

CONTENTS

	Page
1. INTRODUCTION	1
2. REVIEW OF LITERATURE	3
2.1. Ion exchange phenomenon	3
2.1.1. Concept and source of cation exchange capacity in soils	4
2.1.2. Exchangeable cations	5
2.1.3. Qualitative aspects	6
2.1.4. Ion exchange formulas	8
2.2. Relative replacing power and cation exchange selectivity	9
2.3. Exchange isotherms	11
2.3.1. Na-Ca exchange isotherms	12
2.3.2. K-Ca exchange isotherms	14
2.3.3. Cd-Ca exchange isotherms	15
3. MATERIALS AND METHODS	17
3.1. Soil sampling	17
3.2. Pretreatments for mineralogical analysis and separation of clay fraction	17
3.3. Organic matter –free soil samples	17
3.4. Experimental work	18
3.4.1. Na –Ca exchange isotherms	18
3.4.2. K-Ca exchange isotherms.	19
3.4.3. Cd-Ca exchange isotherms.	20
3.4.4. Calculations of selectivity coefficients	21
3.5. Analytical methods.	24
4. RESULTS AND DISCUSSIONS	26
4.1. Physical and chemical properties of the investigated soil	26
4.2. Mineralogical composition of the studied exchanger materials	29
4.2.1. Mineralogical composition of the commercial clay minerals used.	29
4.2.1.1. XRD of the commercial attapulgite clay mineral	29
4.2.1.2. XRD of the commercial bentonite clay mineral	31

4.2.2. Mineralogical composition of the clay fraction of studied soils samples	31
4.1.1.1. The calcareous soil sample of Borg El-Arab	31
4.1.1.2. The Nile alluvial- noncalcareous soil sample of Moshtohor	34
4.2. Na-Ca exchange isotherms	36
4.2.1. Na-Ca exchange on the studied calcareous and Nile Alluvial noncalcareous soils	36
4.2.2. Na-Ca exchange on the clay fractions separated from the calcareous and Nile alluvial noncalcareous soils	40
4.2.3. Na-Ca exchange on the calcareous and Nile alluvial noncalcareous soils after removal organic matter	41
4.2.4. Na-Ca exchange on the commercial used clay minerals.	45
4.3. Sodium adsorption ratio (SAR) as related to exchangeable sodium ratio (ESR)	49
4.4. K-Ca exchange isotherms	55
4.4.1. K-Ca exchange on the studied calcareous and Nile alluvial noncalcareous soils	55
4.4.2. K-Ca exchange on the clay fractions separated from the calcareous and Nile alluvial noncalcareous soils	63
4.4.3. K-Ca exchange on the calcareous and Nile alluvial noncalcareous soils soils after removal of organic matter	66
4.4.4. K-Ca exchange on the commercial used clay minerals	68
4.5. Cd-Ca exchange isotherms	71
SUMMARY AND CONCLUSIONS	89
REFERENCES	93
ARABIC SUMMARY	