

DEDICATION

To:

My mother, the soul of My Father,

My Wife,

My Sons,

My Extended Family,

My Dear Friends

ACKNOWLEDGEMENTS

Praise to Allah, All Mighty, who gave me the strength and patience to conduct this work.

I wish to express my deep gratitude to my supervisor Dr: Amira Abdelaziz for her valuable suggestions and supervision. My thank are due to my brothers for their generous financial support. I am also thankful to those, who have directly or indirectly, helped me, and encouraged me to complete my thesis.

ABSTRACT

Heavy metals are essential for plant growth, but they are required at low concentrations estimated in part per million (ppm). If these concentrations exceed the (codex) limits, the plant is considered contaminated by Heavy metals. Plant contamination by these metals reflected negatively on human and animal health, because plants and their products are the main source of food. With increasing sources of pollution in the present day as a result of extension of activities industrial, this study identified the extent of contamination of samples of sorghum grains by heavy metals in two areas in the Republic of Yemen; the first was Al-rashdh - Dhamar and the second was at the vicinity of Imran cement Factory in Imran governorate, where samples of sorghum were collected and digested by wet digestion method and analyzed by ICP- Optically Emission Spectrometer technique. The results showed a contamination in both samples by the elements: zinc, lead, iron, arsine, and nickel, but the second sample showed high level of heavy metals concentration that exceeded the allowable limits set in codex Alimentaries.

المستخلص

المعادن الثقيلة ضرورية لنمو النبات ولكن بنسب قليلة تقدر بجزء من المليون وإذا زادت هذه النسب عن الحد المسموح به في دستور الغذاء العالمي فإن النبات يعتبر ملوثاً بهذه المعادن ما ينعكس سلباً على صحة الإنسان والحيوان لأن النباتات ومنتجاتها هي المصدر الرئيسي للغذاء ونسبة لزيادة مصادر التلوث في وقتنا الحاضر نتيجة للتوسع في الصناعة فإن هذه الدراسة عمدت إلى تحديد مدى تلوث حبوب الذرة الرفيعة بالمعادن الثقيلة لعينات جمعت من منطقتين مختلفتين في الجمهورية اليمنية، الأولى من منطقة الرشد-ذمار والثانية من جوار مصنع أسمنت عمران بمحافظة عمران حيث جمعت العينات وجهزت بطريقة الهضم الرطب وتم تقدير العناصر الثقيلة بتقنية ICP Optical Emission Spectrometer وقد أظهرت النتائج تلوث العينتين بعناصر الزنك، الرصاص، الحديد، الأرسين، النيكل إلا أن العينة الثانية أظهرت معدلاً عالياً للتلوث بالمعادن الثقيلة تجاوز الحد المسموح به في دستور الغذاء العالمي.

CONTANTS

DEDICATION	I
ACKNOWLEDGEMENTS	Ii
ABSTRACT	Iii
المستخلص	Iv
TABLE OF CONTENTS	V
LIST OF FIGURES	Vii
LIST OF TABLES	Viii
1. CHAPTER 1: INTRODUCTION	
1.1 Introduction	(1)
1.2 Contamination (pollution)	(3)
1.3 The importance of the study	(3)
1.4 Thesis Outline	(4)
2. CHAPTER 2: LITERATURE REVIEW	
2.1 Sorghum	(5)
2.1.1 History	(5)
2.1.2 Sorghum Uses	(5)
2.1.2.1 Human food	(5)
2.1.2.2 Feed	(5)
2.1.2.3 Other	(6)
2.1.3 The types of sorghum	(6)
2.2 Heavy metals	(6)
2.2.1 Contamination Sources	(7)
2.2.2 Heavy metals in health and agriculture	(8)
2.3 Literature review	(13)
2.4 Objective of Study	(22)
3. CHAPTER 3: MATERIALS AND METHODS	

3.1	Study areas	(23)
3.2	Sample collection	(23)
3.3	Materials	(23)
3.4	Apparatuses	(23)
3.5	Preparation of samples	(23)
4	Analysis of heavy metal concentrations in samples	(24)
4.1	Dry ashing	(24)
4.2	Wet method	(24)
4.3	Technique of analyses	(25)
	4.3.1 (ICP – OES) Brand: Varian, Australia Model: 725-ES	(25)
	4.3.2 Varian 710 ICP-OES (INDUCTIVELY COUPLED PLASMA- OPTICAL EMISSION SPECTROMETER (ICP-OES))	(26)
	4.3.2.1 Operational Setup	(26)
	4.3.2.2 ICP-OES APPLICATIONS	(27)
	4.3.2.2.1 ICP-OES Technique on metals	(28)
4.	CHAPTER 4: RESULTS AND DISCUSSION	
4.1	Results and discussion	(30)
4.2	Conclusions	(33)
4.3	Recommendations	(34)
	References	(35)

LIST OF FIGURES

FIGURES NO.	TITLE	PAGE NO.
1	(ICP-OES) instrument used for samples analysis for metals, Varian, Australia Model: 725-ES.	(25)
2	Model: Varian 710 ICP-OES S/N EL 0709 4018 WSU S/N , Operational Mode.	(27)
3	comparison between heavy metals concentrations in sample one to codex limits.	(31)
4	comparison between heavy metals concentrations in sample two to codex limits.	(32)
5	comparison between heavy metals concentrations in samples one and two.	(32)

LIST OF TABLES

Table (1): Element concentration in samples and allowable limit of heavy metals in cereals according to (CODEX), 1995, 2006.