2.1 Reduction of Cr(VI) to Cr(III)
   2.1.1 General
   2.1.2 Chemical Precipitation
      2.1.2.1 Hydroxide Precipitation
      2.1.2.2 Sulphide Precipitation
   2.1.3 Ion exchange
   2.1.4 Membrane Separation
   2.1.5 Electrochemical treatment
   2.1.6 Photocatalysis
   2.1.7 Adsorption
      2.1.7.1 Adsorption on natural materials
      2.1.7.2 Activated carbon adsorbents
      2.1.7.3 Chitosan
   2.1.8 Bioremediation
      2.1.8.1 Bioreduction
      2.1.8.2 Phytoremediation

2.2 Nanoscaled Zero-Valent Iron (nZVI)

2.3 Nanoparticle Synthesis
   2.3.1 Vapour Phase Nanoparticle Synthesis
      2.3.1.1 Flame Synthesis
      2.3.1.2 Chemical Vapour Synthesis
      2.3.1.3 Physical Vapour Synthesis
      2.3.1.4 Inert Gas Condensation
      2.3.1.5 Pulsed Laser Ablation
      2.3.1.6 Spark Discharge Generation
      2.3.1.7 Sputtering Gas Aggregation
   2.3.2 Solution Phase Nanoparticle Synthesis
      2.3.2.1 Micellar Techniques
         2.3.2.1 a) The Chloride method
         2.3.2.1 b) The Sulphate method
Chapter-3 Synthesis and characterization of chemical and biosynthesized zero valent iron nanoparticles

3.1 Introduction

3.2 Materials and methods
   3.2.1 Chemical Synthesis
   3.2.2 Green (Bio) synthesis

3.3 Characterization of Fe⁰ nanoparticles
   3.3.1 SEM and EDS
   3.3.2 UV–Vis spectroscopy
   3.3.3 FTIR spectroscopy
   3.3.4 Raman Spectroscopy
   3.3.5 X-Ray diffraction
   3.3.6 Zeta potential

3.4 Conclusions

3.5 References

Chapter-4 Conjunctive effect of CMC–Zero-valent iron nanoparticles and FYM in the remediation of chromium-contaminated soils

4.1 Introduction
4.2 Comparative study of evaluation of treatment methods
4.3 Materials and methods
   4.3.1 Chemicals and solutions
   4.3.2 Collection of soil samples
   4.3.3 Synthesis of Fe⁰ nanoparticles
   4.3.4 Colorimetric method for the analysis of Cr (VI)
   4.3.5 Effect of Fe⁰ concentration
   4.3.6 Effect of organic amendment (farm yard manure) on removal efficiency of Cr (VI) by Fe⁰ nanoparticles
4.4 Results and discussion
4.5 Experiments on Adsorption
   4.5.1 Adsorption isotherms
      4.5.1.1 Langmuir model
      4.5.1.2 Freundlich model
      4.5.1.3 Temkin model
4.6 Statistical analysis
4.7 Conclusions
4.8 References

Chapter-5 Application of phytogenic zero valent iron nanoparticles in the adsorption of hexavalent Chromium

5.1 Introduction
5.2 Materials and Methods
   5.2.1 Experimental analysis
5.3 Results and discussions
   5.3.1 Mechanism of Cr (VI) adsorption
   5.3.2 Effect of variables and response surface contour plots
   5.3.3 Experiments on Adsorption
      5.3.3.1 Adsorption isotherms
         5.3.3.1a Langmuir model
         5.3.3.1b Freundlich model
         5.3.3.1c Temkin model
Chapter- 6 Plant growth promoting potential of nano-bioremediation under Cr (VI) stress

6.1 Introduction
6.2 Materials and methods
   6.2.1 Nanoscale Zero Valent Iron Characterization
   6.2.2 Germination and Transplantation Experiments
6.3 Analytical Study
6.4 Results and Discussions
   6.4.1 Tolerance of germination and Transplantation of Brassica Juncea
   6.4.2 Physicochemical Properties of Amended Soils
   6.4.3 Effect of FYM on Tolerance Efficiency of B.Juncea
6.5 Conclusions
6.6 References

Chapter- 7 Summary and Conclusions

7.1 Specific Contributions
   7.1.1 Characterizing of ZVNI
   7.1.2 Cr(VI) remediation
   7.1.3 Phytoavailability of Cr(VI) in soils
7.2 Recommended future work
7.3 References

Appendix

Research publications
List of presentations in Symposia/Seminars