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TREATMENT OF DISPOSED ABRASIVE BLASTING WASTE MATERIAL USED FOR CONSTRUCTION INDUSTRY

Abstract

To study the impact of dumping of abrasive blasting materials (ABM), mainly the waste of copper slag (WCS), on the environment and select an appropriate treatment method. The chemical composition analysis for WCS samples revealed that the toxic elements, e.g. Cd, Hg, etc., were within the allowable limit of the Supreme Council for Environment. Although the samples were safe from a toxicity viewpoint, two treatment methods were applied to check the stability of the heavy elements, namely leaching and thermal treatment. Three different leaching solutions were used; seawater, tap water, and deionized water. The thermal heat treatment was conducted in an electric oven at 800°C for 6 hours. Chemical composition analysis of treated samples using both methods (leaching and thermal treatment) revealed insignificant changes in the elemental composition. This conclude that the samples are environmentally safe from releasing toxic element pollutants viewpoint. However, further tests, including organic compound analysis and degradability tests, are to be investigated.

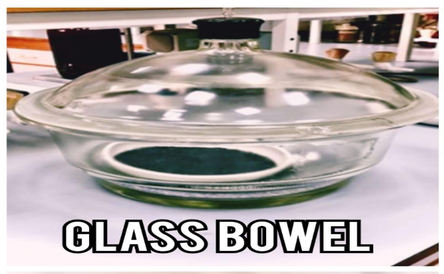
Objective and Motivation

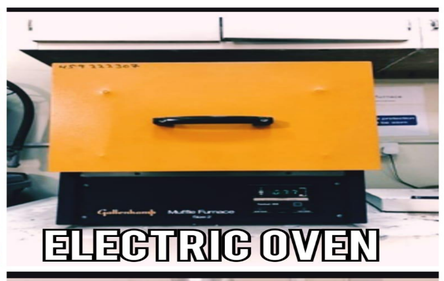
The dumping of Waste Copper Slag (WCS) in ASRY has an increasing challenge in terms of compliance and local health and environmental regulations. Although, the blasting copper grit waste needs to be treated to reduce the heavy metal content to an acceptable level.

This project aimed to analyze the concentration of heavy elements in the WCS sample . Furthermore ،this project aimed to provide a suitable treatment solution to obtain a clean environment according with some of the Sustainable Development Goals 2030, as detailed in the United Nations website in Bahrain which are, “Life Under Water” to reduce sea water pollution that may affect the life of marine organisms, and it done by throwing industrial waste such as WCS . The goal of innovation and technological advancement is to find solutions to both economic and environmental challenges, such as using (WCS) in industrial applications to take advantage of them rather than throw them into the environment.

Design and Implementation

Samples of waste copper slag were collected from different locations (on the surface and under the surface of the ground) from ASRY. Samples were analyzed for their chemical composition using an ICP instrument. For the leaching experiment, samples were divided into three parts to be tested with three different mediums, namely tap water, deionized water, and seawater. The mixing ratio was 1 g: 2 mL, and they were mixed well by stirring the solid samples inside the water for 3 minutes. The samples were closed tightly to prevent them from contamination. These sealed samples were kept in a place far from the sun to prevent and avoid the occurrence of any chemical reaction in the samples that may result from heat and sunlight. Samples were left for 75 days to give sufficient time for the leaching process. Thermal treatment of WCS is mainly used to eliminate harmful organic components .The thermal treatment procedure starts with placing the samples of waste copper slag in an electric oven at 800 ˚C for six hours. After that, it was left to cool in a tightly covered glass bowl to ensure that it was not exposed to moisture.





Results

Leaching process using sea water as leachate medium results demonstrated that there has been either no change or insignificant change in the composition. The maximum concentration difference for heavy metals can be seen to be 0.044 mg/l for barium and a minimum concentration difference of 0.001 mg/l for chromium. The results indicate that the elements are chemically stable even when exposed to seawater. All concentrations are within The Supreme Council for Environmental allowed limits.

Leaching process using deionized water as the leachate medium produced insignificant changes in concentration. For heavy metals, the largest concentration difference is 0.041 mg/l for barium, while the smallest concentration difference is 0.001 mg/l for thallium. The results indicate that even when mixed with deionized water, the components remain chemically stable. The Supreme Council for Environmental has established safe levels for all concentrations.

Leaching process using tap water as leachate medium results indicates that the concentration of element before and after leaching has either stayed constant or showed insignificant change. The highest concentration difference for heavy metals is 0.06 mg/l for barium, whereas the minimum concentration difference for thallium is 0.002 mg/l. The results show that the components remain chemically stable even when subjected to deionized water. The results agree well with acceptable limits stated by The Supreme Council for Environmental.

Thermal treatment result indicates that either no change or insignificant changes in the composition is obtained. The result obtained shows that the maximum concentration difference for the heavy metals is equal to 0.537 mg/l for barium and a minimum concentration difference with a value of 0.001 mg/l for cadmium. The result conclude that the elements may be considered as chemically stable even if subjected to high temperature. All concentration is within the allowable range as recommended by The Supreme Council for Environmental

Conclusion

Analysis of the chemical compositions, and hazardousness of blasting waste copper slag samples collected from ASRY show that concentration of toxic elements is well below the maximum allowable values as recommended by The Supreme Council for Environmental. This concluded that the spent slag could be categorized as nonhazardous.

Chemical analysis resulted from exposing WCS to seawater, tap water or deionized water for three months (leaching process) revealed insignificant change in composition indicating the stability of the WCS in water. This may encourage the use of the WCS in concrete and asphalt industry.

Chemical analysis followed exposing WCS 800°C for 6 hrs. (thermal treatment) indicated inconsequential change in element concentration, concluding that the contained element is stable even when subjected to thermal treatment.

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