

Evaluating Ion Exchange Capacity of Molten Slag for Hydroponic System

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ABSTRACT

To decrease the cost production of hydroponics farming, three varieties of molten slag were speed up in the releasing of some ions in the water. Molten slag is a material from the municipal solid wastes which contains valuable amounts of Ca, Mg, K and P that can be useful for plants development.

INTRODUCTION & OBJECTIVES

Hydroponic system is one of the most efficient agricultural activity, it allows the continuous planting all year round under controlled environment, however the cost of these systems increase due to the constant application of fertilizers which increases the cost of production. As an alternative to provide the nutrients required by the plants, the integration of wastes in the agricultural sector can be a solution to seize the expenses of hydroponic farming. The Fluidized-bed gasification and melting system generate electricity and heat by the combustion of **Municipal Solid Wastes (MSW)**, the sub products obtained in this process are classified as ferrous materials, vitreous and molten slag. This last, has been tested to be used as an aggregate in concrete but, the rich content of some cations such as calcium, magnesium, phosphates and potassium are acceptable for crop development. Since the properties of the molten slag varies according to the source of material, type of waste incinerated and conditions of the furnace used in the melting process, the content of those minerals is different in each molten slag. The objectives in this study are focused to determine the concentration of anion and cation released by 3 different types of molten slag and to select the best parameters for crop development using molten slag under hydroponic systems.

METHODOLOGY

Dried content of CaO , MgO , K_2O and P_2O_5 was determined in three types of molten slag from Kofu (MS1), Kamiina (MS2) and Nishi-Akikawa (MS3) in principle, then the analysis of releasing those minerals was carried out. Anion and cation contents in the water samples were measured by a spectrometric method using Ion analyzer (IA-300, HORIBA).

Step 1. Classification and weight of Molten Slag



Step 2. Shaking period of samples (180 rpm)



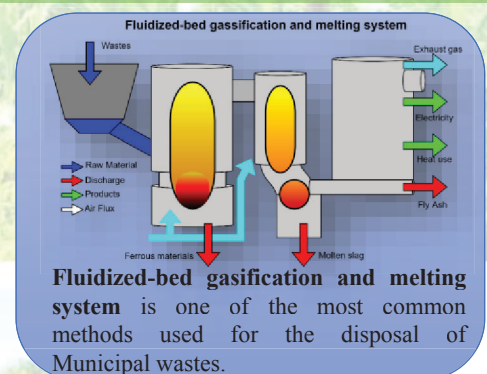
Step 3. Filtering samples, 8 mL each



Step 4. 36 samples were storage to be measured



Step 5. Cation and anion determination using IA-300 analyzer



RESULTS

Electrical conductivity didn't increase at high values but presented different conditions at 6 hours in the shaking period, and there was not a significant variance of pH measured in all 3 samples. However, this level of pH might not be beneficial for the plants.



Fig. Molten slag

Due to the generous amount of CaO in the Molten Slag, this mineral had the highest releasing values along the time.

It was found that higher concentration of cation and anion were released from MS3, followed by MS2

The use of Molten Slag in hydroponic system can significantly reduce the cost of agronomic systems in controlled environments.

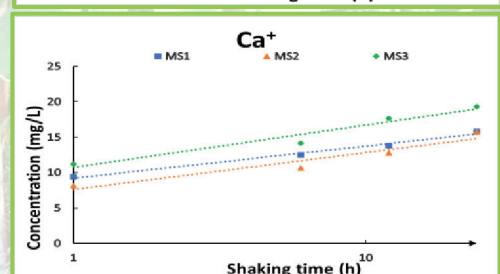
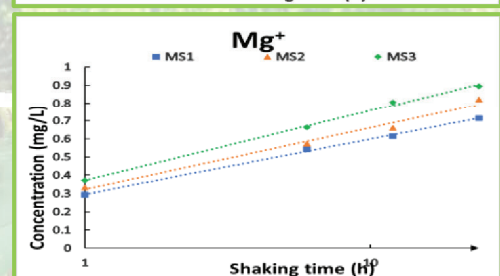
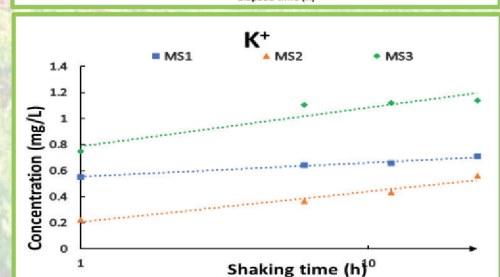
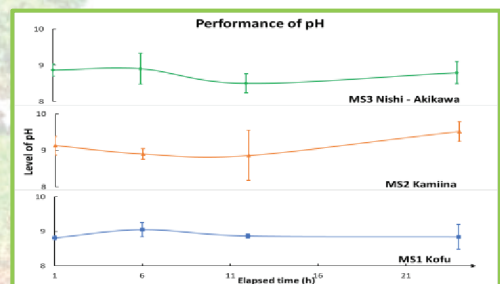


Fig. Mixing MS and sand to lower the pH

Molten slag has been reported as alkaline material. To control this parameter, a ratio of 1:5 of MS and sand was balanced to be tested in crop system



Fig. Hydroponic system using Molten Slag and Sewage Treated Water

CONCLUSION

With this experiment, we confirmed that there is an important release of nutrients that can be useful for the plants in hydroponic systems, anyway deep research about the impact on crops is been studying in this experiment.

By using wastewater and Molten Slag in crop systems, we contribute to save mineral sources, purification and reuse of water, increase carbon stock, avoid soil pollution, enhance agricultural productivity and promote economic development.