

CONTENTS

	<i>Page</i>
1. INTRODUCTION	1
2. REVIEW OF LITERATURE	3
2.1. Copper in soil	3
2.1.1 Available copper	7
2.1.2 Exchangeable copper.....	9
2.1.3 Organically bound copper	10
2.1.4 Carbonate bound copper	12
2.1.5 Copper occluded on minerals oxides	12
2.1.6 Residual copper	13
2.2. Reactions of copper in soils	14
2.2.1 Copper adsorption by soil	16
2.2.2 Sorption of copper by clay minerals	20
2.2.3 Sorption of copper by iron and aluminum oxides	20
2.2.4 Sorption of copper by organic matter	22
2.3. Adsorption of copper and zinc	24
2.3.1 Sorption of copper and zinc in soil	24
2.3.2 Sorption of Cu and Zn by clay minerals	26
2.3.3 Sorption of Cu and Zn by hydrous oxides	29
2.3.4 Sorption of Cu and Zn by organic matter	32
2.4. Competition of copper and zinc in soils	34
3. MATERIALS AND METHODS	36
3.1 Experimental work	36
3.1.1 Experiment I (Adsorption isotherms).....	36

	<i>Page</i>
3.1.2 Experiment II (Copper desorption).....	38
3.1.3 Experiment III(Competition between Cu and Zn).....	39
3.2 Application of adsorption isotherm equations.....	40
3.2.1 Langmuir equation	40
3.2.2 Ferundlich equation.....	40
3.3 Methods of analysis	41
4. RESULTS AND DISCUSSION	42
4.1 Adsorption isotherms of copper on soil, clay minerals and Fe and Al oxides.....	42
4.1.1 Soils.....	42
4.1.2 Clay minerals	61
4.1.3 Effect of pH on Cu adsorption by clay minerals.....	63
4.1.4 Adsorption of Cu on aluminum and iron oxides	82
4.1.5 Effect of pH.....	84
4.2. Desorption of copper	84
4.2.1 Soils	84
4.2.2 Clay minerals	98
4.2.3 Iron and aluminum oxides	99
4.3. Competitive adsorption of Cu and Zn.....	106
4.3.1 Soils.....	106
4.3.2 Clay minerals	109
4.3.3 Iron and aluminum oxides	112
5. SUMMARY.....	120
6. REFERENCES.....	124
7. ARABIC SUMMARY	

LIST OF FIGUERS

No.		Page
1	Adsorption isotherms (Langmuir) for copper by sandy loam soil.....	46
2	Adsorption isotherms (Langmuir linear) for copper by sandy loam soil.....	47
3	Adsorption isotherms (Ferundlich linear) for copper by sandy loam soil.....	48
4	Adsorption isotherms (Langmuir) for copper by sandy clay loam soil.....	49
5	Adsorption isotherms (Langmuir linear) for copper by sandy clay loam soil.....	50
6	Adsorption isotherms (Ferundlich linear) for copper by sandy clay loam soil.....	51
7	Adsorption isotherms for copper by sandy loam and sandy clay loam soil.....	58
8	Adsorption isotherms for copper by sandy loam and sandy clay loam soil as function of pH.....	59
9	Adsorption isotherms (Langmuir) for copper by kaolinite and bentonite.....	64
10	Adsorption isotherms (Langmuir linear) for copper by kaolinite and bentonite.....	65
11	Adsorption isotherms (Ferundlich linear) for copper by kaolinite and bentonite.....	66
12	Adsorption isotherms (Langmuir) for copper by montmorillomite and atapolgite.....	67
13	Adsorption isotherms (Langmuir linear) for copper by montmoriilomite and atapolgite.....	68
14	Adsorption isotherms (Ferundlich linear) for copper by montmorillomite and atapolgite.....	69

15	Copper adsorption on atapulgite, montmorillonite ,bentonite and kaolinite as a function of pH.	81
16	Adsorption isotherms (Langmuir) for copper by iron and aluminum oxides.	86
17	Adsorption isotherms (Langmuir linear) for copper by iron and aluminum oxides.	87
18	Adsorption isotherms (Ferundlich linear) for copper by iron and aluminum oxides.	88
19	Copper adsorption on iron and aluminum oxides as a function of pH.....	89
20	Copper desorption from sandy loam and sandy clay loam soil by DTPA.....	97
21	Copper desorption from kaolinite and bentonite by DTPA.....	100
22	Copper desorption from montmorillonite and atapulgite by DTPA.....	101
23	Copper desorption from iron and aluminum oxides by DTBA.....	102
24	Competitive adsorption of Cu and Zn on sandy loam and sandy clay loam soils as a function of pH.	108
25	Competitive adsorption of Cu and Zn on kaolinite and bentonite as a function of pH.	110
26	Competitive adsorption of Cu and Zn on montmorillonite and atapulgite as a function of pH.	111
27	Competitive adsorption of Cu and Zn on iron and aluminum oxides as a function of PH.....	114
28	Competitive adsorption of Cu and Zn on iron and aluminum oxides as a function of pH.	115
29	Adsorption of copper by Fe and Al oxides and clay minerals.....	116
30	Adsorption of copper by soil samples and clay	117

	minerals.....	
31	Adsorption of copper by kaolinite, bentonite, montmorillonite and atapulgite at different concentrations.	118
32	Adsorption isotherms for copper by aluminum and iron oxides.....	119