`Vol. 4, No. 4, pp. 261-273, (September 2023)
DOI: 10.21608/AUJES.2023.213476.1157

Aswan University Journal of Environmental Studies (AUJES)
Online ISSN: 2735-4237, Print ISSN: 2735-4229
Journal homepage: https://aujes.journals.ekb.eg/ E-mail: AUJES@aswu.edu.eg
Original research

Pollution levels and risk assessment of heavy metals in the agricultural area affected by sugar cane factory's fly ash: A case study from south Egypt

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Received: 26/5/2023 Accepted: 14/8/2023

Abstract:

The present study was carried out in the sugar cane factory area of Kom Ombo, Upper Egypt. The objective of the study is to characterize some heavy metals in the agricultural soil affected by sugar cane factory's fly ash produced during sugar processing, evaluate the effect of deposition on soil and plants, and calculate the risk assessment of the soil and plant at area under study. Data showed that the ammonium bicarbonate and diethylene triamine pentaacetic acid (AB-DTPA) extract of all soil heavy metals content increased by increasing the soil depths in all areas. Also, the heavy metal content of plants grown in the south areas of the factory data showed that iron and copper content in most plant parts grown was high; also, the content of manganese content was moderate in all plants except lettuce and cabbage in El-Shatb area. While zinc content was low in all plant samples. With regard to the bioaccumulation factor of heavy metals data indicated that the bioaccumulation factor was > 1.0 in most sites under study where iron was the most accumulated metal in cabbage leaves followed by copper ranged then zinc in plants that grew in the south area during factory activity. While, for manganese, lead, and nickel data revealed that the bioaccumulation factor was < 1.0 for manganese, cadmium, lead, and nickel except in the El-Nagagra area. For translocation factor data showed that lead metal was the highest translocation factor values flowed by zinc, nickel, iron, copper, and manganese, respectively for most sites under study.

Key words: Flay ash, heavy metals, sugar cane, bio accumulation and translocation factory

1- Introduction

In recent years, advancement in technology, urbanization, and industrialization has contributed to the increase in the discharge of metals into the environment such as industrial effluents, solid waste disposals, fertilizer application in soils and domestic wastes It has been shown that soils can act as a depository for pollutant metals as a result of adsorption processes which bind these metals to it. The high concentration of these metals will eventually lead to the contamination of such soils. Soil contamination by trace metals is of major concern to man because at high concentrations metals can cause harm to human life and the environment **(Isibor, 2016).**

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Sugarcane is basically a food crop but it can also be considered as an energy crop as its fiber (bagasse) is an excellent fuel for the generation of electricity. It comes under renewable sources of energy and thus provides an alternative to the more polluting fossil energy sources **(Singh** *et al***., 2019).**

Sugar is one of the oldest commodities in the world. It can be produced from sugarcane, sugar beet or other crops having sugar content. One of the waste from the sugar industry; bagasse were utilized for steaming of the boiler by all most all the country, which produced sugar from sugarcane, Without reprocessing or wasting in the open of waste from sugar industry has a significant impact on air, water, and land ecosystem. They have a major role in changing the physicochemical characterization of this ecosystem, Air pollution from sugar industry is considered to be very negligible as compared to other industry, Source of air pollutant are during burning of waste sugarcane bagasse inform of smoke and open dumping of solid waste in form of smells **(Sahu, 2018).** A significantly large volume of waste is generated during the manufacture of sugar and contains a high amount of pollution load, particularly in terms of suspended solids, organic matter, and press mud, bagasse and air pollutants by heavy metals. Several chemicals are used in sugar industries mainly for coagulation of impurities and refining of end products **(Poddar** and **Sahu, 2017).**

Therefore, the current study aimed to characterize the heavy metals (Fe, Mn, Cu, Zn, Cd, Pb and Ni) in the agricultural soil affected by sugar cane factory's flay ash produced during sugar processing near Kom Ombo area. In addition, study the effect of deposition on soil and plants grown. Finally, calculate risk assessment of the soil and plant at different area under study.

2. Materials and Methods

Aswan Governorate is one of the upper governorates of Egypt in the South of the country. Therefore, Kom Ombo industrial zone content one of the biggest factory in the sugar industry in Egypt. The environmental impact of byproduct ash from sugar cane industry to produce sugar was contenting some heavy metals. The content of heavy metals was tabulated in Table, 1.

Table, 1: Heavy Metals content of byproduct ash from sugar cane factory during activity

mg kg^{-1} Heavy elements							
Fe	Zn	Mn	Cu	Pb	Cd	Ni	pH (1:100)
4.88	0.12	1.84	0.25	0.11	0.01	0.03	6.43

Soil samples with three replicates were collected from soil depth 0-30 and 30-60 cm. Some sites were located near South of sugar cane factory at Kom Ombo during factory activity. Similarly Plants were randomly collected from same soil sample locations from the area under study. All samples were collected at their maturity stage, taking representatives samples for each studied crop. The collected plants (Lettuce and Cabbage) separated into different parts (leaves and roots).

The soil was air-dried, oven-dried then sieved through a < 0.2 mm sieve and stored in the labeled polythene sampling bags according to **(Adepetu** *et al***., 1996).**

Plant samples one gram of each dried sample was digested using 20 mL HNO_3: HCl (3: 1) acid mixture in a covered Teflon beaker, then heated to a clear solution for 3 hr., and continued near dryness. The cooled residue was dissolved in 5 ml *2N* HCl and filtered through Whatman number 0.42 filter paper into 50 ml measuring flask and filled to the mark with deionized water **(AOAC, 1995).**

Available Fe, Mn, Cu, Zn, Cd, Pb and Ni were extracted according to the method described by **Soltanpour (1991)** by solution of ammonium bicarbonate and diethylene triamine pentaacetic acid (AB-DTPA) with adjusting pH at 7.6; 20 g of soil sample were shaken with 40 ml from the solution to 15 minutes before being filtered through filter paper according to **Cottenie** *et al.* **(1982)** and **ICARDA, (2013).** The determined was used inductively coupled plasma (ICP) Spectrometry model Ultima-Expert LT was used for metal determination.

Byproduct ash samples were heated and digested with 1:1 (v/v) conc. HNO_3 to H_2O_2 (the process was repeated several times until complete digestion), and then diluted to a volume of 50 mL with 1% HNO_3 for analyses of total Fe, Mn, Cu Zn, Cd, Pb and Ni. Elements in dust, soil and plant extraction; were determined using inductively coupled plasma (ICP) Spectrometry model Ultima-Expert LT.

Assessment risk was used the bioaccumulation factor (BAF) was calculated according to **(Liu** *et al.***, 2006)** using the following equation:

$BCF = C_{plant} / C_{soil}$

Where: C_{plant} is the concentration of elements in the plant and C_{soil} was the concentration of the same elements in the soil on dry weight basis.

Translocation factor (TF) expressed as the ratio of heavy metals in plant shoot to that in plant root according to **(Cui** *et al.***, 2007).**

TF = Heavy metals content in leaves / Heavy metals content s in root

3. Results and Discussion

3.1. Soil heavy metals available and total content at different depth and location affected by fly ash produced from sugar cane factory

Data presented in Table, 2 and Figs., from 1 to 7 showed detectable content of AB-DTPA extractable iron that was found in the soils at different sites located South of Kom Ombo sugar cane factory. However, with increasing depth of soils in areas under study increased Iron content values in all sites its detected during factory on activity in depth (0-30 and 30-60 cm) as 14.94 & 15.65 and 15.68 & 16.82 and 16.81 & 17.69 mg kg^{-1}, in El-Alban, El-Nagagra, and El-Shatb respectively. But there was a decrease in the total iron content with depth in areas under study except El-Nagagra area, the total iron content was 1799 & 1788, 1808 & 1887 and 1862 & 1834 mg kg^{-1} in the same areas under study and was illustrate in Table, 2. El-Sokkary and Lag (1980) and **Aboulroos** *et al.*, **(1996)** found that the range of soil Egypt was between 0.42 and 4.38 mg kg^{-1} as an AB-DTPA extract. However, they also added a rapid accumulation of plant available form of studied metal as a result of soil pollution and industrial wastes. Also, the extracted values were increased with time. Bioavailable portions were found to represent a great deal of the contents from (2.01 to 3.79 %). The low content of iron extracted by AB-DTPA was due to its precipitation in the form of Fe CO_3 **(Street** *et al.***, 1977).**

Data illustrated in Table, 2 and Fig., 2 showed that content of AB-DTPA extractable of manganese which was detected in the soil at sugar cane factory zones. However, data obtained indicated that increasing soil depths had resulted in an increase in manganese content in all sites under investigate except in El-Nagagra site its decrease with increase depth and it was detected as 22,87 & 25.37, 23.94 & 32.43 mg kg^{-1} in El-Alban and El-Shatb respectively. Furthermore, data detected that the content of manganese was 21.28 & 19.46 mg kg^{-1} in El-Nagagra in depth (0-30 and 30-60 cm). Regard to data in Table, 2 it showed total manganese content in soil in two depth (0-30 and 30-60 cm) during factory on activity it was, 225.62 & 221.58, 213.53 & 179.71 and 209.53 & 196.12 mg kg^{-1} in El-Alban, El-Nagagra, and El-Shatb respectively. Data also showed that decrease content with increase soil depth in all sites under study. **Aboulroos** *et al.*, **(1996)** noticed that accumulation of plant available form of manganese as a heavy metal as total contents was remanded from 1.19 to 2.99% may be due to its precipitation as $MnCO_3$ **(Street** *et al***., 1977).**

Data presented in Table, 2 and Fig., 3 showed detectable content of AB-DTPA extractable zinc that was found in the soils at different sites at Kom Ombo sugar cane factory area during factory on activity. Data showed increasing depth of soils in areas under study decrease zinc content in all sites under study. The content was between 3.64 & 2.52, 4.18 & 3.51 and 5.88 & 4.23 mg kg^{-1} in soil depth (0-30 and 30-60 cm), El-Alban, El-Nagagra, and El-Shatb areas, respectively.

Regard to data in Table, 2 and Figs., 4 to 7, the detectable content of AB-DTPA extractable copper was found that the soils at different sites at Kom Ombo sugar cane factory area during factory on activity. Data showed that with depth there was a decrease in copper content in El-Alban and El-Nagagra but in El-Shatb areas there was an increase in content with soil depth, the content in sites under investigated was 4.63 & 3.67, 3.09 & 2.32 and 4.99 & 5.07 mg kg^{-1} in soil depth (0-30 and 30-60 cm), in El-Alban, El-Nagagra, and El-Shatb areas, respectively. According to **Soltanpour, (1985)** who stated that the content of copper in soil under study exceed to the high permissible limit was for copper in agricultural soils > 0.5 mg kg^{-1}. The higher values in sites under study soils may be due to low the contents of total soil content of calcium carbonate and lower soil pH. The low of copper extracted by AB-DTPA is due to its precipitation as $CuCO_3$ **(Street** *et al***., 1977).**

Data showed in Table, 2 and Fig., 5 the detectable content of AB-DTPA extractable Cadmium which higher content recorded and reached to 0.091 mg kg^{-1} in El-Alban area in soil depth 0-30 cm located South of Kom Ombo sugar cane factory area and lower content reached to 0.007 mg kg^{-1} at El-Shatb area in depth 30-60 cm. **Rashed** *et al*., **(2009)** found same content of cadmium in Kom Ombo agriculture land were between 0.08: 0.02 mg kg^{-1}, and with **Soltanpour, (1985)** who found that permissible limit was > 0.5 for cadmium in agricultural soils.

Data showed in Table, 2 and Fig., 6 the detectable content of AB-DTPA extractable lead which higher content recorded between 5.81 mg kg^{-1} at El-Shatb area in depth 0-30 cm located area at south factory under study and lower content at El-Nagagra area in depth 30-60 cm. **El-Sokkary** and **Lag (1980)** observed the extracted values were decrease with depth of soils due to the bioavailable portions. The great deal of the contents of lead extracted by AB-DTPA was due to its precipitation as $PbCO_3$ **(Street** *et al***., 1977)**.

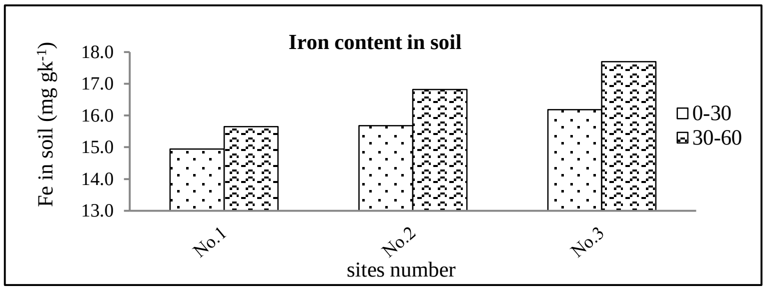
Data presented in Table, 2 and Fig., 7 also showed the detectable content of AB-DTPA extractable nickle at El-Shatb in soil depth 0-30 cm. The same contents was obtained with **Rashed** *et al*., **(2009)** they found same content of nickle in Kom Ombo agriculture area and were exceed than permissible limit reported by **Soltanpour, (1985)** may be causes an bioaccumulation in plant grown in same soil.

Aswan University Journal of Environmental Studies (AUJES) 4 (4), pp. 261-273, (2023).
Online ISSN: 2735-4237, Print: ISSN 2735-4229. https://aujes.journals.ekb.eg/

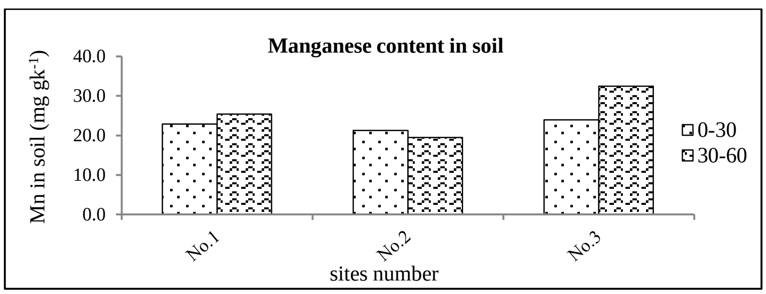
Table, 2: Soil heavy metals AB-DTPA- extractable content affected by fly ash from sugar cane factory at different soil layers and sites

Site name	Soil Depth (cm)	Content, mg kg^{-1} soil AB-DTPA- extractable						
		Fe	**Mn**	**Zn**	**Cu**	**Cd**	**Pb**	**Ni**
El-Alban area	0-30	14.94	22.87	3.64	4.63	0.091	4.64	23.65
	30-60	15.65	25.37	2.52	3.67	0.004	3.89	24.39
El-Nagagra area	0-30	15.68	21.28	4.18	3.09	0.027	3.74	26.47
	30-60	16.82	19.46	3.51	2.32	0.008	2.54	25.76
El-Shatb area	0-30	16.18	23.94	5.88	4.99	0.018	5.81	27.29
	30-60	17.69	32.43	4.23	5.07	0.007	3.92	25.84
Critical limit	Low	0-3[a]	0-0.5[a]	0-0.9[a]	0-0.2[a]	0.31[b]	13.0[b]	8.1[b]
	Medium	3.1-5[a]	0.6-1[a]	1-1.5[a]	0.3-0.5[a]			
	High	>5[a]	>1[a]	>1.5[a]	>0.5[a]			

a - Soltanpour (1985) and b - Maclean et al., (1987)



Fig, 1: Effect of fly ash on AB-DTPA Iron content in different soils depth and sires.
Sites No.1= El-Alban area, 2= El-Nagagra area and 3= El-Shatb area.



Fig, 2: Effect of fly ash on AB-DTPA Manganese content in different soils depth and sires.
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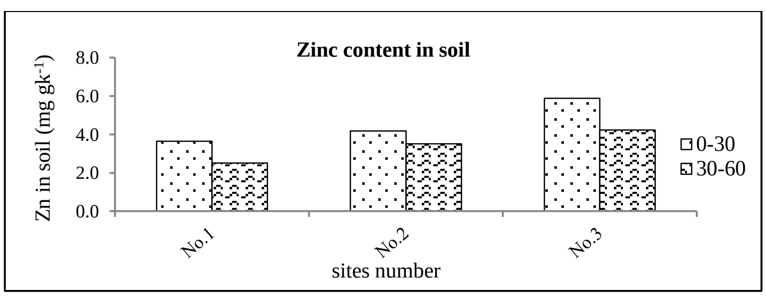

Fig, 3: Effect of fly ash on AB-DTPA Zinc content in different soils depth and sires.
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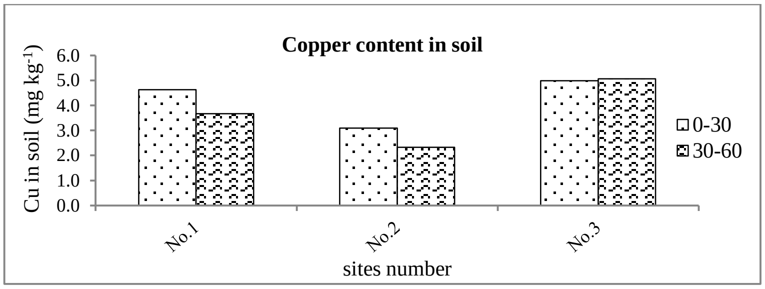
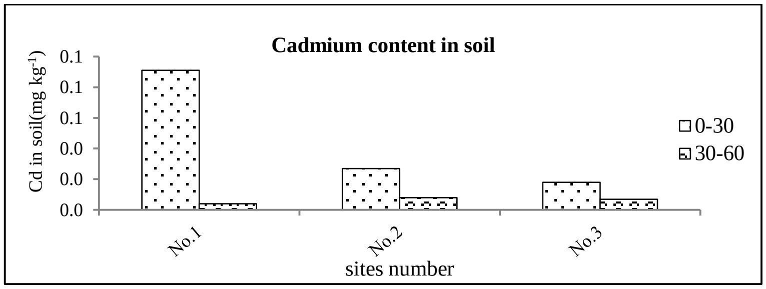
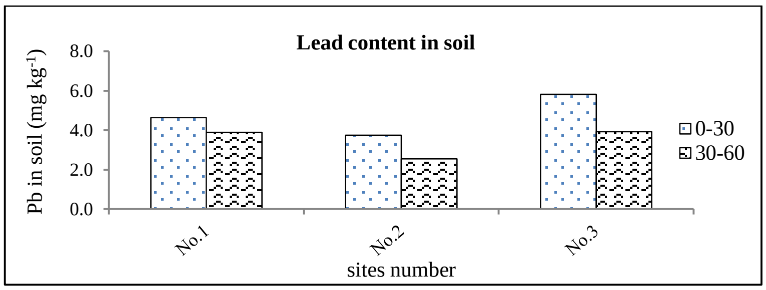


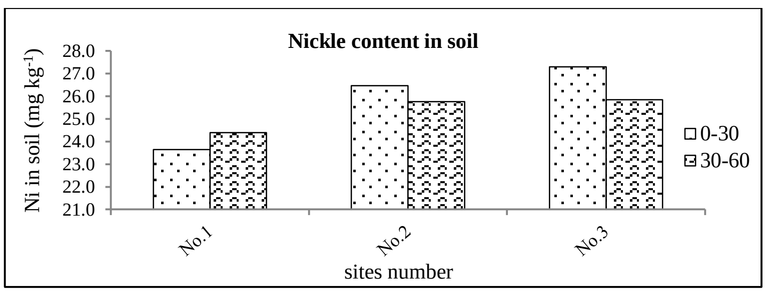
Fig, 4: Effect of fly ash on AB-DTPA Copper content in different soils depth and sires.
Sites No.1= El-Alban area, 2= El-Nagagra area and 3= El-Shatb area.



Fig, 5: Effect of fly ash on AB-DTPA Cadmium content in different soils depth and sires.
Sites No.1= El-Alban area, 2= El-Nagagra area and 3= El-Shatb area.



Fig, 6: Effect of fly ash on AB-DTPA Lead content in different soils depth and sires
Sites No.1= El-Alban area, 2= El-Nagagra area and 3= El-Shatb area.



Fig, 7: Effect of fly ash on AB-DTPA Nickle content in different soils depth and sires.
Sites No.1= El-Alban area, 2= El-Nagagra area and 3= El-Shatb area.

3.2. Plants heavy metals content at different location affected by fly ash produced from sugar cane factory

Actually, the content of heavy metals by plant grown in area at different sites located at South area near sugar cane factory at Kom Ombo during factory activity.

Data in Table, 4 and Figs., from 8 to 14 showed that the different content of iron, manganese, copper, zinc, cadmium, lead and nickel in plant. data showed that iron content in different plants grown in these areas was high at all plants all area located south of factory; while content of manganese was moderately in content at all plants except Lettuce and cabbage in El-Shatb area. On other hand, copper content was high at all plants in all three areas located south of factory. Also, zinc content was low in all plant samples under study.

Table, 3: some heavy metals content of different plants affected by fly ash from sugar cane factory at different sites

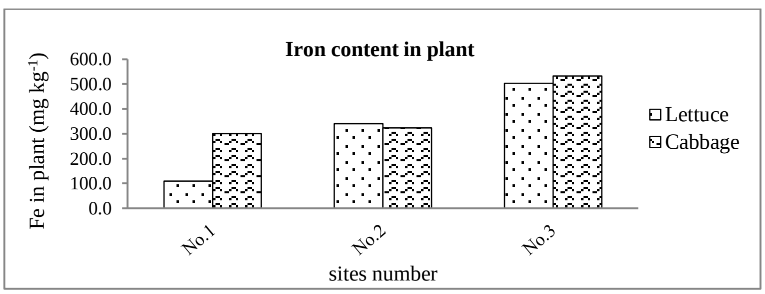
Site name	Plants namely	Contents, mg kg^{-1}						
		Fe	**Mn**	**Cu**	**Zn**	**Cd**	**Pb**	**Ni**
El-Alban area	Lettuce	109.5	7.88	39.42	6.91	0.032	2.45	2.35
	Cabbage	300.6	8.36	30.39	8.45	0.046	2.49	1.99
El-Nagagra area	Lettuce	340.3	10.19	48.54	9.39	0.056	2.66	2.02
	Cabbage	323.3	15.62	54.23	15.24	0.068	2.76	2.05
El-Shatb area	Lettuce	502.9	19.23	80.38	16.85	0.027	2.82	2.49
	Cabbage	532.2	22.67	98.54	20.21	0.039	2.97	3.55
Critical levels*		20	2	3	27.4	0.21	0.43	1.63

* Critical limit for FAO/ WHO (1984).

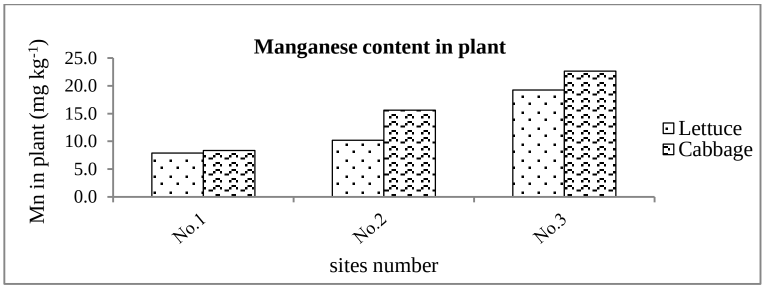
Regard to heavy metals cadmium, lead and nickel contents were not safe and exceeded the permissible limits according to FAO/ WHO (1984). These results correspond with **Sherif, (2019)**, who found that, Fe content in different plants grown behind industrial zone was very high in all plants; while content of manganese was low. Copper content in different plants was safe and below the permissible limits.

Generally, the highest content in different plants was as follows: lettuce and cabbage plant for Fe in all area located south of factory; lettuce, cabbage for Mn in El-Shatb area during factory on and cabbage plant for Cu during factory on in El-Shatb area. It was clear that the content of the element which exceeds the critical limits in some sites may be because of discharge of fly ash on agriculture land around factory area. It can be concluded that continuously discharge fly ash from sugar cane factory in Kom Ombo area that we selected to study lead to increase the pollutants of some heavy metals in different part of plants.

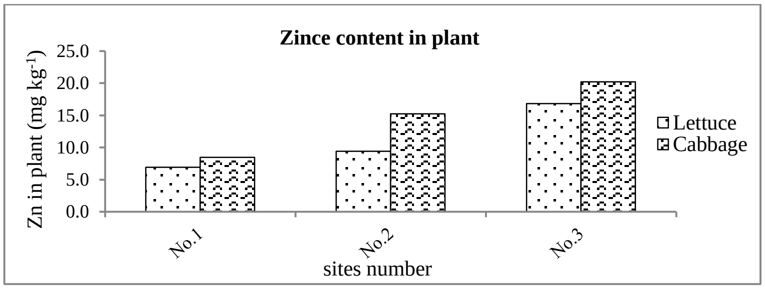
Regard to sites that we studied data showed there was high content of heavy metals in plants where it turns out the presence of high content in plants of lettuce and cabbage plant at El-Nagagra and El-Shatb areas, respectively.



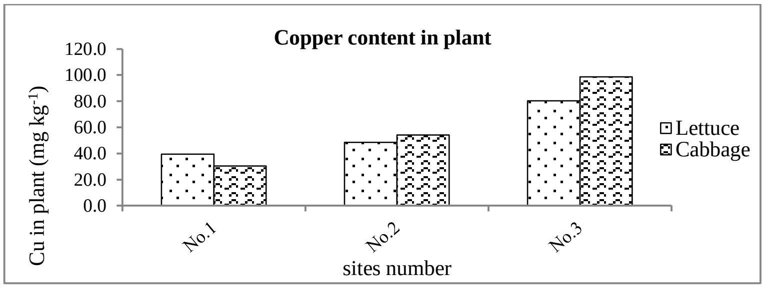
Fig, 8: Effect of fly ashes on Fe content in different plants and sites.
Sites No.1= El-Alban area, 2= El-Nagagra area and 3= El-Shatb area.



Fig, 9: Effect of fly ashes on Mn content in different plants and sites.
Sites No.1= El-Alban area, 2= El-Nagagra area and 3= El-Shatb area.



Fig, 10: Effect of fly ashes on Zn content in different plants and sites.
Sites No.1= El-Alban area, 2= El-Nagagra area and 3= El-Shatb area.



Fig, 11: Effect of fly ashes on Cu content in different plants and sites.
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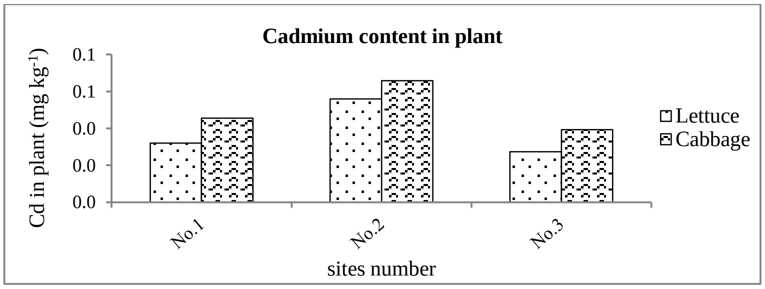
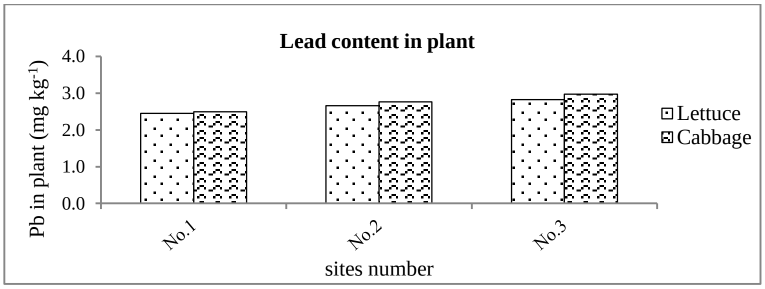
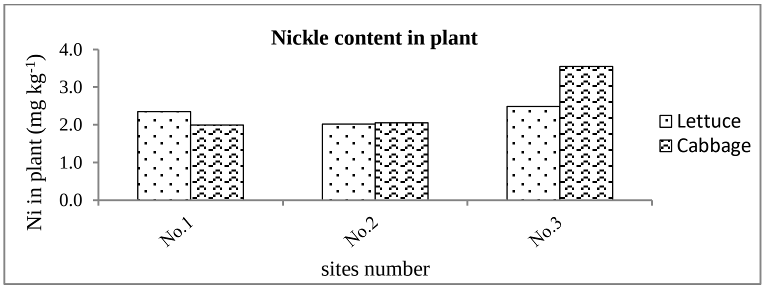


Fig, 12: Effect of fly ashes on Cd content in different plants and sites.
Sites No.1= El-Alban area, 2= El-Nagagra area and 3= El-Shatb area.



Fig, 13: Effect of fly ashes on Pb content in different plants and sites
Sites No.1= El-Alban area, 2= El-Nagagra area and 3= El-Shatb area.



Fig, 14: Effect of fly ashes on Ni content in different plants and sites.
Sites No.1= El-Alban area, 2= El-Nagagra area and 3= El-Shatb area.

3.3. The bioaccumulation factor (BAF) and Translocation factor (TF) of different plants from different location affected by fly ash around sugar cane factory

3.3.1. The bioaccumulation factor (BAF)

The bioaccumulation factor (BAF) refers to the heavy metals content of a substance in a different organism's tissue. BAF > 1 then the plants can be accumulators; BAF = 1 is no influences and BAF < 1 then the plant can be an excluder. This may indicate that the increases in total heavy metals contents in soils were in readily extractable forms. Also, most of the added metals could be present in a soluble form due to their easy solubility in polluted soils.

Data in Table, 5 and Figs., 8 to 14 indicated the bioaccumulation factor of iron, manganese, zinc, copper, cadmium, cobalt, nickel and lead in different parts of lettuce and cabbage plants grown near area around sugar cane factory where the data indicated that the iron the most accumulated metal in leaves and root parts of plants under study located south during factory activity overall sites under study the ranged was between 20.12 and 32.89 in cabbage leaves at El- Alban area to and El-Shatb sites, respectively, followed by copper ranged between 6.56 and 19.75 in El- Alban area and El-Shatb site during factory on activity.

Regard to zinc as heavy metals the ranged between 1.90 and 3.65 in lettuce leaves at El-Alban site to in cabbage leaves at El- Nagagra site, followed by cadmium it ranged between 1.52 in Lettuce leaves at El-Shatb site, to 2.44 in cabbage leaves at El- Nagagra site.

Moreover, data in Table, 5 showed that manganese, lead and nickel had no bioaccumulation in root and leaves parts at all different sites under study, as in Lettuce leaves manganese was 0.80 and in cabbage leaves 0.95 at area in El-Shatb site on other hand nickel and lead showed no bioaccumulation in all sites under study at all sites.

Table, 4: Bioaccumulation factor and Translocation factor of heavy metals of different plants parts grown in soil near sugar cane factory at different sites during factory activities.

Site name	Plants namely	Bioaccumulation factor (BAF)						
		Fe	**Mn**	**Cu**	**Zn**	**Cd**	**Pb**	**Ni**
El-Alban area	Lettuce	7.33	0.34	8.51	1.90	0.36	0.53	0.15
	Cabbage	19.21	0.33	8.28	3.35	0.51	0.64	0.15
El-Nagagra area	Lettuce	21.71	0.48	15.71	2.25	2.07	0.71	0.15
	Cabbage	19.22	0.80	23.28	4.34	2.44	1.09	0.17
El-Shatb area	Lettuce	31.08	0.80	16.11	2.87	1.52	0.49	0.12
	Cabbage	30.09	0.70	19.44	4.78	2.18	0.76	0.23
		Translocation factor (TF).						
El-Alban area	Lettuce	1.09	0.33	1.29	1.44	0.68	2.88	2.35
	Cabbage	1.39	0.34	1.32	1.76	0.82	2.54	1.99
El-Nagagra area	Lettuce	1.06	1.40	1.18	3.45	1.02	3.24	2.02
	Cabbage	1.11	4.29	1.06	3.65	1.20	4.25	2.05
El-Shatb area	Lettuce	1.00	3.60	1.02	2.81	0.41	3.92	2.49
	Cabbage	1.23	1.00	1.07	2.67	0.46	3.00	3.55

Sites No.1= El-Alban area, 2= El-Nagagra area and 3= El-Shatb area.

So, bioaccumulation factor of heavy metals for two plants cabbage and lettuce at both root and leaves could be followed the descending order Iron> Copper> Zinc> Cadmium> Nickel> Lead> Manganese, respectively. The order of the bioaccumulation factor measured in in different plant parts indicating that these plants possessed a strong biological enrichment ability to accumulate a variety of heavy metals. The presence of heavy metal in plant parts have been attributed to reckless use of soil, leading to contamination **(Abdullateef** *et al***., 2014)**. **Islam** *et al***., (2020)** stated that a lower bioaccumulation factor value is observed which can be attributed to difference in location, soil properties (concentration of metals in soil, pH, organic matter, clay content, cation exchange capacity, metals forms or speciation in soils), vegetable tissue content efficiency and growth factors.

However, during the factory activity at South areas the obtain data indicated that the same behavior was with different values. And that means the cabbage leaves was more accumulator plant may be this due to the value of bio accumulation factor according to the equation used.

3.3.2. Translocation factor (TF)

Translocation factor refers to the mobilization ratio to determine relative translocation of heavy metals from soil to other plant parts (roots and leaves). Translocation factor (TF) expressed as the ratio of heavy metals in plant leaves to that in plant root **(Cui** *et al***., 2007).**

Translocation factor is the ability of a plant to translocation metals from the roots to the leaves is determined by the ratio of metal concentration in plant leaves to metal concentration in the root **(Gupta** and **Sinha, 2007)**. According to **Mellem** *et al.*, **(2012)**, translocation factor values nearer to zero imply high retention of metal in the soil and result in less movement to the plants. According to **Kumar** *et al***., (2009)**, high values of Translocation factor indicate low retention capacity. Similarly, translocation factor above 1.0 indicates hyper-accumulation, especially in soils, according to **Eze** and**)**, but values of 0.1 indicated that plant was excluding metals from its tissues, while the TF values of 0.2 indicated the probability of metal contamination by anthropogenic activities **(Khan** *et al***., 2009).**

According to **Masona** *et al***., (2011)**, pollution sources increases heavy metal concentrations in soils, which agrees with the earlier research result of **Schmidt, (1997)**, those toxic heavy metals, and especially Ni, is commonly found in high concentrations.

Impacts both of heavy metal as Fe, Mn, Zn, Cu, Cd, Pb and Ni contamination by fly ash on soil located near sugar cane factory Off and On activity. Data in Table, 5 indicated that leaves and roots of both lettuce and cabbage plants grown near sugar cane factory in Kom Ombo due to continues adding of fly ash from processing sugar production agriculture land around sugar cane factory during activity. Data represented that translocation factor of heavy metal in different plants part grown for leaves and roots of lettuce and cabbage in three sites located at South of sugar cane factory during of factory activity which affected by fly ash from processing sugar production.

Data was observed that the translocation factor for both plant lettuce and cabbage at two different parts under study was lower than 1.0 at all sites in heavy metals content under study located in South in two factory status (off and activity) which was may be due to the mobility of heavy metals from soil and roots to leaves for both plant under study.

On the other hand, both heavy metals of lead and manganese content was observed that the highest translocation factor values of cabbage plants grown in El-Nagagra areas during factory on activity was 4.25 and 4.29 respectively. Also, nickel and zinc in lettuce and cabbage were in the same trend at different sites and with values 5.55 and 3.65 in El-Shatb and El-Nagagra, respectively with low value in both copper and iron content in sites, previously under study

The same result gained with **Rashed** *et al*.**, (2009)** they found that the storage of heavy metals through primary or secondary contamination of the atmosphere affects the food chain, and that is the case of Cu, Fe, and Mn in the flowers/honey chain in our study.

4. Conclusion

From previous mention could be concluded that translocation factor data showed that lead metal was the highest translocation factor values flowed by zinc, nickel, iron, cupper and manganese, respectively for all sites under study except translocation factor was < 1.0 at El-Alban area for manganese. While, the translocation factor for cadmium was less than 1.0 in most sites under study.

5. Aknowledgement

Great thanks extended to all academic staff members and colleagues in the Department of Natural Resources, Institute of African Research and Studies and Nile basin country, Aswan University and I am deeply grateful to the all scientist staff of the Soil, Water and Environment Research Institute, Agriculture Research Center at Giza, for their help and support.

6. Referance

A.O.A.C. (1995). Method of Analysis Association of Official Agriculture Chemists. 16th Ed,Washington, D.C, USA.

Abdullateef, B., Kolo, B. G., Waziri, I. and Idris, M. A., 2014. Levels of heavy metals in soil as indicator of environmental pollution in Maiduguri, Borno state, Nigeria. Bull. Env. Pharmacol. Life Sci., 3:133–136.

Aboulroos, S. A., Holah, S. S. and Badawy, S. H. (1996). Background levels of some heavy metals in soils and corn in Egypt. Egyptian Journal of Soil Science (Egypt).

Adepetu, J. A., Nabhan, H. and Osinubi, A. (1996). Simple soil, water and plant testing techniques for soil resource management. *Proceedings of a training course held in Ibadan, Nigeria*, 16-27.

Cottenie, A., Verloo, M., Kiekens I., Velghe, G. and Camerlynck. R. (1982). Chemical analysis of plants and soils. Lab of analytical and agro. Univ. Ghent. Belgium.

Cui, S., Zhou, Q. and Chao, L. (2007). Potential hyper-accumulation of Pb, Zn, Cu and Cd in endurant plants distributed in an old smelters, northeast China. Environmental Geology, 51: 1043-1048.

Elsokkary, I. H. and Lag, J. (1980). Status of some trace elements in Egyptian soils and in wheat grains. Beitrage zur Tropischen Landwirtschaft und Veterinarmedizin (Germany DR)., 18(1), 35-47.

Eze, M. O. and Ekanem, E. O. (2014). Bioaccumulation and mobility of cadmium (Cd), lead (Pb) and zinc (Zn) in green spinach grown on dumpsite soils of different pH levels. Bull. Environ. Pharmacol. Life Sci., 4:85–91.

FAO/WHO., (1984). Contaminants. In Codex Alimentarius, vol. XVII, Edition 1. FAO/WHO, Codex Alimentarius Commision, Rome.

FAO/WHO., (1984). Contaminants. In Codex Alimentarius, vol. XVII, Edition 1. FAO/WHO, Codex Alimentarius Commision, Rome.

Gupta, A. K. and Sinha, S. (2007). Phytoextraction capacity of the plants growing on tannery sludge dumping sites. Bioresource technology, 98(9):1788-1794.

ICARDA "International Center for Agricultural Research in the Dry Areas" (2013). Methods of soil, Plant, and water analysis: A manual for the West Asia and North Africa region. Estefan, G., Sommer, R. and Ryan, J. 3th ed., Box 114/5055, Beirut, Lebanon.

Isibor, R. A. (2016). Assessment of trace metal contamination of soils around Oluyole Industrial Estate, Ibadan, Southwestern Nigeria. *Global Journal of Pure and Applied Sciences*, *22*(1), 101-114.

Islam, M. D., Hasan, M. M., Rahaman, A., Haque, P. and Rahman, M. M. (2020). Translocation and bioaccumulation of trace metals from industrial effluent to locally grown vegetables and assessment of human health risk in Bangladesh. SN Applied Sciences, 2(8):1-11.

Khan, S., Farooq, R., Shahbaz, S., Khan, M.A. and Sadique, M. (2009). Health risk assessment of heavy metals for population via consumption of vegetables. World Appl. Sci. J., 6:1602–1606.

Kumar, N. J. I., Soni, H., Kumar, R. N. and Bhatt, I. (2009). Hyper accumulation and Mobility of Heavy Metals in Vegetable Crops in India. J. Agric. Environ., 10:29–38.

Liu, W.-h., J.-z. Zhao, Z.-y. Ouyang, L. Söderlund. and G.-h. Liu, (2006). Impacts of sewage irrigation on heavy metal distribution and contamination in Beijing, China. Environment International, 31(6): 805-812.

MacLean, K.S., A.R. Robinson and H.M. MacConnell. (1987). The effect of sewage-sludge on the heavy metal content of soils and plant tissue. Commun. Soil Sci. Plant Anal. 18:1303-1316.

Masona, C., Mapfaire, L., Mapurazi, S. and Makanda, R. (2011). Assessment of heavy metal accumulation in wastewater irrigated soil and uptake by maize plants (*Zea Mays L.*) at fire farm in Harare. J. Sustain. Dev., 4:132–137.

Mellem, J. J., Baijnath, H. and Odhav, B. (2012). Bioaccumulation of Cr, Hg, As, Pb, Cu and Ni with the ability for hyper accumulation by *Amaranthus dubius*. African Journal of Agricultural Research, 7(4):591-596.

Poddar, P. K. and Sahu, O. (2017). Quality and management of wastewater in sugar industry. *Applied Water Science*, *7*, 461-468.

Rashed, M. N., M. T. A. El-Haty. And S. M. Mohamed (2009). Bee honey as environmental indicator for pollution with heavy metals. Toxicological and Environ Chemistry 91.3: 389-403.

Sahu, O. (2018). Assessment of sugarcane industry: Suitability for production, consumption, and utilization. *Annals of Agrarian Science*, *16*(4), 389-395.

Schmidt, J. P. (1997). Understanding phytotoxicity thresholds for trace elements in land-applied sewage-sludge. J. Environ. Qual., 26:4–10.

Sherif, A. E. A. (2019). Environmental Assessment for Soils and Plants Irrigated From Canal Bani Ghalib Assiut Governorate Egypt. *Int. J. Environ*, *8*(4), 189-209.

Singh, O. K. (2019). Energy analysis of a grid-connected bagasse-based cogeneration plant of sugar factory and exhaust heat utilization for running a cold storage. *Renewable energy*, *143*, 149-163.

Soltanpour, P.N. and Schwab, A.P. (1985). Determination of nutrient availability element toxicity by AB-DTPA. Soil Test ICPS Adv. Soil Sci., 16: 165-190.

Soltanpour, P.N. and Schwab, A.P. (1991). Determination of nutrient availability element toxicity by AB-DTPA. Soil Test ICPS Adv. Soil Sci., 16: 165-190.

Street, J. J., Lindsay, W. L. and Sabey, B. R. (1977). Solubility and plant uptake of cadmium in soils amended with cadmium and sewage sludge American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America. Vol. 6, No. 1, pp. 72-77.