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**National University of Science and Technology**  
**Zimbabwe**

**FACULTY OF INDUSTRIAL  
TECHNOLOGY**

**FINAL YEAR PROJECT**  
**APPROPRIATE METHODS OF IRON  
AND MANGANESE REMOVAL IN  
GROUNDWATER.**

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## Abstract

Iron is not harmful to health, but causes people to reject the water, mainly because it tastes bad and stains clothes, containers and skin. In rural areas in developing countries where groundwater is extracted by hand pumps, rejection of this borehole water causes people to drink contaminated surface water and this can result in disease and death, especially for young children.

With the shortage of foreign currency to buy the much needed chemicals for water treatment, groundwater has become a better option for use. Serious water rationing has been affecting many consumers especially the high density suburbs of Bulawayo hence people would rely on borehole water.

The occurrence of iron and manganese in groundwater varies from area to area depending on the geology and the activities (industrial, farming, and mining) done in the area. The study sought to come up with the appropriate methods for the removal of iron and manganese in groundwater. An in-depth study of redox processes and reaction kinetics was undertaken with the hope of understanding the factors that affect the oxidation or reduction of iron and manganese. Boreholes in the Matsheumhlope aquifer were sampled and analysed using different treatment methods.

It emerged that oxidation with household bleach followed by sand filtration was more effective in removing iron and manganese. The levels of iron fell from 0.31mg/l to 0.17mg/l after contact time of 60minutes. Manganese levels in the sampled boreholes were below the recommended standards. The levels of manganese fell from 0.06mg/l to 0.01mg/l after 120minutes of contact time. A more powerful oxidant can make the reactions faster; household bleach has 5% concentration of chlorine only. Moringa and chlorine tablets were the other treatments used. After a contact of 60 minutes, iron concentration fell from 0.31mg/l to 0.21mg/l and manganese from 0.06mg/l to 0.04mg/l with the treatment using chlorine tablet. Generally the groundwater quality of Bulawayo is good as reflected in the physic-chemical and microbiological analysis of the boreholes in the Matsheumhlope Wellfield.