

**ENVIRONMENTAL IMPACTS OF IRON SLAG  
AND ITS UTILIZATION FOR IMPROVEMENT OF  
ROAD BASES**

**Submitted By**

**Mohamed Ahmed Mohamed Gharieb Mwafy**

B.Sc. of Science (Chemistry/Biochemistry), Faculty of Science,  
Alexandria University, 2003

A thesis submitted in Partial Fulfillment  
Of  
The Requirement for the Master Degree  
In  
Environmental Sciences

Department of Environmental Basic Sciences  
Institute of Environmental Studies and Research  
Ain Shams University

**2017**

**APPROVAL SHEET**

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# ABSTRACT

## **MSC. Thesis:**

**Name of Student:** Mohamed Ahmed Mohamed Gharieb Mwafy

**Thesis title** : Environmental impacts of iron slag and its utilization for improvement of road bases

In this study Electric arc furnace (EAF) slag is utilized in two applications, namely the improvement of engineering properties of soil materials (problematic soil stabilization) and in blended cement. In Egypt, there is found that a very small percentage of EAF slag was utilized in engineering purposes, although, on the other hand a huge quantity of EAF slag was accumulated. In order to validate this application, a series of tests have been carried out to determine the environmental impact such as chemical and mineral composition, boiling test, pH, and leaching test for the different cooling rates EAF slag.

From the chemical analysis results, it is shown that all heavy metals in EAF slag except V and Cr are found to be very low and insignificant in term of environmental impacts. The cooling rate affects significantly the leaching of Cr, without a significant relation of the original slag Cr content.

Various mixes (up to 20% EAF slag by dry weight of the test soil) with or without lime are used in this study. The investigations showed that free swelling improved by increasing the addition of EAF slag till 10% EAF slag and then remain constant, and the percent of improving varied according to the cooling rate of EAF slag, where the water cooled slag decrease the free swelling more than the air cooled slag. The addition of lime resulted in a dramatic improvement in the free swelling.

By comparing the effect of the two different cooling rates of EAF slag (up to 10% by dry weight) on the properties of the concrete pastes after 28 days of curing are carried out in this study. XRD, SEM, density, pH and compressive strength results show that the water (rapid) cooled EAF slag causes a marked improvement in the mechanical properties for the hardened pastes.

**Keywords:** Electric arc furnace slag, Soil stabilization, Concrete pastes, Environmental impacts.

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