ACCUMULATION OF METALS IN PLANTS IN POLLUTED ENVIRONMENT, SADAT CITY EGYPT

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ABSTRACT

Sadat city consists of industrial zones and residential zones, inside factories of the city some plants were growing. Recorded the accumulation of metals in this plants were found more than the plants grow in residential zones. Atomic absorption spectrophotometer was used to measure the concentration of metals in plants (Fe, Pb, Ni, Cu, and Zn) in both residential and industrial zones.Iron (Fe) was found only in plants which grew in steel factories under prevailing wind and not found in plants which grew in residential zones. Cu was not found in all plants. Pb, Zn and Ni were recorded in plants which grew in steel factories more than that were recorded in plants which grew in residential zones.

Keywords: *Heavy metals, pollution and plants.*

INTRODUCTION

Accelerated movement led development in the Arab Republic of Egypt to increase manufacturing processes and increased demand for manufacturing products for the domestic market and export to the countries of the world by agreements within the framework of strict environmental standards. (UNCTD, 2013)

Industrialization and urbanization are the main contributors to destabilizing the fragile ecology. Rapid and uncontrolled industrialization causing health hazards. So the effect of industrialization on human health, vegetation and on the atmosphere is of great concern in the world today. Various types of diseases, mainly respiratory, are common in industrial towns due to air pollution) Sengupta and Venkatachalam (1994).

The industrial activities are expected to discharge their wastes to the surrounding atmosphere. There for, monitoring and assessment should be done to manage and control the air pollution, water source pollution and soil pollution) .UNEP (2005).

General outline of El-Sadat city: An overview

SadatCitywas established by Presidential Decree No. 123 dated 1978 with an area of 500 square km /s.

It is located north of Cairo –Alexandria desert road between Km 95and Km103 from Cairo. The City is bounded by longitudinal 30° 19’ 30” -30° 40’ 27” E and latitude 30° 15’ 50” –30° 34’ 00”N ,. It is bounded from the East by KaferDawoud and El Khatataba, from the West by El Birigat, and from the North by Nubariya canal and El Tahrir (Hegazy, 2010).

Industry zones are located on a separated spine along the south–eastern edge of the city to ensure industry pollution being downwind. To protect the city against wind and storms, a green shelterbelt about 35000 feddans are planted round the city and two thousand feddans were planted with vegetables and fruits.

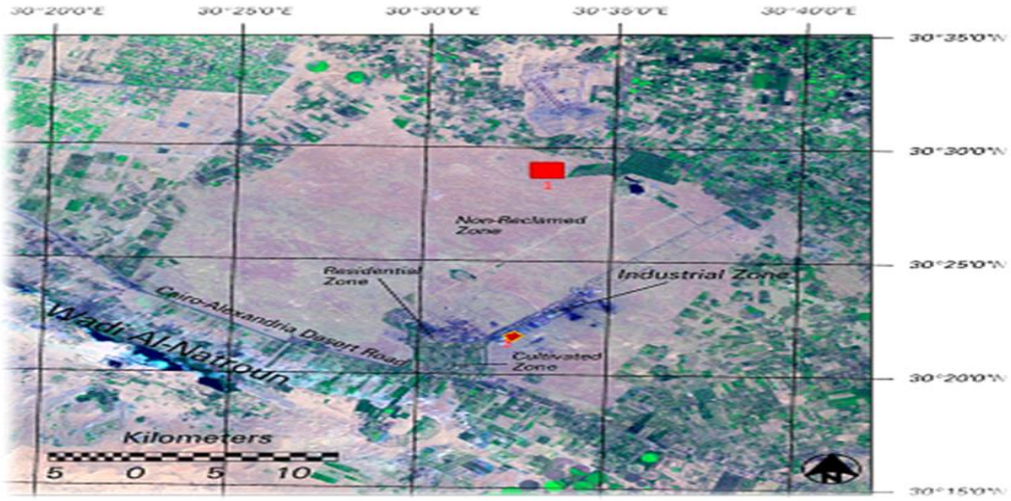


Fig. (1) Map of Sadat city related toCairo – Alexandriadesert road.

Biomarker

Air pollution, a global problem being faced by both the developed nations as well as the developing ones, has been aggravated by developments that typically occur as countries become industrialized: growing cities, increased traffic, rapid economic development and industrialization, and high levels of energy consumption. All these factors act as cause and effect for one another and act in a synergistic manner to befoul the sanctity of natural environment.(Qayoom*et al*., 2009).

Some plants being directly and constantly exposed (round the clock) to the pollutants (both gaseous and particulates) play a significant role as indicators and in mitigating the problem. They absorb, accumulate and integrate the pollutants impinging on their foliar surface, acting as the sinks for various pollutants and thus mitigating the problem. The plants don't render this service to the mankind without any serious implications; in turn they suffer from various deformities caused by the integrating pollutants and show diverse morphological, biochemical, anatomical and physiological responses. In this backdrop the present transplant study was planned using plants to assess whether certain ecophysiological responses may be valid bioindicators of urban auto pollution.

Study of the effects of air pollution caused by thermal power plant emissions on some foliar traits of Ruelliatuberosa L. has shown that length and width of stomata, length of stomatal pore, stomatal density, photosynthetic rate, stomatalconductanceand chlerophyll content were reduced in the polluted plants in pre-flowering, flowering as well as post-flowering phases of plant growth. Intercellular (Nighat*et al*., 2000).

Motivation

The interest for environmental biomarkers was intensified around late 1980's and early 1990's (Peakall, 1994b), and the evolution of its use as a tool to monitor and evaluate the environmental state is closely linked to progress in our knowledge of molecular toxicity

mechanisms of pollutants in different animal and plant species in the ecosystem(Narbonne, 2000). Pollution of the environment has been a subject of interest for decades, and with the ever increasing number and amounts of agricultural and industrial chemicals released to the environment, there has been a need to monitor the presence and effect of these chemicals on the environment.

Fig. (8). Dendrogram indicating which biomarkers are appropriate for which xenobiotic stress type. This diagram does not represent the extent of application of any biomarker, simply the groups of contaminants which have been evaluated most appropriately by a given biomarker. Biomarkers followed by (All) indicate that the biomarker is potentially appropriate for all types of stressors. (Brain &Cedergreen, 2009).

MATERIAL AND METHOD

Atomic Absorption Spectrophotometer analysis

Analyst 100 Atomic Absorption Spectrophotometer –Perkin Elmer (lab. Of ISRAE&Lab. Of The American University inCairo– Research Station in Sadat city (To determine heavy metals concentration in plants this grew in pollutant factory under prevailing wind and the same plants this grew in clean environmentAs, Fe, Ni, Zn,Mn, K, Na,Pb

RESULT AND DISCUSSION

Biomarker in plants

Morphological deference's according environment

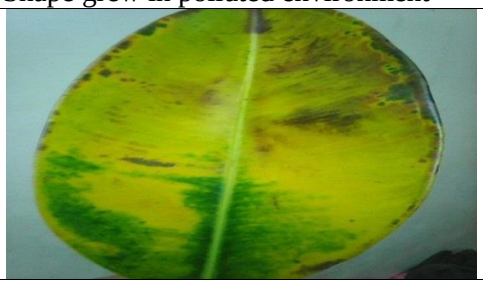
1- Bogainvilleaspp.

No	Shape grew in polluted environment	Shape grew in clean environment
1		
2	Polluted sample plant from arcosteel co Green yellow leaf Have brown spots and edge Dusty leaves have wrinkles in large curvature edges	Clean sample plant from an house good green leaves good surface and edge clean leaves haven't wrinkles normal edges

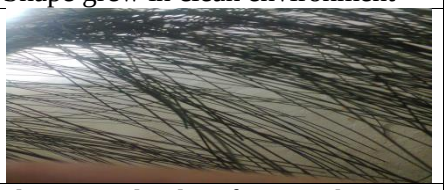
2- Phoenix dactylifera

No.	Shape grew in polluted environment	Shape grew in clean environment
1		
2	Polluted sample plant from arcosteel co. Pale green leaves Have brown spots Twisted some leaves Dusty leaves	Clean sample plant from an house good green leaves good surface and edge clean leaves haven't wrinkles

3- Ficusbenjamina-:

No	Shape grew in polluted environment	Shape grew in clean environment
1		
2	Polluted sample plant from arcosteel co. Yellowish green leaves with brown spots Good surface and edge Dusty leaves haven't wrinkles normal edges with brown edge	Clean sample plant from an house good green leaves good surface and edge clean leaves haven't wrinkles normal edges

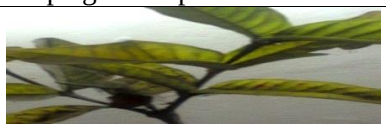
4- CasuarinaEquistifolia

No.	Shape grew in polluted environment	Shape grew in clean environment
1		
2	Polluted sample plant from arcosteel co. Dark green leaves good surface and edge heavy dust leaves haven't wrinkles normal edges	clean sample plant from an house good green leaves good surface and edge clean leaves haven't wrinkles normal edges

5 -Nerium Oleander

No.	Shape grew in polluted environment	Shape grew in clean environment
1	 	
2	Polluted sample plant from arcosteel co. Pale green leaves good surface and edge heavy dust leaves haven't wrinkles normal edges	clean sample plant from an house good green leaves good surface and edge clean leaves haven't wrinkles normal edges

6- PsidiumGuayava

No.	Shape grew in polluted environment	Shape grew in clean environment
1		
2	Polluted sample plant from arcosteel co. Yellowish green leaves good surface and edge dusty leaves haven't wrinkles normal edges	clean sample plant from an house good green leaves good surface and edge clean leaves haven't wrinkles normal edges

Ppm of metals (Fe, Zn, Pb, Ni, Mn) in some plants

Metal	Zone	Casuarina*Equistifolia*	*Dodonea Viscosa*	*Phoenix Dactyliferae*	*Nerium Oleander*
Fe(ppm)	Industrial	436	291	0.0	291
	Residential	0.0	0.0	0.0	0.0
Zn(ppm)	Industrial	447.33	188.93	212.55	628.78
	Residential	23.62	79.70	39.85	13.28
Pb(ppm)	Industrial	0.002	0.002	0.002	0.003
	Residential	0.001	0.001	0.002	0.000
Ni(ppm)	Industrial	64.97	71.43	57.14	21.43
	Residential	50	42.86	7.14	28.57
Mn(ppm)	Industrial	361.9	288.71	342.86	438.1
	Residential	209.52	419.05	266.67	247.62

Fe

In the study plant samples, the analysis for plant samples collected from different studied sites (industrial and residential) indicates that the highest Fe concentration value was in*Casuarinaequistifolia* 436)ppm). And they are detected in other two plants only)*DodoneaViscosa*was 291 ppm ,*Nerium Oleander*291 ppm) All three plants grew in industrial zones (polluted zones).

While the same plant in residential zones the Fe was not detected.This mean some plants in polluted zones were contaminated with Fe metal which result from steel company (study place).

Zn

In the study plant samples, the analysis for plant samples collected from different studied sites (industrial and residential) indicates that the highest Zinc concentration value was in*Nerium Oleander*in industrial zone 628.78) ppm). While the lowest Zinc concentration value was in*Nerium Oleander*also but in residential zone (13.28ppm).

Generally the result show all plant samples from residential zones (clean) lower than plant samples from industrial zones (polluted). This mean the plants in polluted zones were contaminated with Zinc metal which result from industrial activities and zinc metal play a role as plant marker.

Pb

In the study plant samples, the analysis for plant samples collected from different studied sites (industrial and residential) indicates that the highest Lead concentration value was in CasuarinaEquistifolia, and*Nerium oleander*in industrial zone (0.003ppm). While the lowest lead concentration value was in*Ficusbenjamina*and*Nerium oleander*in residential zone (ND ppm).

Generally the result show the Lead concentration in the study plant samples was higher in samples from industrial zones (polluted) than samples from residential zones (clean).

Ni

In the study plant samples, the analysis for plant samples collected from different studied sites (industrial and residential) indicates that the highest Nickel concentration value was in*Ficusbenjamina*in Residential zone (92.88ppm).

While the lowest Nickel concentration value was in ficus*bengalensis*in industrial zone (0.0ppm).

Generally the result show was not role in distribution of Nickel in all plant samples from residential zones (clean) and industrial zones (polluted).

Mn

In the study plant samples, the analysis for plant samples collected from different studied sites (industrial and residential) indicates that the highestManganese concentration value was in*Nerium oleande*r in industerial zone (438.1ppm).

While the lowest Manganese concentration value was in*FicusStarlightes*in industrial zone (171.43 ppm).

The result show was not role in distribution of Manganese in all plant samples from residential zones (clean) and industrial zones (polluted).

Generally the results of Fe,Zn,Pb,Ni, Mn. Show were played a role in all plant samples as Xenobiotic stress for morphological Biomarker.

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