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ARTICLE

PHYTOREMEDIATION USING POA PRATENSIS BALIN LAWN AND SLUDGE IN MASHAD INDUSTRIAL TOWN TREATMENT PLANT

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ABSTRACT

We studied four levels of Mashad Industrial town treatment sewage sludge (0,10,15,20) on phytoremediation capacity of metals such as Nickle, Lead on physiological and developmental features of Poa pratensis balin lawn in a full random design with four iterations .Results showed meaningful accumulation of Nickle in roots and aerial organs in Poa lawn. The highest amount of Nickle accumulation is in Poa lawn root with treatment of 15% and 20% (0.23 and .022 mlgr/kg) .The lowest amount of accumulation obtained in control treatment (0.15 mlgr/kg). Lead accumulation in Poa lawn aerial parts is meaningful at 5% probability which is not observed in roots yet. The value of Poa lawn dried and wet weight in aerial parts and roots has meaningfully changed as a result of sludge usage. Measures of general values of chlorophylls and carotenoid have not changed drastically. Sludge usage lead to decrease in relative ratio of wet content and stomatal conductance. The lowest amount of ion leakage is in controlled sample (13.43%) and treatment with 10% sludge weight (24.5%) and 15% (24.83%) sludge weight didn't show any meaningful difference. The highest rate of ion leakage obtained in treatment with 20% Poa sludge (28.7%) which proved meaningful change in comparison with other treatment samples. Results demonstrated that lawn can develop in floors containing sludge in Mashad Industrial town treatment plant. It can be introduced as a Nickle purifying of soil but it is not much capable of soil lead absorption.

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KEY WORDS
Lead, Phytoremediation, Ion leakage and Nickle

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INTRODUCTION

The most important soil pollutants are heavy metals, acid rain and organic substances .Among which recently , heavy metals have attracted much attention for their soil polluting features. Locational changes of heavy metal contents on surface agricultural soil may be under the influence of original soil elements and human sources .In other words , naturally, there are such metals in soil ,though they are added to the soil due to human interactions with nature .Actually, human interactions may result in more heavy metal accumulation [1].

Heavy metals are environmental hazardous pollutants for human health and its environment. Such metals can affect agricultural soil qualities which are either poisonous or absorbed by plants and added to human food cycles to cause health and body problem. Besides, they are considered as permanent and lasting pollutants in environment for they are not decomposed nor damaged .They are accumulated in soil and sediments whose high amount of them in sea and on lands may both affect creatures in general or poison human via consumption of food gained in sea or on land [2].

Treatment plants' sludge contains organic substances which are produced along sewage biological purifying processes without any charges. At specified periods, that redundant amount of such sludge must be moved to sludge drying floors to be eliminated from purifying process [3].

In most treatment plants, both sewage and sludge contain components and elements which are useful and needed for plants' development. Also, they have organic components which can help to improve soil structure. At present, the extra produced sludge in treatment plants is a basic strategic problem .After it is collected and stored from sludge drying floors, it is always an obstacle which should be removed from the original environs and eliminated .It imposes a lot of charges on treatment plants' management [4-5].Ways of elimination and safe burial of such sludge along the expenses are those issues which always occupy treatment plants management' mind. Nowadays, different methods such as burning or safe burial of such sludge are applied to remove the sludge. Yet each method has its own disadvantage. Generally, sludge removal is not an economic and reasonable way for the sludge nutritional potential is ignored [6-7]. Methods such as burial are perhaps moving pollutants and heavy metals to the earth and ground water depth which may lead to environmental damage [8].

Researchers have found that plants have features which can be used as a purifying agent. As a result, a new context such as plant modification, plant purification or plant phytoremediation is introduced [9-10].This relation between plants and heavy metals are known since medieval ages. For instance, Marker plants were used to discover mines. In late 19th century, Viola calaminaria and Thlaspi caerulscens were first plant varieties whose capacities in absorbing and storing metals in high volume were proved [2]. Purifying plants are those which inherently or for genetic modifications are used to correct and purify polluted soil [11].Plant purification is easier in view of management of plants for it is an autotrophic system with large biomass which does not require much feeding. It is able to remove pollutants from soil and accumulate and store them in aerial plant organs. Furthermore, such plants are having protective roles in the face of water wind soil erosion .They also prevent pollutant transmission [3].Extra accumulation capacity of heavy metals in this method is based on growth fast rate (Biomass production) and heavy metal accumulation (gr of metal per kg plant tissue) .Heavy metal elimination by plants is

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carried out by plants which are called super accumulators. These plants carry out heavy metal accumulation more efficiently than other plants. It is reported that there are super accumulators which are able to collect heavy metals such as Cobalt, Copper, Chrome, Lead, Nickle and Magnesium up to 1000ppm of their dried tissue weight .This proportion is reported up to 1000 ppm for Zinc [12].On the account of the fact that there is no study on purifying capacity of Poa Pratensis balin lawn on Nickle and Lead, we aim to evaluate absorption rate of two heavy metals such as Nickle and Lead from soil via the above lawn. We also study the effect of Mashad industrial town treatment plant sludge usage on developmental and physiological features of the lawn.

MATERIALS AND METHODS

After we sterilized shallowly the lawn seeds of Poa, they were planted in plastic vases with 210 mm diametre by 45 cm height under greenhouse condition. Cultivating environ includes the control sample (natural soil), Soil and dried sludge with ratio of 10%, 15%, and 20% of weight .Thus, in control sample, for instance with 10% of weight, there is 10gr dried sludge in 90gr soil. The used soil in this experiment is the one with loamy structure without any salinity limitations or other agricultural ones. To measure soil and sludge elements, we weighed 25 gr of it in a 250 ml Erlenmeyer plastic flask. Afterwards, we added 50 ml extractor solution who's PH is 7.3, then its lid was closed and we shook it with a circular shaker make G.F.L, shaking 145 rounds per minute. It was filtered with wattman paper 42. Later, we switched on the atomic absorption instrument connected to graphite furnace .There is a specific lamp installed for each element whose element concentration is read after initial adjustment. If the elements concentration in the extract is higher than the standard level, we may dilute the samples by D.T.P.A. Soil tissue is measured by hydrometric method [13].its PH is measured by PH meter (MacClean 1982), and its electric conductance potential in saturated flower extract is measured by conductivity meter instrument [14].

Morphologic features

Features of this study are investigated in two parts. The first part is of sludge effect on with varying levels on the quality of lawn development. In this part, morphologic features of aerial organs length , roots , roots and aerial organs dried weight , roots and aerial organs wet weight, the ratio of wet and dried weight of roots to the aerial organs , lawn leaf width and other morphologic features such as total Chlorophyll a, b, carotenoid rate , relative humidity of water content, ion leakage , stomatal conductance and leaf surface index were measured to investigate the sludge varying levels effect on lawn growth to determine what levels of sludge usage is producing the best growth quality .The height of lawn crown is measured each 14 days before trimming. To do it, we held a ruler tangent to the soil surface, then a piece of paper on which there is a central hole is moving across ruler easily. We placed the paper at three points of each experiment unit along moving the ruler. So we can measure the height. Wet and dried weight of leaves and roots were measured each two weeks. Trimming was carried out at above 4 cm with a scissors, weighed on a scale, put in paper bags and moved to the oven at nearly 72 C for 48 hours. Finally the dried weight of control samples was measured. Roots were also taken out of soil, washed, dried and their wet and dried weight was measured as explained above.

Physiological features

Measures of chlorophyll and carotenoid

Chlorophyll and carotenoid were measured on (Liqten taler 1987) basis. Leaves pigments were extracted by acetone 80% and the rate of control sample absorption was read at wavelength of 663, 645, and 470 nanometer by spectrophotometer .On following formula the amount of Chlorophyll and carotenoid was calculated.

b chlorophyll = 21.5 .A665 – 5.1A663

a+b chlorophyll = 7.15A663+18.71A645

Carotenoid = [1000A470-1.82(a chlorophyll) – 85.02 (b chlorophyll]/198

The relative water content of leaves

RWC in fully developed and young leaves measured. It is performed after the initial weighing of leaves , sinking in distilled water for 24 hours and being dried at 75c. It is obtained via following formula (Smart & Bingham 1974).

RWC= ((wet weight - dried weight)/(turgor weight - dried weight) ×100

Ion leakage

Ion leakage is calculated through dividing initial electric conductance by dead cells electric conductance(Demichic and colleagues 2010).

Leaves surface index

Leaves surface index is measured and studied by AcuuPAR (Make Delta T device) after it is separated.

Stomatal Conductance

Stomatal conductance measurement is carried out by Photo synthesis device of a German company Walz make HCM-1000,when leaves are irrigated at saturation level (while leaves are in the device box) , 4-week bushes were used.

Heavy metals measurement

Heavy metal content such as Nickle and Lead were measured in different organs such as leaves and roots 4 months after development. Also, rate of such heavy metals in soil were measured and compared before and after lawn growth. To measure heavy metal rate in plant tissues, we used atomic absorption device equipped with graphite furnace (Varianspectr AA 280) with 1ppb precision. Aerial organs such as leaves and roots were first washed with distilled water .Then It was dried at 80 c in the oven for 48 hours. Afterwards, plant control samples were milled and extracted by Nitric Acid and Hydrogen peroxide. At final step, rate of heavy metals like Nickle and Lead were measured. To evaluate rate of heavy metals, atomic absorption device in science and food tech park in Khorasan Razavi was used.

Statistical calculation

This experiment is carried out at full random design with four iterations .Data organization is performed by Excel SW and their analyses carried out by SPSS version 19.Mean comparison is done via Doncan test at 5% probability.

RESULTS AND DISCUSSION

Used Soil and sludge physiological features shown in [Table 1] and soil structure shown in [Table 2].The Nickle and Lead of the soil used in this experiment was lower than allowed world standard. Amount of metals such as Nickle and Lead in used sludge was higher than soil. Nickle rate in the sludge of Mashad Industrial town was somewhat higher than the standard level reported by different organizations, which is at allowed extreme point of this metal. Although Nickle rate in experimental sludge was two times higher than the one in the soil, it was at standard point [Tables 1 and 2).

Table 1: Physical and chemical features of used soil and sludge

	Pb (mg/kg)	Ni (mg/kg)	Fe (mg/kg)	CO3H (mg/kg)	pH	Clay (%)	Silt (%)	Sand (%)	EC (dS/m)
Soil	42.8	25.4	3.5	953	6.4	30.5	43	26.5	6.6
Sludge	81.5	62.7	4.3	911	7.2	-	-	-	9.1

Table 2: Allowed levels of Nickle and lead in soils in different world standard (mg/kg)

Organization	Pb	Ni
EU[i]	300	50-75
NZWWA[1]	300	60
SEPA[2]	350	60
CEPA	300	50
CODEX[3]	-	50

Variance analyses result showed that treatment samples using different sludge density in Mashad industrial town treatment plant proved meaningful changes in most morphological , physiological and phytoremediation capacity of the lawn species Poa pratensis balin features at 1% and 5% probability levels [Table 3].

NICKLE PLANT PHYTOREMEDIATION

Variance analyses results have shown that sludge usage has meaningfully affected the Nickle rate of absorption in roots at 1% probability. Absorption and accumulation of roots in aerial parts were getting meaningful at 5% probability [Table3]. As demonstrated, Nickle accumulation rate in Poa roots are higher than aerial parts. The highest rate of Nickle accumulation in Poa roots on using the sludge are in treatment samples of 20% and 15% (0.23 0.22 mg/kg) .The lowest rate of accumulation in treatment samples (0.15 mg/kg) was obtained [Fig. 1]. In aerial parts, the highest rate of accumulation gained in treatment samples with sludge usage, which showed no meaningful differences at three levels of 10%,15% and 20% of their weight. Though, the lowest rate of Nickle accumulation obtained in treatment samples which showed meaningful difference with other treatment samples at 5% probability [Fig. 2].

Soroosh et al [23] have done a research on heavy metal absorption by some Japanese lawn species (Zoshia Grass) .They came to the conclusion that irrigation with different sewage treatment in various soil tissues ,such tissues have no effect on metal absorption by this kind of lawn, yet sewage usage for irrigation caused heavy metal absorption such as Nickle, Lead, Cadmium and Cobalt to increase. Although sewage irrigation has no effect on Iron and Zinc absorption,

this study result expressed the Japanese lawn absorption ability in decreasing and extracting some metals particularly Nickle and Cadmium from soil. On the account of Al souraii et al [24] the tree Conocarpus lancifolius has high ability to accumulate high levels of Chrome (Cr),Vanadium(V), and Nickle (Ni) in its roots. This tree can also accumulate loads of Alminium(Al), Calsium(Ca), and Iron (Fe) in all parts of its organs. A study has been conducted in Zanjan Lead and Zinc Plant campus to investigate some trees species in absorbing heavy metals .It was done in quite random block designs with three iterations. These trees species' sample leaves, branches and soil were taken off and the content of Lead (pb), Zinc(Zn) , Cadmium (Cd) and Nickle (Ni) was measured by (ICP) device. The result demonstrated that among those species investigated, Poplar trees and Robinia have high absorption ability of Lead, Zinc and Nickle in their branches and Poplar trees are able to highly absorb metals such as Lead, Zinc and Cadmium through their leaves which make them all appropriate to be planted in polluted areas green lands (Moradi).

Table 3: Variance analyses of morphologic features and heavy metal concentration of Lead and Nickle in roots and aerial organs of Poa pratensis balin lawn with sludge treatment of Mashad industrial town treatment plant (Ni-R-Nickle root,Ni-A Nickle aerial organs,Pb-R Lead roots,DW-R dried weight root,DW-A dried weight aerial organs,FW-R wet root weight,FW-A wet aerial organs weight, R/ADW relative dried weight of root to aerial organs, R/AFW relative wet root weight to the aerial organs,LW leaf width)

Source	df	Mean square												
		Ni-R	Ni-A	Pb-R	Pb-A	Height	Length-R	DW-R	DW-A	FW-R	FW-A	R/A(DW)	R/A(FW)	LW
Treat	3	0.04**	0.004*	0.757 ns	0.333**	0.25 ns	3951.6 *	0.067*	0.506**	0.354 *	1.386 **	0.352**	0.6 **	0.012 ns
Error	12	0.001	0.001	0.26	0.044	0.099	594	0.01	0.028	0.084	0.077	0.01	0.02	0.05
CV		19.2	17.6	16.9	21.07	17.8	22.2	11	16.8	9.5	8.7	12.41	10.9	14

Ns*** is meaningfulness at 1% probability, meaningfulness at 5% probability and non-meaningfulness

Lead phytoremediation

Using varying sludge amount has no meaningful effect on Lead accumulation in Poa lawn root but Lead showed meaningful changes in aerial organs at 5% probability [Table 3]. The highest rate of Lead accumulation obtained in aerial organs in treatment samples of Mashad industrial town treatment plant sludge which had no meaningful difference and the lowest rate of Lead accumulation observed in aerial organs in treatment samples (without sludge usage) with 3.33 mg/kg [Table 3].

Taghi zadeh et al [25] studied and compared Lead heavy metal absorption ability in various concentrations by three kinds of Regrass lawn, Kentuky blue grass and Bermuda grass lawns. It is reported that along Lead concentration increasing rate in soil, generally Lead accumulation rate in aerial organs and roots increased which showed highest absorption in aerial organs in Regrass and lowest absorption in Kentuky blue grass .Besides, in terms of Lead accumulation rate in lawns roots, Bermuda grass showed the lowest and Regrass showed the highest rate of absorption and accumulation.

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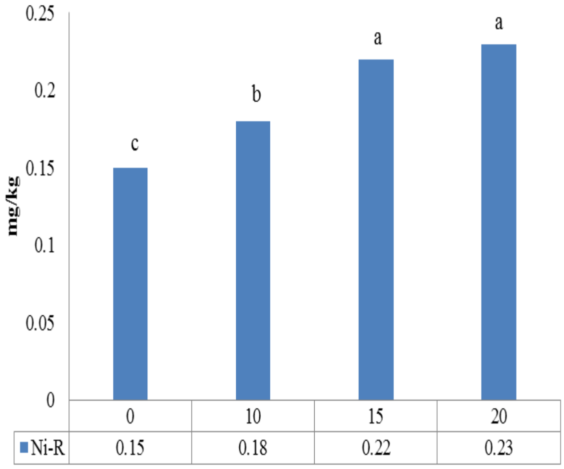

[Fig.1: The mean omparison of Nickle accumulation in Poa pratensis balin lawn root under the influence of varying amount of sludge in Mashad industrial town treatment plant

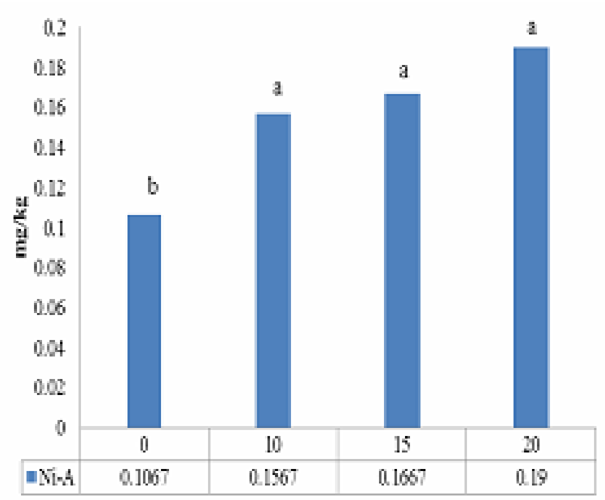

Fig. 2: Mean comparison of Nickle accumulation in aerial organs of Poa pratensis balin under the influence of varying amount of sludge in Mashad industrial town treatment plant

Besalat pour et al [2010] have done studies on several different species .Ultimately , Festuca arundinacea and Agropyron gaertn species were chosen for final phytoremediation of oil sewage and heavy metal . In Grassca studies [2011], several different plants such as corn and wild tumbleweed were used to purify polluted soil with heavy metals such as Lead, Nickle and Zinc in vase controlled and free environs .In this study, the average rate of Lead absorption in wild tumbleweed plant is higher than others. It is observed that plant Poa pratensis balin ‘s ability in absorbing and accumulating Lead in its root is rather low but it is quite able to do so in aerial parts.

Morphologic features

Variance analyses results demonstrate that sludge usage has neither affected Poa lawn height rate ,nor any meaningful changes have been proved thus far.[Table 3].Considering heavy elements low accumulation in lawn aerial and agrarian parts ,we may conclude that heavy elements have not much affected this lawn for its heights rate has not changed.

The root rate length has meaningfully changed around 5% probability [Table 3].The highest rate of root length has been resulted in treatment with 20% ;(504 cm) , while treatment of 15% sludge weight comes second(483.5 cm).The lowest rate of root length resulted in typical samples and treated ones holding 10% of sludge are 424.5 and 445 cm respectively (Table 4).High sludge usage EC caused higher rate of land salinity which will end up in dryness tension. Under such stress and dryness which is aggravated by heavy elements, this plant reacted in a way to increase its length. Soroosh and colleagues reported that irrigation with purified sewage of treatment plant in Shahin Shahr has resulted in meaningful root length in Japanese lawn with 1% probability.

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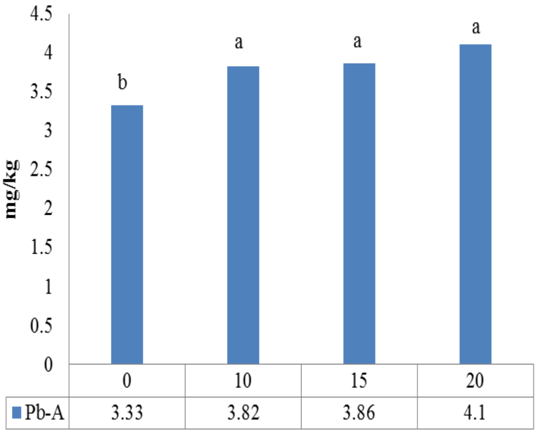

Fig. 3: The mean comparison of Lead accumulation in aerial organs in Poa pratensis balin under the effect of varying amount of sludge usage in Mashad Industrial town treatment plant

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The rate of root dried weight with 5% probability and Poa pratensis balin lawn aerial parts with 1% probability which are treated with sludge usage have demonstrated meaningful changes in comparison with the typical untreated samples (Table 3). The highest rate of dried root weight (2.07 gr in the plant) obtained in treated sample whose sludge usage is 20% and the lowest rate is of the typical sample (1.74 gr I the plant). The highest rate of dried weight of aerial parts in Poa pratensis balin lawn obtained in those treated with 20% sludge weight (2.69 gr in the plant), after which those teeated with 15 % and 10 5 sludge have proved highst rate of aerial parts dried weight (Table 5).On the account of sludge sample analyses and its high rate of Nickle, Lead and Iron[Table 1], such increase in dried weight of different lawn's organs under studied can be justified.

The ratio of root dried weight to aerial part with 1% probability has become meaningful [Table 3].Different studies have reported contradicting results in terms of purifying plants organs dried weight changes .Adavy [2008] investigated different varieties of Bermuda Grass purifying rate in petrol hydrocarbons .He reported, considering the detriment impact of petrol hydrocarbons on plants, refinery oil sludge increase to the soil resulted in decrease on lawn aerial parts dried weight. Meanwhile, refinery oil sludge increase to 20% lead to root dried weight increase. While the higher sludge increase resulted in lawn root dried weight decrease.we can conclude that proportion of taken sludge and sewage has affected on plants dried weight organ's changes. Soroosh et al [22] have reported the Japanese lawn different organs dried weight due to irrigation with Industrial town treatment plant sewage. The ratio of root wet weight to the aerial parts became meaningful at 5% probability. The feature of leaf width has not shown any meaningful changes as a result of Mashad Indutrial Town sludge usage [Table 3].

Physiological feature

On the basis of results gained from variance analyses of physiological features, leaf surface feature index , total chlorophyll rate, a , b chlorophyll and total carotenoid didn't show any meaningful changes due to sludge usage in cultivating floor [Table 4].Tartary et al, [2013] reported the 30% decrease in total chlorophyll , b, and photosynthesis capacity in Poa pratensis balin took place due to dryness tension . This study didn't result in such a finding .One of the reason could be the dryness tension which the lawn underwent. Consequently, low irrigation levels may be the decreasing factor in chlorophyll rate.

20% decrease in plant water requirement, may lead to chloroplast damage and may end up to eventual cell death(Keiser 1987, Fu and Hung 2001). As anticipated, due to high sludge salinity used , the relative water content of leaves has dropped which showed meaningful difference at 5% probability. The highest relative water content in control samples was 84% and in treatment samples was 10% of sludge weight of 81.5% .The relative lowest wet content obtained in treatment samples with 20% of sludge weight of (77.3%).

Meaningful changes were observed at 1% probability in stomatal conductance features [Table 4]. Consequently, higher sludge concentration caused noticeable decrease in leaves of Poa pratensis balin lawn stomatal conductance, in that the highest rate of stomatal conductance (345.9mc ml per sqm /s) obtained in control samples and the lowest rate reported to relate to treatment samples with 20% sludge weight (255 mc ml /sqm/s) [Table 5]. There are various reasons to explain stomatal conductance decrease. Sometimes, different tensions particularly, salinity and dryness tensions will result in stomatal conductance which ultimately causes decrease in photosynthesis rate. Mohsen zade et al, [2003] reported that they observed decrease in stomatal conductance and photosynthesis rates in wheat irrigated by sewage which will end up in plant tensions.

Meanwhile, Poa leaves ion leakage in treatment samples using treatment plant sludge at 5% probability demonstrated meaningful changes (Table4). The lowest ion leakage reported in control samples (13.43%) while treatment samples of 10% of sludge weight (24.5%) and 15% sludge weight (24.83%) did not demonstrate any meaningful difference. The highest rate of ion leakage observed in treatment samples of 20% sludge weight (28.7%) , which showed meaningful difference with other treatment samples [Table 5]. Since most tensions naturally accompanied with the beginning of an oxidative tension, so the production and storing of poisonous groups and destructive substances to free oxygen are also increased. Therefore, electrolyte leakage will rise across tensions [26]. In this study, along sludge usage, ion leakage rate has arisen. Taken into account the high rate of EC in used sludge, this kind of sludge was exposed with salinity tension which led to increase in ion leakage. Non-saturated fatty acids peroxidation available in membrane phospholipids has knowing roles in the increase rate of electrolyte permeability through membrane [13].

Freera and colleagues have done researches on different proportions of sludge cultivated with a combination of Logominoos and Grass. They realized that , when they have done four rounds of iterated researches on cultivation, those plots treated with sewage sludge have shown higher and better physical and chemical characteristic in comparison with those which have been treated with just chemical fertilizers. Total rate of Phosphor, available soil absorbing Phosphor in plant CEC, soil water holding capacity , organic Carbon and sewage sludge treatment samples increased in comparison with those receiving the chemical fertilizers .

In India in 1986, they have irrigated more than 150 farms as large as 12000 hectares with at least 500 millions square meter sewage water. Sewage irrigation has rapidly grown since 1985. According to available statistics, nowadays in China, there are nearly 3 million hectares of agricultural lands ad farms around small and big cities, cultivated to grow and produce rice, wheat and corn which are all irrigated with sewage [14].

Table 4: Variance analyses of Poa pratensis balin lawn Physiological features under the treatment of Mashad industrial town sludge (LAI- leaf surface index, Chol-T total Chlorophyll, RWC leaf relative water content, SC stomatal conductance, EL electrolyte leakage)

Source	df	Mean square							
		LAI	Chlo-T	Chlo-a	Chlo-b	Cartenoid	RWC	SC	EL
Treat	3	0.014^{ns}	0.074^{ns}	0.052^{ns}	0.02^{ns}	0.004^{ns}	23.25^{*}	4340.5**	129.9*
Error	12	0.106	0.019	0.023	0.008	0.003	3.16	204.7	3.9
CV		15	27.1	22.4	23	13.75	16.3	14.8	16

Ns, *, ** meaningfulness at 1% probability, at 5% probability and non-meaningfulness

Table 5: Mean comparison of studied Poa pratensis balin lawn features under the treatment of Mashad industrial town treatment plant (LR root length, DW-R dried weight of root, DW-R Aerial dried weight, FWR dried weight root, FWA dried weight aerial, R/A(DW) relative weight of root to aerial organs, RWC relative water content, SC leaf electric conductance , EL electrolyte leakage in each column , figures with mutual letters have no meaningful difference.

	LR (Cm)	DW-R(g/plant)	DW-A(g/plant)	FW-R(g/plant)	FW-A(g/plant)	R/A(DW)	R/A(FW)	RWC (%)	SC($\mu m.m^2.s$)	LE (%)
0	424.2c	1.74c	3.62a	3.93a	6a	1.27d	1.78a	84a	345.9a	13.43c
%10	445bc	1.83bc	3.22b	3.92a	5.34b	1.49c	1.41ab	81.5ab	301.6b	24.5b
%15	483.5ab	1.99ab	2.87c	3.46ab	4.76c	1.82b	1.22bc	80.29bc	283.8bc	24.83b
%20	504.3a	2.07a	2.69c	3.24b	4.46c	2.04a	1.1c	77.3c	255c	28.7a

CONCLUSION

Using sludge of Mashad industrial town treatment plant has brought about meaningful changes on developmental characteristics of a kind of lawn called Poa pratensis balin . This sludge usage in turn caused meaningful increase in dried weight of aerial and ground organs. Our finding showed that this kind of Poa pratensis balin has high potential to purify Nickle from soil , even though Lead was accumulated only in aerial organs. Therefore, this kind of Poa pratensis balin lawn could be introduced as a suiTable phytoremediation kind of plant for lands and soil contaminated with Nickle.

To purify an area contaminated with different pollutants (through phytoremediation), plants should be selected in a way to ensure they have the ability and potential to adjust ,grow and develop in contaminated environs. They should also bear, bloom, grow, develop and improve roots under such conditions [2].However, reported researches on decorative phytoremediation plants in contaminated lands hit by ecological and environmental pollutants such as heavy metals are somehow rare. Yet recognizing and introducing resistant species which could be used as phytoremediation plants in horticultural development, enhancing green areas, landscapes and land improvement are vital.

CONFLICT OF INTEREST

There is no conflict of interest

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None

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