بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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MONA MAGHRABY

THE ENVIRONMENTAL IMPACTS OF FERTILIZER FACTORIES WASTE ON SOME VEGETABLE CROPS

Submitted BY

Magda Attia Abd El-Moamen Ali El-Bahat

B.Sc. of Agricultural Sciences, (General Plant Production), Faculty of Agriculture, Mansoura University, 1989
Diploma of Environmental Sciences, Institute of Environmental Studies & Research, Ain Shams University, 2001
M.Sc. of Environmental Sciences, Institute of Environmental Studies & Research, Ain Shams University, 2014

A THESIS

Submitted in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

In

Environmental Sciences

Department of Agricultural Sciences,
Faculty of Graduates Studies and Environmental Research,
Ain Shams University.

2021

APPROVAL SHEET

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Department of Environmental Agricultural Sciences

This thesis was discussed and approved by:

Name **Signature**

1- Prof. Dr. Mohamed Emam Ragab
Emeritus Prof. of Vegetables, Hort.Dept.,
Faculty of Agriculture, Ain Shams University.

2- Prof. Dr. Ahmed Abd-Elkader Ali Taha
Emeritus Prof. of Soils, Soil. Dept.,
Faculty of Agriculture, Mansoura University.

3- Prof. Dr. Ayman Farid Abou-Hadid
Emeritus Prof. of Vegetables, Hort. Dept.,
Faculty of Agriculture, Ain Shams University.

4- Prof. Dr. Usama Ahmed El-Behairy
Prof. of Vegetables, Hort. Dept.,
Faculty of Agriculture, Ain Shams University.

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1- Prof. Dr. Ayman F. Abou-Hadid

Emeritus Prof. of Vegetable crops, Horticulture Department, Faculty of Agriculture, Ain Shams University.

2- Prof. Dr. Usama A. El-Behairy

Prof. of Vegetable crops, Horticulture Department Faculty of Agriculture, Ain Shams University.

3- Dr. Abd El-Badea S. Ezzat

Associate Prof. of Vegetable Crops Departments, Horticulture Research Institute, Agriculture Research Center.

4- Prof. Dr. Adel M. Abd El-Hamed

Prof. of Plant Nutrition, Soils, Water and Environmental Research Institute, Agriculture Research Center.

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Magda Attia Abd El-Moamen Ali El-Bahat

ABSTRACT

Magda Attia Ali El-Bahat: The environmental impacts of fertilizer factories wastes on some vegetable crops .

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A field survey study was conducted during the two successive winter seasons of (2016/2017 and 2017/2018) near the Factory of Nitrogen Fertilizers and Chemical Industries near Mansoura city, Dakahlia Governorate to evaluate the effect of the factory wastes on some heavy metals (Arsenic, Cadmium, Cobalt and Lead), nitrate and nitrite contents in the edible parts of some vegetables, soil and water. The experimental design was complete randomized design (CRD) with three replications. Samples of three vegetable crops; i.e.; potato, sweet pepper and watercress, soil and water were taken from both sides of the main drainage channel of wastes at three distances at (1, 3 and 5 km) from the factory, besides the control at the opposite direction from the factory.

The study revealed significant effects of some heavy metals (Arsenic, Cadmium, Cobalt and Lead), nitrate and nitrite contents in the edible parts of vegetables, soil and water.

Data obtained in this study, indicated that increasing the distance at (5 km), from source of the pollution increased in the vegetative growth and yield of vegetable crops under study. In the same time, nitrate, nitrite and some heavy metals espeasilly (cobalt and lead) concentrations were increased in the edible parts of the tested vegetables (potato tubers, sweet pepper fruits and watercress leaves) and also in soil and water. This effect may be decrease or fading by increasing the distance from the source of pollution more than that.

Therefore, it could be recommend cultivation in the vegetables at a distance more than (5 km) from sources of the pollution and must be prevent cultivation of vegetables near or round of the different sources of pollution specially factories for nitrogen fertilizers production.

CONTENTS

	Page
INTRODUCTION ……...	1
REVIEW OF LITERATURE ……..……...	4
MATERIALS AND METHODS …….	20
RESULTS AND DISCUSSION ……..	25
A- Potato ……..……..…….	25
1-Vegetative growth characters and tubers yield	25
2- Chemical contents …….……	28
2.1- Heavy metals, *i.e.* ,Arsenic (As), Cadmium (Cd), Cobalt (Co) and Lead (Pb) contents in leaves ……	28
2.2- Heavy metals, i.e., Arsenic (As), Cadmium (Cd), Cobalt (Co) and Lead (Pb) contents in tubers ……	30
2.3- Nitrate (NO_3^-) and nitrite (NO_2^-) contents in leaves and tubers ……..…	32
B- Sweet pepper…….……..…..……..…….	34
1- Vegetative growth characters and fruits yield …….….	34
2- Chemical contents …….……..…	37
2.1- Heavy metals, i.e., Arsenic (As), Cadmium (Cd), Cobalt (Co) and Lead (Pb) contents in leaves ……..……	37
2.2- Heavy metals, *i.e.*, Arsenic (As), Cadmium (Cd), Cobalt (Co) and Lead (Pb) contents in fruits ……	39
2.3- Nitrate (NO_3^-) and nitrite (NO_2^-) contents in leaves and fruits ……..…	41
C- Watercress …….……..……..…….	43
1- Vegetative growth characters and leaves yield ……	43
2- Chemical parameters …….……	45

2.1- Heavy metals,*i.e.* ,Arsenic (As), Cadmium (Cd), Cobalt (Co) and Lead (Pb) contents in leaves …… 45

2.2- Nitrate (NO_3^-) and nitrite (NO_2^-) contents in leaves …… 47

D- Soil content from heavy metals, nitrate and nitrite : 49

1- Soil content from heavy metals, *i.e.*, Arsenic (As), Cadmium (Cd), Cobalt (Co) and Lead (Pb) …… 49

2- Soil content from nitrate (NO_3^-) and nitrite (NO_2^-) …… 51

E- Water content from heavy metals, nitrate and nitrite : 53

1- Water content from heavy metals, *i.e.*, Arsenic (As), Cadmium (Cd), Cobalt (Co) and Lead (Pb) 53

2- Water content from nitrate (NO_3^-) and nitrite (NO_2^-) 55

SAUMMARY…… 57

REFERENCES…… 63

ARABIC SUMMARY…… ١

List of Tables

No.	Title	Page
1	Heavy metals (As, Cd, Co and Pb) contents in mineral fertilizers	21
2	Fresh weight/plant, plant height, leaf area/plant and total tuber yield/fed of potato as affected by distances from the source of pollution during 2016/2017 and 2017/2018 seasons	26
3	Potato leaves content from heavy metals, *i.e.*, Arsenic (As), Cadmium (Cd), Cobalt (Co) and Lead (Pb) as affected by distances from the source of pollution during 2016/2017 and 2017/2018 seasons	29
4	Potato tubers content from heavy metals, *i.e.*, Arsenic (As), Cadmium (Cd), Cobalt (Co) and Lead (Pb) as affected by distances from the source of pollution during 2016/2017 and 2017/2018 seasons	31
5	Potato leaves and tubers content from nitrate (NO_3^-) and nitrite (NO_2^-) as affected by distances from the source of pollution during 2016/2017 and 2017/2018 seasons	33
6	Fresh weight/plant, plant height, leaf area/plant and total fruit yield/fed of sweet pepper as affected by distances from the source of pollution during 2016/2017 and 2017/2018 seasons	36
7	Sweet pepper leaves content from heavy metals, *i.e.*, Arsenic (As), Cadmium (Cd), Cobalt (Co) and Lead (Pb) as affected by distances from the source of pollution during 2016/2017 and 2017/2018 seasons	38
8	Sweet pepper fruits content from heavy metals, *i.e.*, Arsenic (As), Cadmium (Cd), Cobalt (Co) and Lead (Pb) as affected by distances from the source of pollution during 2016/2017 and 2017/2018 seasons	40
9	Sweet pepper leaves and fruits content from nitrate (NO_3^-) and nitrite (NO_2^-) as affected by distances from the source of pollution during 2016/2017 and 2017/2018 seasons	42

No.	Title	Page
10	Fresh weight/plant, plant height, leaf area/plant and total yield/fed of watercress as affected by distances from the source of pollution during 2016/2017 and 2017/2018 seasons	44
11	Watercress leaves contents from heavy metals, *i.e.*, Arsenic (As), Cadmium (Cd), Cobalt (Co) and Lead (Pb) as affected by distances from the source of pollution during 2016/2017 and 2017/2018 seasons	46
12	Watercress leaves content from nitrate (NO_3^-) and nitrite (NO_2^-) as affected by distances from the source of pollution during 2016/2017 and 2017/2018 seasons	48
13	Soil content from heavy metals, *i.e.*, Arsenic (As), Cadmium (Cd), Cobalt (Co) and Lead (Pb) as affected by distances from the source of pollution during 2016/2017 and 2017/2018 seasons	50
14	Soil content from nitrate (NO_3^-) and nitrite (NO_2^-) as affected by distances from the source of pollution during 2016/2017 and 2017/2018 seasons	52
15	Water content from heavy metals, *i.e.*, Arsenic (As), Cadmium (Cd), Cobalt (Co) and Lead (Pb) as affected by distances from the source of pollution during 2016/2017 and 2017/2018 seasons	54
16	Water content from nitrate (NO_3^-) and nitrite (NO_2^-) as affected by distances from the source of pollution during 2016/2017 and 2017/2018 seasons	56

INTRODUCTION

The pollution of air, soil and plants specially fruits and vegetables become a common thing these days, and it happens due to the man made. The factories waste products are full of chemicals which lead to soil, fruits and vegetables pollution.

Most of the polluting gases enter leaves through stomata, following the same pathway as CO_2. NOx dissolves in cells and gives rise to nitrite ions (NO_2^-) which is toxic at high concentrations) and nitrate ions (NO_3^- that enter into the nitrogen metabolism of the plant as if they were absorbed by the roots) **(Sikora and Chappelka, 2004).**

Tomato, watermelon, squash, potato, peas, snap beans, tobacco, soybeans, cantaloupe, muskmelon, beets, carrots, rocket, sweet corn, gourds, turnips, grapes, peaches, and strawberries are some of the more susceptible crops to air pollution damage. Cucumbers, pumpkins, and peppers are less susceptible **(Brust, 2013).**

Ammonia is present in soil, water and air, and it is an important source of nitrogen for plants. Nitrogen promotes plant growth and improves vegetables fruits and seeds production, resulting in a greater yield. Although ammonium ions are effective as fertilizer, the aqueous ammonia is toxic and can damage or kill. Exposures to ammonia at environmental concentrations have adverse effects on health. However, exposure to high concentrations following an accidental release or in occupational settings could cause irritation of the eyes, nose and throat as well as burning the skin where there is direct contact.

Heavy metals are enriched in the environment by human activities of different kinds. Results of these activities end up in outlets and wastes where they are transported to the environment by air, water or deposits, thereby increasing the metal concentrations in the environment. Heavy metal pollution

not only affects the production and quality of crops, but also influences the quality of the atmosphere and water bodies, and threatens the health and life of animals and human being. Land disposal of municipal and industrial wastes, automobile emissions, mining activity and applications of fertilizers and pesticides for agriculture have contributed to a continuous accumulation of heavy metals in soils (**Nouri *et al.*, 2008**).

The toxic effects of heavy metals especially lead (Pb) focus on several organs, such as liver, kidneys, spleen and lung, causing a variety of biochemical defects. The nervous system of infants and children is particularly affected by the toxicity of these heavy metals. Adults exposed occupationally or accidentally to excessive levels of Pb exhibit neuropathology. There is association between Pb in human body and the increase of blood pressure in adults. Excessive accumulation in agricultural soils may result not only in soil contamination, but has also consequences for food quality and safety and significantly contributed to decrease human life expectancy (**Oliver *et al.*, 1997**).

Ingestion of vegetables containing heavy metals is one of the main ways in which these elements enter the human body. Once entered, heavy metals are deposited in bone and fat tissues, overlapping noble minerals. Slowly released into the body, heavy metals can cause an array of diseases The permissible limit established by FAO/WHO for Cd ranges between 0.05 and 0.4 mg kg^{-1} and for Pb between 0.1 and 0.3 mg kg^{-1}, depending on food type (**Codex Alimentarius Commission, 1995**).

Vegetables are the major source of the daily intake of nitrate by human beings, supplying about 72 to 94% of the total intake (**Dich *et al.*, 1996**). Therefore, the European Union prescribed almost a decade ago, the maximum limits for nitrate in leafy vegetables, which became the foundation stone for the subsequent European Commission Regulation. Leafy vegetables occupy a very

important place in the human diet, but unfortunately constitute a group of foods which contributes maximally to nitrate consumption by living beings. Therefore, nitrate content should not be allowed to exceed of the limits allowed globally.

Soil pollution occurs when the presence of toxic chemicals, pollutants or contaminants in the soil is in high enough concentrations to be of risk to plants, wildlife, humans and of course, the soil itself. Arable land is turning to desert and becoming non-arable at ever-increasing rates, due largely in part to global warming and agricultural fertilizers and pesticides, lessening the hope that we can feed our booming population .The water contamination and aerial transport of ammonia and trace pollutants from wastes of fertilizer companies especially those which form volatile compounds, in addition to, other sources of trace pollutants, fertilizers, pesticides and companies wastes causing pool of this pollutants in soil and plants especially vegetables.

This research aims to study the content of some vegetables (potato, sweet pepper and watercress) from some heavy metals such as (arsenic, cadmium, cobalt and lead) and the content of nitrate and nitrite in the edible parts, in addition to the growth and productivity of this vegetable due to the pollutants produced by a fertilizer and chemical industry company near Mansoura city in the governorate of Dakahlia at different distances.