

Application of water filtration methods to minimise the environmental impact of slag dump's iron rich effluent discharge - a case study of Kansanshi copper smelter

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INTRODUCTION

This project is inspired by the increasing need to prevent industrial wastes from contaminating both aqueous and land life. Development goals for good health and wellbeing, clean water and sanitation, industry innovation and infrastructure, responsible production, and consumption are all envisaged in this preamble paper.

Purpose

The purpose of this paper is to design a water circuit which will function as a recycling process for iron saturated water in a pond received from slag dump effluents. The recycling process will apply water filtration methods of de-ionisation and de-alkalisation to produce qualified water which shall again be used as process and plant water.

Background information

The source of the slag which is dumped on site is the matte settling electric and furnace (MSEF) which performs as the holding furnace in the smelter process⁴. This furnace is a source of both magnetite (Fe_2O_3) and ferrite (FeO) which are oxides from the combustion of charcoal pyrite (CuFeS_2) from the primary (ISA) furnace. From this furnace, volumes of slag are skimmed and taken to the slag dump site where water and natural cooling take place, in turn creating effluents rich in soluble and insoluble iron stored in a pond. This pond over time forms a dead sea which does not or cannot support any form of life⁶ and hence is a hazard to both the macro and microorganisms in surrounding ecosystems; therefore the need to treat its water as a way of establishing a more sustainable and environmentally friendly process.

Procedures and Methods

1. Take pond water samples before recycling and treatment plant
2. Introduce soluble water into the recycling and treatment plant
3. Take water samples after the recycling and treatment plant

The Recycling and Treatment Plant

The small pilot water recycling and treatment plant shall comprise two critical stages which will treat the iron saturated water passing it through de-ionisation and de-alkalisation¹. Water samples will be taken for laboratory analysis and the contents examined for iron. It is from here that the effectiveness of the designed treatment plant shall be proven to be effective.

Summary Results

A comparative regression analysis shall be presented in a way to demonstrate the consistency of the claims of the study and also the effectiveness of the designed water recycling and treatment plant. A more reliable treatment will be established as opposed to seasonal rainwater make up, thereby minimising the adverse environmental impacts the pond full of iron rich effluents may certainly have on aqua life, flora and fauna, micro and macro-organism ecosystems.

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1. Available from: Online[<https://shilongnews.in/water-softening-method> 2. MSEF Daily Production Log sheets, 2022, Kansanshi Copper Smelter, Solwezi-Zambia, 3.MSEF Daily Production Assays, 2022, Kansanshi Copper Smelter Laboratory, Solwezi-Zambia. 4. Environmental Office, 2022, Samples from the pond, Kansanshi Copper Smelter, Solwezi-Zambia

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