

Contents

1. Introduction:	1
1.1. Contextual:	1
1.2. What is inorganic contaminant?	1
1.3. Origin and mitigation of inorganic contaminants in groundwater:	2
1.4. Consequences of metal contamination of groundwater:	7
1.5. Occurrence of inorganic contaminants in groundwater:	9
1.6. Remediation of inorganic contaminants from groundwater:	12
1.6.1. Coagulation/precipitation:	12
1.6.2. Electrocoagulation:	14
1.6.3. Membrane processes:	16
1.6.4. Adsorptive techniques:	21
1.6.5. Electro dialysis:	25
1.6.6. Ion exchange:	26
1.6.7. Oxidation processes:	27
1.6.8. Other technology:	29
1.7. Comparison of technologies:	29
1.7.1. Design and procedure of OCOP method:	34
1.8. Motivation for the present work:	35
1.9. Aim and Objectives of the research work:	36
1.9.1. Utilization of co-existing Fe for simultaneous removal of As and Fe by OCOP:	36
1.9.2. Simultaneous removal of As, Fe and Mn by OCOP:	37
1.9.3. Evaluation of performance of different oxidizing agents in OCOP:	37
1.9.4. Removal of some metals: Cd, Pb, Ni, Cr, Cu and Co by OCOP:	38
2. Experimental:	39
2.1. Materials:	39
2.1.1. Chemicals:	39
2.1.2. Stock solutions:	39
2.1.3. Analytical tools:	39
2.1.4. Water:	41
2.1.5. Response surface methodology:	41
2.2. Experimental Methods:	42
2.2.1. Methods for utilization of co-existing iron for simultaneous removal of removal of As and Fe by OCOP:	42

2.2.2. Simultaneous removal of As, Fe and Mn by OCOP:	51
2.2.3. Evaluation of performance of different oxidizing agents in OCOP:	53
2.2.4. Removal of some metals: Cd, Pb, Ni, Cr, Cu and Co by OCOP:	55
3. Results and discussion:	57
3.1. Utilization of coexisting iron for simultaneous removal of removal of As and Fe by OCOP*:	57
3.1.1. Batch experiment:	57
3.1.2. Observations with Explanations:	58
3.1.3. Optimization of the doses by RSM:	61
3.1.3. Field study:	81
3.1.4. Feasibility of this modified OCOP method:	86
3.2. Simultaneous removal of As, Fe and Mn by OCOP*:	87
3.2.1. Initial laboratory experiments:	87
3.2.2. Field trial:	98
3.2.3. Suitability of the method:	101
3.3. Evaluation of performance of different oxidizing agents in OCOP*:	103
3.3.1. Arsenic removal experiment:	103
3.3.2. Observation:	103
3.4. Removal of some metals: Cd, Pb, Ni, Cr, Cu and Co by OCOP*:	111
3.4.1. Laboratory Experiment:	111
3.4.2. Observations:	111
3.4.3. Analysis of the precipitate or coagulates obtained in the OCOP experiment:	114
3.4.4. Mechanism of removal:	120
4. Conclusions and Future scope:	123
4.1. Conclusions:	123
4.1.1. Utilization of co-existing iron for simultaneous removal of removal of As and Fe by OCOP:	124
4.1.2. Simultaneous removal of As, Fe and Mn by OCOP:	125
4.1.3. Evaluation of performance of different oxidizing agents in OCOP:	127
4.1.4. Removal of some metals: Cd, Pb, Ni, Cr, Cu and Co by OCOP:	128
4.2. Future scopes:	130
5. References:	132
6. List of publications:	163
7. Conferences and Workshops:	164