, egg weight, feed consumption and efficiency were measured for all experimental groups before and after treatment.

Table (1): Composition and calculated analysis of the basal experimental diet

Ingredients	Basal diet
Yellow corn	62.01
Soybean 48%	22.95
Corn gluten	6.0
Dicalcuim phosphate	1.5
Calcium carbonate	5.5
Sunflower oil	1.0
Permix*	0.4
Salt	0.32
L-Lysine	0.22
DL-Methionine	0.1
Total	100
Calculated analysis	
Protein	19.911
ME	2966.69
Crude fat	3.76
Crude fiber	2.28
Calcium	2.527
Av. phosphorus	0.398
L-lysine	1.o9
Meth+ Cys.	0.489

***Supplied per Kg of diet : Vit. A.120000 IU; Vit.D.2200IU; Vit. E. 10mg ; Vit. K. 2 mg; Vit. B1, 1mg; Vit. B2, 5mg; Vit. B6, 1.5mg; Vit. B12, 10mg; Nicotinic acid 30mg; Folic acid 1mg; Pantothenic acid 10mg; Biotin 50mg; Choline chloride 500mg; Copper 10mg; Iron 30mg; Manganese 60mg; Zinc 50mg; Iodine 1mg; Selenium 0.1mg and Cobalt 0.1mg .**

Egg quality : Yolk weight, yolk%, albumin weight, albumin %, yolk high, albumin high and yolk diameter were measured .

Salughter traits and biochemical analysis:-

At the end of expermint, two birds of each replicate group were slaughtered , allowed to bleed for blood samples collection, defeatherd and eviscreted and liver, heart , gizzard , spleen, tibia were separated .

Blood samples were collected at the end of each period in heparinized tubes. Plasma was obtained and stored for analysis. Total protein were determined according to Weichselbaum (1946),albumin according to Doumas (1971), cholesterol according to Siedel (1983), globulin (G) was calculated by difference between the total protein and albumin and A/G ratio was calculated, creatinine (mg/dl) according to (Barthes, 1971), glutamic pyruvic transaminase (GPT) (U/l) and glutamic oxalocetic transaminase (GOT) (U/l) were also determined by using available commercial kits (Biomeurix, France).

Determination of lead :-

Samples of tibia, liver, meat and whole eggs were collected from six quails in each group (3 per replicate) and stored at -20 °C in polyethylene bags for heavy metal analysis.The ash content of samples was determined according to the method described by A.O.A.C. (1995) using muffle

(VULCAN A-550) at 550°C until a constant weight was obtained .The resulting ash as obtained previously was dissolved in hydrochloric acid solution 0.2N and analyzed for lead . The concentration of lead was determined by using Atomic Absorption Spectrophotometer (Model Thermo Elemental 300VA- 50-60Hz- 100-240v, U.K.)

Statistical analyses : The data obtained were subjected to analysis of variance according to SPSS, (1997). Significant differences among individual means were analyzed by Duncan's multiple range test (Duncan,1955).

RESULTS AND DISCUSSION

Biosorption of lead ions :

Alginate is a natural polymer and can easily be converted into hydrogels via cross linking with divalent calcium ions. It was preferred over other materials because of its various advantages such as biodegradability, hydrophilicity, presence of carboxylic groups and natural origin.

The water was contaminated by 0.3025 mg/L lead and treated by immobilized live *P. sajur-caju*, immobilized heat killed *P. sajur-caju* and calcium alginate beads. The concentration of lead ions in water after treatment were 0.0082, 0.0014 and 0.008 mg/L for water treated by immobilized live *P. sajur-caju*, immobilized heat killed *P. sajur-caju* and calcium alginate beads respectively while the concentration of lead in tap water was 0.0025 mg/L

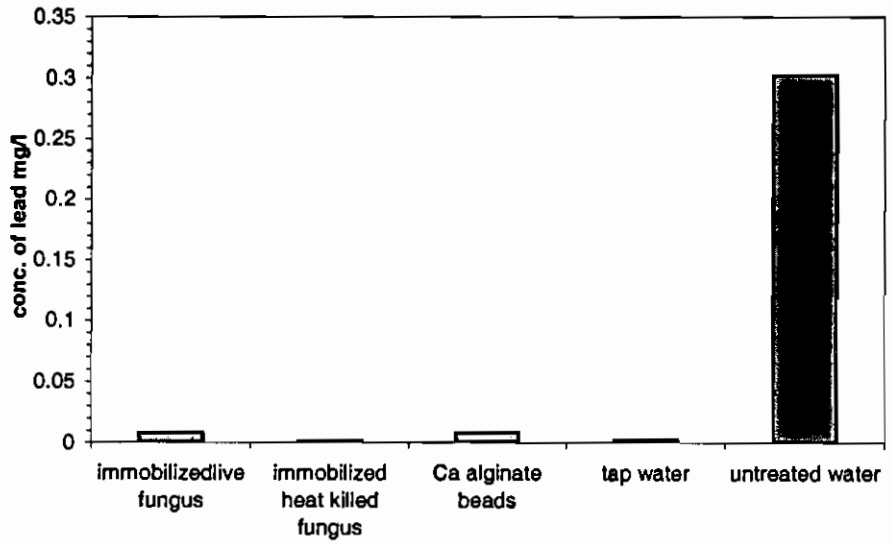

Fig. (1) shows the concentration of Pb ions in water with immobilized live fungus,immobilized heat killed fungus, Ca alginate beads,tap water,and contaminated water.

High biosorption was observed by immobilized heat killed *P. sajur-caju* followed by Ca alginate beads and immobilized live *P. sajur-caju.* Fungal biomass walls are composed of (chitin, chitosan, glucon, lipid and phospholipids) which contain carboxyl macromolecules group, amino group, phosphates, lipid, melanin, sulphates and hydroxides (Kapoor,*et al.* 1999), those functional groups are metals sorption sites (Mullen *et al.*, 1992). White rot fungi are suitable for the degradation of a large variety of pollutants to produce at some time metabolites of great added values (protein and enzymes) and some residual biomass have been used to remove metals and dye from waste water (Coulibaly, *et al.* 2003)

Effect of drinking water on body weight and relative organ weight of quails.

Table (2) showed the mean of body weight and relative organ weight of quails drank contaminated water by lead as lead acetate (0.3mg/l) and treated by immobilized live *P. sajur-caju,*(T1), immobilized heat killed *P. sajur-caju,*(T2), Ca alginate beads (T3), water contaminated (T4) and tap water for 4 weeks (T5) control.

Table (2): Means of body weight and relative organ weight of quails drank treated water for 4 weeks.

Parameters / Treatment	Body weight (g)	Carcass %	Heart %	Liver %	Gizzard%	Spleen %	Tibia %
T1	308.5	67.75	0.765	3.32	1.74	0.053	0.433
T2	333.5	68.59	0.665	2.98	1.685	0.082	0.426
T3	296	68.89	0.7	2.76	1.86	0.056	0.524
T4	256	65.87	0.655	3.14	1.915	0.039	0.52
T5	311	72.58	0.87	2.48	1.735	0.088	0.481
Sig.*	N.S	N.S	N.S	N.S	N.S	N.S	N.S

T1:Polluted water treated by immobilized live mycelia of *P. sajur-caju*
T2: Polluted water treated by immobilized heat killed mycelia of *P. sajur-caju*
T3:Polluted water treated by Ca alginate beads
T4: water contaminated by lead acetate 0.3025 mg/l
T5: tap water
***Sig: Significance. N.S: Non significance**

The mean of body weight of quails drunk T2 was the highest (333.5gm) the lowest weight was (256gm) for T4.All treatments drank tap water for 4 weeks after treatments, The mean of body weight of quails drank T1 was the highest (306gm) while the quails drank T4 was (293 gm) as showed in Table (3). On the other hand, there was insignificant effect on carcass percentage compared to the quails drank tap water . Ozcelik *et al.*(2003) found that weigh of chickens was significantly lower than that of control due to fed by lead acetate (300mg Pb/Kg), Vodela *et al.*(1997) reported that body weight was decreased in chickens provided low and high concentration of (Cd, Pb and arsenic) in drinking water compared with chickens given control drinking water, Grasman and Scanlon, (1995) studied the effect of lead at 400 and 100μg/ml lead as lead acetate in drinking water for 7 days on Japanese quails and found that quails died due to lead poisoning at low and high concentration. Anorexia is a classical sign of lead toxicosis (Osweiler *et*

al.,1985). Anorexia and weight loss occurred in humans exposed to drinking water containing lead levels of 40 to 200 ppm (Pagliuca, *et al.*, 1990).

Table(3): Means of body weight and relative organ weight of quails drank tap water for 4 weeks after treatment .

Parameters / Treatment	Body weight(g)	Carcass %	Heart %	Liver %	Gizzard%	Spleen &	Tibia %
T1	306	68.56	0.802	2.65	2.04	0.23	0.637
T2	301	68.75	0.779	3.199	2.019	0.278	0.591
T3	285.1	69.46	0.687	2.4	1.958	0.17	0.665
T4	293	70.03	0.816	2.86	1.769	0.13	0.738
T5	272	73.33	0.72	1.84	1.901	0.154	0.77
Sig.*	N.S	N.S	N.S	N.S	N.S	N.S	N.S

*Sig: Significance. N.S: Non significance

Heart: Table (2) showed that the percentage of heart weight was decreased in quails at T4(0.655 gm) compared with quails consuming a treated and tap water, on the other hand, the relative heart weight was the highest (0.816 gm) at T4 when the quails drank tap water for 4 weeks after treatment, (Table, 3). An increase in heart weight usually develops as a compensatory response to an increase in work load, Haschek and Rousseaux, (1991), long term exposure of laboratory animals to low level of lead resulting hypertensive effect, Ramos *et al.* (1996).

Liver: The relative liver weight was increased in quails when drank untreated water (T4) compared other treatments and this increasing continued until the quails drank tap water for 4 weeks after treatments, Tables, (2 &3) .Vodela *et al.*(1997) found that liver increased in chickens exposed to high concentration of chemicals and heavy metals in drinking water and detected that liver weight increased due to the chemical and heavy metal in water, Anderson, (1989) observed hepatic necrosis in mice exposed to single dose of 78 mg/kg cadmium, Sun-Young *et al.* (2005) reported that non essential fatty acid were being preferentially degraded for energy in the Pb exposed rats.This is consistent with their lower body weight and lower liver weight, indication of decreased energy intake . When Pb exposure was discontinued and the rats were allowed to recover, the difference between Pb exposed and unexposed group in body and liver weight diminshed with time .

Gizzard: there were insignificant effects on weight of gizzard due to the treatments but the relative weight of gizzard increased at T4 Table (2) as compared with other treatments, on the other hand the relative weight of gizzard decreased at T4 when the quails drank tap water for 4 week after treatments Table (3) . Vodela *et al.*(1997) reported that there was a significant increase in percentage gizzard weight in chickens exposed to low and high levels of chemicals mixture in drinking water and demonstrated that increased percentage gizzard weight were partially due to chemicals mixture and partially due to restricted water consumption .

Spleen: Table (2&3) showed that no significant effect on relative weight of spleen when the quails drank treated water for 4 weeks or when all groups drank tap water for 4 weeks after treatments and the weight of spleen decreased insignificantly compared to the other treatments. This results

similar to Stone *et al.* (1977) who found that the relative weights of spleen, liver and heart were not significantly affected when the Japanese quail fed a diet contaminated with Pb as (Pb acetate) up to 1000 ppm .

Tibia: Tables (2&3) showed that there was insignificantly effects on weight of tibia when the quails drank contaminated or treated water by Pb or drank tap water for 4 weeks after treatments, Stone *et al.* (1977) showed that Japanese quails fed on a diet containing 25 ppm Pb / kg of feed for two weeks were not significantly different from control in tibia weight.

Effects on quails performance:

Table (4) showed that significant effects on feed consumption, average egg weight, total eggs number, total eggs weight and feed efficiency when the quails drank treated water water for 4 week or drank tap water for other 4 weeks after treatments .The results similar to Mazlian *et al.* (1989) claimed that Pb treated hens (25 ppm/kg) lead more eggs during three years while Edens and Garlich (1983) observed that eggs production of Japanese quails which received 1, 10 and 100 ppm Pb/kg of feed was decreased . They also added that removal of Pb from diet of quail was associated with a significant increase in egg production .On the other hand, the results dissimilar to Bakalli *et al.* (1995) and Fathi *et al.* (1999) who reported that significant negative effects of 10 ppm Pb acetate/kg diet on feed efficiency and feed conversion of broiler.

Table (4): Effect of drinking treated and tap water on quails performance.

	Quails drank treated water for 4 weeks					Quails drank tap water for 4 weeks after treatments				
Treatments / Variable	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
Feed consumption g/ day	58.2^{b}	64.75^{a}	54.06^{d}	55.89^{c}	49.14^{e}	43^{A}	33.35^{B}	27.62^{C}	28.59^{C}	33.2^{B}
Average egg weight	12.7	13.62	13.81	13.59	13.02	12.93	12.42	12.12	13.31	12.95
Total egg number / rep.	189^{b}	199^{c}	159^{a}	159.5^{a}	185^{d}	100.5^{D}	159.5^{A}	144^{B}	118^{C}	144.5^{B}
Egg/mass/rep.	2402.7^{b}	2624.5^{a}	2196.5^{c}	2143.5^{c}	2408.6^{b}	1965^{B}	2428.2^{A}	1743.2^{D}	1570^{E}	1871.6^{C}
Feed efficiency (g egg/ g feed)	0.11^{b}	0.14^{a}	0.1^{b}	0.1^{b}	0.11^{b}	0.156^{B}	0.294^{A}	0.165^{B}	0.14^{C}	0.157^{B}

a, b, c, d, e and ab means in the same row within the same item followed by different superscripts differ significantly at P< 0.05.

A, B, C, D, E and ab means in the same row within the same item followed by different superscripts differ significantly at P< 0.05.

Egg quality :-

Neither the external nor the internal eggs quality parameters seemed to be influenced by any treatments, there were insignificant effects on yolk weight, yolk percentage, albumin weight and albumin percentage, yolk hight, albumin hight and yolk diameter when the quails drank treated water or drank tap water for 4 weeks after treatments, Table (5 & 6).

Table (5): Egg quality of quails drank treated water for 4 weeks.

Treatments / Variable	T1	T2	T3	T4	T5
Yolk weight	4.617	5.207	4.739	5.015	4.433
Yolk %	33.69	33.44	33.26	34.47	318
Albumin weight	6.96	7.98	7.33	7.32	7.14
Albumin %	50.795	51.25	50.895	50.309	51.44
Yolk hight mm	11.82	12.07	12.25	13.48	12.2
Albumin hight mm	6.84	5.35	7.22	6.86	5.98
Yolk diameter mm	4.36	4.35	4.45	4.35	4.43
Sig.*	N.S	N.S	N.S	N.S	N.S

Sig: Significance. N.S: Non significance
T1:Polluted water treated by immobilized live mycella of *P. sajur-caju*
T2: Polluted water treated by immobilized heat killed mycella of *P. sajur-caju*
T3:Polluted water treated by Ca alginate beads
T4: water contaminated by lead acetate 0.3025 mg/l
T5: tap water

Table (6): Egg quality of quails drank tap water for 4 weeks after treatments.

Treatments / Variable	T1	T2	T3	T4	T5
Yolk weight	4.8	4.34	4.69	4.73	4.75
Yolk %	37.12	34.94	38.696	35.537	36.679
Albumin weight	7.85	6.19	7.71	6.71	7.27
Albumin %	60.70	49.83	63.61	50.41	56.139
Yolk hight mm	10.56	11.85	11.34	10.59	10.76
Albumin hight mm	6.15	5.007	5.63	6.13	5.98
Yolk diameter mm	4.43	4.44	4.4	4.44	4.42
Sig.*	N.S	N.S	N.S	N.S	N.S

Sig: Significance. N.S: Non significance

Effects on some blood plasma constituents

No significant differences were detected among groups drank, T1, T2,T3, T4, or T5 for 4 weeks on total protein, albumin (A), globulin (G) and A/G ratio as shown in Table (7). Insignificant decrease A/G ratio at T4 was observed . Significant effects were detected on total cholesterol and creatinine between the groups. This increase in the creatinine at T4 may reflect deleterious effect on the kidney

There was significant effect on GOT and GPT activity. This finding may be concomitant by healthy liver and caused deleterious effects on liver due to drink contaminated water by lead. Table (8) showed that there were insignificant effects on total protein, albumin, globulin, A/G ratio, GPT and GOT in all groups when drank tap water for 4 weeks after treatments and significant effects on total cholesterol and creatinine . Morgan *et al.*(1975) reported that dietary Pb acetate at 500 ppm was toxic to Japanese quail and this toxicity was due to reduction in blood hemoglobin concentration. Wittmann *et al.* (1994) reported a significant decrease in blood haemoglobin compared with control after 21 days feeding on diet supplemented with Pb up

to 1800 ppm /kg feed for broilers while, Fathi *et al.* (1999) observed that STP (Serum total protein) concentration were slightly lower, while GPT level was significantly increased in chicks fed on Pb compared to control chicks .

Table (7): Means of some blood constituents of laying quails drank treated water for 4 weeks.

Treatments / Parameters	T1	T2	T3	T4	T5
Total protein mg/dl	4.63	3.02	3.24	4.38	3.13
Cholesterol mg/dl	145.01^{d}	163.11^{c}	183.11^{a}	175.78^{b}	125.7^{ef}
Creatinine mg/dl	1.81^{b}	1.86^{b}	1.45^{c}	1.92^{a}	1.63^{c}
Albumin(A)	2.68	1.89	1.99	2.19	1.97
Globulin(G)	1.95	1.13	1.25	2.19	1.16
A/G ratio	1.37	1.67	1.59	1	1.69
GPT (U/l)	20.5^{a}	12.0^{ab}	21.5^{a}	11.0^{ab}	6.0^{b}
GOT(U/l)	93.0^{b}	83^{b}	102.0^{a}	85.0^{b}	91.5^{b}

a, b, c, d, e and ab means in the same row within the same item followed by different superscripts differ significantly at P< 0.05.
T1:Polluted water treated by immobilized live mycelia of *P. sajur-caju*
T2: Polluted water treated by immobilized heat killed mycelia of *P. sajur-caju*
T3:Polluted water treated by Ca alginate beeds
T4: water contaminated by lead acetate 0.3025 mg/l
T5: tap water

Table (8): Means of some blood constituents of laying quails drank tap water for 4 weeks after treatments

Treatments / Parameters	T1	T2	T3	T4	T5
Total protein mg/dl	3.38	3.13	3.25	3.5	3.57
Cholesterol mg/dl	163.7^{a}	158.11^{b}	102.8^{d}	96.2^{d}	123.5^{c}
Creatinine mg/dl	1.42^{c}	1.99^{a}	1.82^{b}	1.02^{d}	1.84^{b}
Albumin(A)	1.99	1.95	1.97	2.08	2.11
Globulin(G)	1.39	1.28	1.18	1.42	1.46
A/G ratio	1.4	1.65	1.54	1.46	1.45
GPT (U/l)	7.0	10.0	18.0	9.0	6.0
GOT(U/l)	96.28	94.16	92.65	92.5	92.5

a, b, c, d and f means in the same row within the same item followed by different superscripts differ significantly at P< 0.05.

Lead residues concentration:

Residues concentration of lead was analyzed in liver, meat, tibia and whole egg Table(9). The concentration of lead was increased in liver at T4 and in whole egg at T3 significantly compared with control. On the other hand, lead concentration in meat and tibia increased insignificantly compared with control. When the quails drank tap water for 4 weeks after treatments the lead didn't determine in tibia and increased significantly in meat at T4 compared with control, Table (10) .

Ozcelilk *et al.*(2003) measured the lead in liver, kidney, muscle and bone of chickens fed contaminated feed by lead for 4 weeks and found that

tissue lead concentration were higher than that of control values. Dissmilar finding reported by Vodela *et al.*(1997)detected the highest of lead concentration detected in bone followed by kidney and liver in hens drank contaminated water by heavy metals,

Table (9): Residue levels of lead in liver, meat, tibia, whole eggs and percentage of ash of quails drank treated water for 4 weeks

Treatments	Liver		Meat		Tibia		Whole egg	
	Pb (ppm)	Ash %	Pb (ppm)	Ash %	Pb (ppm)	Ash %	Pb (ppm)	Ash %
T1	0.445^{c}	3.960	0.248	3.263	0.053	38.062	0.169^{b}	3.446
T2	0.440^{c}	2.810	0.228	2.719	0.072	38.603	0.149^{b}	3.672
T3	0.557^{c}	3.446	0467	3.983	0.033	42.985	0.442^{a}	3.539
T4	1.101^{a}	4.405	0.442	3.2	0.034	38.919	0.202^{b}	3.446
T5	0.84^{b}	3.025	0.38	2.91	0.015	34.616	^{b} 0.142	3.464

a, b, and c means in the same column within the same item followed by different superscripts differ significantly at P< 0.05.
T1:Polluted water treated by immobilized live mycelia of *P. sajur-caju*
T2: Polluted water treated by immobilized heat killed mycelia of *P. sajur-caju*
T3:Polluted water treated by Ca alginate beads
T4: water contaminated by lead acetate 0.3025 mg/l
T5: tap water

Table (10): Residue levels of lead in liver, meat, tibia, whole eggs and percentage of ash of quails drank tap water for 4 weeks .

Treatments	Liver		Meat		Tibia		Whole egg	
	Pb (ppm)	Ash %	Pb (ppm)	Ash %	Pb (ppm)	Ash %	Pb (ppm)	Ash %
T1	0.379^{a}	4.109	0.124^{c}	2.639	0.0	43.415	0.123	3.65
T2	0.189^{b}	3.424	0.196^{c}	2.832	0.0	39.078	0.243	3.633
T3	0.193^{b}	3.235	0.408^{b}	3.222	0.0	37.363	0.267	3.604
T4	0.088^{b}	4.693	0.511^{a}	3.603	0.0	37.159	0.188	3.663
T5	0.053^{b}	3.876	0.275^{c}	3.251	0.0	46.338	0.00	3.717

a, b, and c means in the same column within the same item followed by different superscripts differ significantly at P< 0.05.

Conclusion

P. sajur-caju was entrapped into alginate beads in three days growth period. The live and heat inactivated forms have been successfully used as the biosorping agents for removal of Pb ions from water by using plain of the alginate beads.The water treated by immobilized heat killed fungal mycelia gave the best quails performance while, the quails drank water polluted by lead at concentration 0.3025 mg/L for 4 weeks lead to increase of Pb in liver and affected on quails performance .

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الإمتصاص الحيوي للرصاص بواسطة فطر بلورتس ساجور – كاجو من المـــاء وتأثيره على كفاءة الإنتاج للسمان البياض

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الهدف من هذه الدراسة بحث إزالة الرصاص كمعدن ثقيل ملوث للبيئة من الماء بواسطة ميـــسيليوم فطر بلورتس ساجور– كاجو الحية وغير الحيةالمثبتة على الجينات الكالسيوم ودراسة تأثير المـــاء المعـــالج وغير المعالج على كفاءة السمان البياض . تم إضافة 0.3025 مجم /لتر من خلات الرصاص إلـــى المـــاء وإضافة ميسيليوم فطر بلورتس ساجور– كاجو الحية وغير الحية المثبتة على الجينات الكالـــسيوم والجينـــات الكالسيوم لمعالجة الرصاص الملوث للماء وتم قياس الرصاص في الماء المعالج وقد وجد أن نسبة الرصاص انخفضت في الماء إلى 0.0082 ، 0.0014 و0.008 مجم/لتر على التوالي وكان تركيز الرصاص فـــي ماءالصنبور 0.0025 مجم/لتر ولدراسة تاثير الماء المعالج وغير المعالج على السمان استخدمت مائة سمانة بياض عمر ١٣ اسبوع قسمت إلى خمس مجموعات كل مجموعة تحتوي علـــى ٢٠ طـــائر قـــسمت إلـــى مكررتين (عشرة سمانات لكل مكررة) . المجموعة الأولى (T1) شربت ماء معامل بميسيليوم الفطر الحـــي المثبت على الجينات الكالسيوم ، المجموعة الثانية (T2) شربت ماء معامل بميسيليوم الفطر الميت المثبـــت على الجينات الكالسيوم ، المجموعة الثالثة (T3) شربت ماء معامل بالجينات الكالسيوم ، المجموعة الرابعـــة (T4) شربت ماء ملوث بخلات الرصاص 0.3 مجم/لتر والمجموعة الخامسة (T5) شربت ماء صـــنبور وقد استمرت المعاملات أربع أسابيع ثم بعد ذلك شربت كل المجموعات ماء صنبور لمدة أربع أسابيع أخرى . وقد أشارت النتائج إلى أن الماء الملوث بالرصاص أدى إلى زيادة تركيز الرصاص في الكبد حتـــى بعـــد التوقف عن شرب الماء الملوث بالمقارنة بالمعاملات الأخرى . المعاملات لم يكن لها تأثير علـــى قياســـات جودة البيض ، البروتين الكلي، الألبومين ، الجلوبيولين و نسبة الألبومين : الجلوبيولين بينما كان لها تـــأثير معنويا على GPT و GOT والكولسترول الكلي والكرياتينين أيضا انخفض الوزن النسبي للطحال انخفاضا غير معنويا نتيجة المعاملة بالرصاص .