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BIOLOGICAL TREATMENT OF CONTAMINATED WATER IN MINERAL ELEMENTS BY USING MIXING OF *DODONAEA* SP. AND *ARUNDO* SP. PLANTS

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Abstract

The present study was testing the two plants (*Dodonaea sp.* and *Arundo sp.*) for repairing some lab ecosystems through their ability of treating contaminated water with some pollutants metals that produced from some laboratory equipments and before throwing it to the wastewater drainage channels. Four treatments were prepared and tested (TA= *Dodonaea* 25% + *Arundo* 75%, TB= *Dodonaea* 50% + *Arundo* 50%, TC = *Dodonaea* 75% + *Arundo* 25% and C= contaminated water only that consider to be a control test. Both plants were exposed to heavy elements (Pb, Cd, Cu, Fe and Zn) for a period of thirty days and record the tolerance range twice weekly for both mixed plants, all data recorded was triplicate. Atomic absorption spectrometer used to estimated metals concentrations. The results show that mostly there are significant differences at each mineral concentration towards treatments during tested period. Aim of this work is to find a simple and friendly ways to limit the contamination in aqua ecosystem.

Keywords **:** Tolerance rang, heavy elements, Atomic absorption spectrometer.

Introduction

In present time the scientists give a great interests in environments (water, soil, air) pollution. So they concentrate their works on different process for removing metals from water, such as limiting the toxicity of some heavy metals that causing harm to plants, other way is by using of plants as bio filters for polluted water, and also the bio monitoring of many metals in the ecosystems (Jan *et al*., 2017). The dangers of these elements and minerals is because of their bad and lethal effects on organisms life, for example they can enter to the human bodies so easily by contaminated water and food. Some heavy elements interfere with gene expression causing damages to DNA repair systems includes oxidative stress that will effect negatively on body organs and cells metabolic (Hadi, Ali & Fuller, 2016).

Plants and their residues shows high efficiency in removal also adsorption of some heavy metals from polluted or contaminated water, new studies shows that many plants such as *Arundo sp.* may use for phytoremediation purposes. Giant reed (*Arundo donax* L.), has received un attention for remediation soils and water polluted by multi-metals due to its capacity of rapid growth and high yields (Alshaal *et al*., 2013 & Miao *et al*., 2012). There are new researches shows the great ability of plants to accumulate minerals, a study by (Emam, Sayed, & other, 2017) shows that higher Concentration of some toxic elements was found in leaves more than in the roots, many plants take role in limiting and removing some heavy elements such as *Acalypha wilkesiana, Asclepias curassavica, Dodonaea viscosa and Tabernaemontana divaricata,* also other plants like *Aptenia cordifolia, Carpobrotus edulis and Bryophyllum tubiflorum*. (Erdogan *et al*., 2011). A study was done on *Chlorophytum comosum* and a study on *Euphorbia milii*, insure that plants can be a good bio treatments (Ramana *et al*., 2015), also a recent study on *Helianthus annuus* and *Hydrangea paniculata* reported that these species may accumulated significant amounts of Cu and Pb (Forte & Mutiti, 2017).

Materials and Methods

I- Plants samples collecting and preparing

Two Samples were chosen *Dodonaea sp. and Arundo sp*. and the collection was done randomly from many regions of Baghdad city at the beginning of summer seasons. Clean fresh Leaves were firstly washed by tap water then by dilute water, then they cut to small pieces and dried and crush to be a powder (Hamadi & Sabah, 2017).

II- water samples collecting and preparing

The contaminated water samples were taken from the waste water that produced from atomic absorption spectrometer at some laboratories in Baghdad. Water contaminated samples were collected in clean plastic containers well closed.

III- Treatments preparing

Four treatments were prepared and tested [TA= *Dodonaea* 25 gm + *Arundo* 75 gm, TB= *Dodonaea* 50gm + *Arundo* 50gm, TC = *Dodonaea* 75gm + *Arundo* 25gm] all these treatments were add to a specific velum of contaminated water, but the treatment [C= contaminated water only that consider to be a control test].

Table 1 : The contents of prepared treatments

n	Treatments	The percentage of plants mixed
1	TA	*Dodonaea* 25% + *Arundo* 75%
2	TB	*Dodonaea* 50% + *Arundo* 50%
3	TC	*Dodonaea* 75% + *Arundo* 25%
4	C	control test(Contaminated water without plants mixed)

IV- Mineral elements measuring

Samples of mixed plants and contaminated water were subjected to be analyzed by the atomic absorption spectrometer (AAS-7000) for measuring the concentrations of (Pb, Cd, Cu, Fe and Zn) (Abu-ALmaaly, Karm, Alsaffar, 2018) Minerals were measured twice weekly for one month, all the data were triplicate.

V- Statistical analysis

The Statistical Analysis System program was taken up to detect the effect of difference treatments on the concentrations of tested contaminated minerals. Least significant difference (LSD) test was observed in this study at (P <0.05) (SAS, 2012) all data consider to be mean of three replications.

Results and Discussion

This study tested anew strategy for bio treatment through some mixed plants. This can be a step for getting a friendly way for repairing some lab ecosystems using two plants (*Dodonaea sp*. and *Arundo* sp.) for their ability of treating lab water before throwing it to the wastewater drainage channels (Ruchita & Malaviya, 2015). Four treatments were prepared in this study one is the control treatment and the three others are mixture of two plants, the efficiency of the mixed two plants were tested for the limitation the concentrations of some contaminated minerals such as (Pb, Cd, Cu, Fe and Zn) that cause pollution to water ecosystem in the laboratory and farther to the aqua system.

Plant Samples:

The two tested plants were identified and classified according to some references *Arunda sp.* (Alshaal, Elhawat, 2014) and *Dodonaea sp.*(Al-Snafi, 2017).

The minerals assay in the study

In table (2) results shows that there is a significant differences among all data through time of the experiment for each polluted mineral that had tested, the treatment used is TA(*Dodonaea* 25% + *Arundo* 75%) the concentration of the minerals (Pb, Cd, Cu, Fe and Zn) degreased from (0.1204, 1.62320, 0.0120, 0.7700 and 0.2200) to (0.0007, 0.0116, 0.0009, 0.5006 and 0.1676) ppm respectively at different weeks.

In table (3) the fallouts illustrations a significant differences with the minerals Pb, Cd, Cu and Zn at tested weeks, but Fe show no significant differences, the treatment TB (*Dodonaea* 50% + *Arundo* 50%) the concentration of the minerals (Zn, Fe, Cu, Cd and Pb) degreased from(0.2221, 0.7700,0.0100,1.2010,0.1104) to (0.1676, 0. 6567, 0.0080, 0.0000,0.0000) ppm respectively at experiment weeks.

In table (4) results displays a significant differences in Pb and Cd data, but there were no significant differences in Cu, Fe and Zn through the eight weeks for each polluted mineral that had tested, the treatment used is TC (*Dodonaea* 75% + *Arundo* 25%) the concentration of the minerals (Pb, Cd, Cu, Fe and Zn) limited from(0.0818, 1.3127, 0.0151, 0.7380, 0.2488) to (0.0000, 0.0001, 0.0100, 0.6587, 0.2133) ppm respectively at different weeks of study test.

Table 2 : Minerals concentration (ppm) at (TA) treatment

Treatments	Pb	Cd	Cu	Fe	Zn
Control	0.1207	1.6777	0.0130	0.7730	0.2394
TA1	0.1204	1.62320	0.0120	0.7700	0.2200
TA2	0.1100	1.2000	0.0111	0.7550	0.2112
TA3	0.0801	1.1989	0.0102	0.7111	0.2204
TA4	0.0501	1.0686	0.0062	0.6017	0.2121
TA5	0.0200	0.0888	0.0041	0.5006	0.1800
TA6	0.0104	0.0116	0.0022	0.5507	0.1676
TA7	0.0060	0.0200	0.0009	0.5707	0.1699
TA8	0.0007	1.0106	0.0012	0.6567	0.2100
LSD	0.0546 *	0.392 *	0.0074 *	0.163 *	0.0552 *

* (P≤0.05), NS: Non-Significant.

Table 3 : Minerals concentration (ppm) at (TB) treatment

Treatments	Pb	Cd	Cu	Fe	Zn
Control	0.1207	1.6777	0.0130	0.7730	0.2394
TB1	0.1104	1.2010	0.0100	0.7700	0.2221
TB2	0.0900	1.1 233	0.0111	0.7580	0.1777
TB3	0.0401	1.0818	0.0102	0.7611	0.1676
TB4	0.0133	1.0466	0.0092	0.6567	0.1809
TB5	0.0060	0.0069	0.0090	0.6606	0.2100
TB6	0.0004	0.0016	0.0096	0.6707	0.2181
TB7	0.0000	0.0001	0.0090	0.7207	0.2252
TB8	0.0000	0.0000	0.0080	0.7067	0.1809
LSD	0.0471 *	0.559 *	0.0067 *	0.1245 NS	0.0516 *

* (P≤0.05), NS: Non-Significant.

Table 4 : Minerals concentration (ppm) at (TC) treatment

Treatments	Pb	Cd	Cu	Fe	Zn
Control	0.1207	1.6777	0.0130	0.7730	0.2394
TC1	0.0818	1.3127	0.0151	0.7380	0.2488
TC2	0.0215	0.6290	0.0124	0.7241	0.2534
TC3	0.0098	0.1871	0.0112	0.7 199	0.2501
TC4	0.0025	0.0427	0.0123	0.6884	0.2851
TC5	0.0017	0.0396	0.0107	0.7109	0.2849

TC6	0.0002	0.0009	0.0104	0.7055	0.2800
TC7	0.0000	0.0010	0.0120	0.6587	0.2566
TC8	0.0000	0.0001	0.0100	0.7030	0.2133
LSD	0.0446 *	0.4078 *	0.0094 NS	0.1494 NS	0.0779 NS

* ($P \leq 0.05$), NS: Non-Significant.

Biological treatment activity

The importance of the synergistic activity of plants has emerged as antibiotics towards some pathogenic microbes(Karm, 2019) & (Karm, 2016) while research based on the synergy between two or more plants to reduce or remove some chemical pollutants from the environment were few, so this activity had to be tried against some Chemical pollutants that are released to the environment causing serious problems that are difficult to deal with, so the treatments used in the current study were a mixture of the studied plants in different proportions to treat water contaminated with some minerals and the concentrations of these minerals were recorded in the laboratory during time of experiment.

Treatment (TA) contained more concentrations of the *Arundo sp.* plant than the *Dodonaea sp.* plant, so the strength and effectiveness of *Arundo sp.* in decontamination will be greater in the studied and polluted water samples. These results were in agreement with other research results on the efficacy of *Arundo sp.* to treat pollution in the aquatic environment (Alshaal, Elhawat, 2014)& (Bonanno, 2012). The results of the treatment (TC) showed significant differences in some of the minerals under experiment conditions, and the effect of *Dodonaea sp*. plant is more significant than *Arundo sp.* because the first plant concentration is greater than the second. It is noted that there are results of studies compatible with the current results in support of the effect of *Dodonaea sp*. in removing pollutants such as some heavy metals from the environment and according to what was mentioned from some source(Ahmad, Hadi, Ali, and Jan, 2017).

The treatment (TB) possesses an equal percentage of the two plants' concentrations, and therefore the opportunities are somewhat similar to the effect of the efficacy of the removal by the *Arundo sp*. and *Dodonaea sp*. plants. Significant differences were recorded in most minerals except in iron, which showed no significant differences. The results obtained from this treatment were in support of the published results on the effect of some plants to clean the environment from some causes of pollution, such as minerals (utomo and mangkoedihardjo, 2018).

Aqua system pollution due increasing in technology create a great attention. Major pollutant can refer to toxic metals which lastingly increases as the result of increased industrial activity that led to harmful effects. Now days approaches for bioremediation can be dealing with bio mineralization which means synthesis of minerals by living organisms or biological substance. Heavy metals observed in aquatic plants in Lakes for example. The important role that aquatic plants have in the food chain of lake ecosystems, can be relatively with high levels of heavy metals in the aquatic system.

The conclusion of this study refer to synergistic activity that formed between *Arundo sp.* and *Dodonaea sp.* reduced pollution due to the decrease in concentrations of mineral elements polluting the water gradually during different weeks in the experiment. The most prominent and important effect was the direction of reducing and removing lead and cadmium, followed by copper, zinc, and finally iron.

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