

Contents

Nomenclature	3
1. Motivation and structure of the thesis	5
2. Boundary conditions and state of the art	8
2.1. Boundary conditions in Libya	8
2.2. Ground water	10
2.3. Chromium chemistry: Environmental behavior, impact on humans and its applications	11
2.3.1. Basics of chromium - origin and chemistry	11
2.3.2. Industrial applications of chromium	13
2.3.3. Fate and behaviour of chromium in the environment	14
2.3.4. Chromium and health	16
2.3.5. Treatment of chromium contamination from the aqueous phase	18
2.4. Environmental analysis	20
2.4.1. Water analysis	21
2.4.2. Analytical methods the determination of hexa- and trivalent chromium determination	21
2.4.3. Atomic absorption spectrometry and photometric methods	22
2.5. Adsorption basics	27
2.5.1. Adsorption fundamentals and dynamics	27
2.5.2. Adsorbents and their preparation	29
2.5.3. Adsorption isotherms	35
2.5.4. Adsorption kinetics	38
3. Materials and methods	40
3.1. General reagents	40
3.2. Sample collection, preservation and handling	40
3.3. Analysis of hexavalent and total chromium by means of photometry	42
3.4. Analysis of hexavalent chromium by means of FAAS	48
3.5. Interlaboratory comparison	50
3.6. Adsorptive removal	50
3.6.1. Experimental setup	50
3.6.2. Production of adsorbents	50
3.6.3. Choice of silicagel	51

3.6.4. Physical characterization	51
3.6.4.1. Drying of silicagel	52
3.6.4.2. Preparation of adsorbents HSU-100-8001 and HSU-100-8002	52
3.6.4.3. Preparation of zinc ricinoleate adsorbent HSU-100-8004	53
3.6.4.4. Preparation of zinc ricinoleate adsorbent HSU-100-8004 - new method	53
3.6.5. Experimental setup of the adsorption experiments	53
4. Results and discussion	55
4.1. Chromium concentrations in portable water – an interlaboratory comparison	55
4.2. Adsorptive removal of chromium	61
4.2.1. Natural adsorbents	63
4.2.2. Special chemical compounds	66
4.2.3. Selective adsorbents	67
4.3. Kinetics	76
5. Summary and outlook	79
6. Literature	81
List of figure	89
List of table	91