TREATMENT OF RED MUD WITH AGROINDUSTRIAL WASTE:

Neutralization and Product Obtainment.

Isabelle S. Mamede[1]* & Simone A. Cardoso[2].

Bioprocess Engineering, Biotechnology Graduate Program, Institute of Biological Sciences, Federal University of Pará (UFPA), Belém, Pará, Brazil.
[1] Bioprocess Engineering student at Faculty of Biotechnology, UFPA.
[2] Degree and master's degree in Chemical Engineering and doctorate in Natural Resources Engineering, Professor at the Faculty of Biotechnology, UFPA.
**E-mail address: isabelle.mamede@icb.ufpa.br*

ABSTRACT

Red mud is a solid waste residue of the digestion of bauxite ores with caustic soda for alumina production. Its disposal remains a worldwide issue in terms of environmental concerns. A lot of research and developmental activities are going on throughout the world to find effective utilization of red mud, which involves various product developments and neutralization of the mud for environmental reuse.

Keywords: Red Mud. Neutralization. Fertile Soil.

1 INTRODUCTION

Red mud (RM) is the product generated from bauxite refining, using the Bayer process and aimed at producing aluminum hydroxide Al(OH)3 and alumina Al_2O_3, which are used in the production of metallic aluminum. In the clarification stage of this process, iron oxides and other compounds are separated from aluminum hydroxides, generating an insoluble solid residue called Red Mud *(SILVA, et al., 2007).*

An important characteristic of red mud is its extremely alkaline pH (10 to 13). However, the National Solid Waste Policy of the Ministry of the Environment indicates that its disposal needs to be done in appropriate locations, generally in disposal tanks, built using high-cost techniques, which make it impossible to leach its components and the consequent contamination of bodies. surface and underground water sources, as the amount of red mud produced is large and its disposal must cover a large area *(ANTUNES et al., 2010).*

An alternative to reducing these large reservoirs of red mud is to employ technologies that can enable the reuse of this material for more suitable applications. Composting is rich in biological matter from organic waste, produced by a diverse population of organisms, which under aerobic and thermophilic conditions, results in a material that provides good physical-chemical conditions for the earth. In conjunction with anaerobic digestion, which performs the biochemical decomposition of organic matter and allows the red mud to be stabilized, the process has the capacity to promote the neutralization of the residue, making it reusable for processes such as reforestation, as it helps to reverse the degradation of the soil and, consequently, reduce risks for communities, such as dam slides and pollution of water resources, as well as conserving biodiversity and reducing CO_2 in the atmosphere, one of the main causes of the greenhouse effect and global warming *(SHINOMIYA, et al. al. 2019; FIGUEIREDO,2016).*

In this context, aiming to neutralize red mud, this work aims to evaluate the effectiveness of using agro-industrial biomass and composting in reducing the pH of red mud to obtain fertile land for reuse.

2 MATERIAL & METHODS

The RM was provided by the Faculty of Chemical Engineering of the Institute of Technology of the Federal University of Pará, provided by the company Hydro Alunorte of Barcarena, Pará. The legumes were collected at the Supply Center of the State of Pará (CEASA), located about Curió-Utinga. Most of the legumes included fruits with a pH between 4 and 5, such as tomatoes, potatoes, papayas and peppers. The potting soil (PS) was acquired at a fair in Belém.

The RM was stored in a container at room temperature, the vegetable and fruit residues were cut by hand and sent to the mud samples. To check the pH of the RM, the procedures according to *Teixeira et al (2017)* were followed.

Figure 1 Collected vegetables

Figure 2 Cut vegetables

The samples were made in 300mL plastic cups to make the mixtures. To neutralize the RM, a pH meter was used to measure the pH of the liquid and an earth pH meter was used for samples with PS; an analytical balance for weighing all masses and a 100mL Becker to measure the water needed for the samples. Using procedures from *Holanda et al. (2020),* mixing 70mL of water with RM samples, variations in different proportions of mud and biomass.

SAMPLES	RED MUD (g)	BIOMASS (g)	POTTING SOIL (g)	CULTURE MEDIUM
L2B6	20	60	100	70mL of water
L5B3	50	30	100	70mL of water
L6B2	60	20	100	70mL of water
L4B4	40	40	100	70mL of water
L3B5	30	50	100	70mL of water

Table 1 Composition of samples and treatment of red mud

The treatments were carried out at room temperature, sealed and without agitation. Neutralization was initially used with just the introduction of vegetables and the pH was checked for approximately 14 days. After that, it was mixed with potting soil and stored in an open greenhouse, measuring the pH for another 25 days, both at intervals of 3 to 4 days.

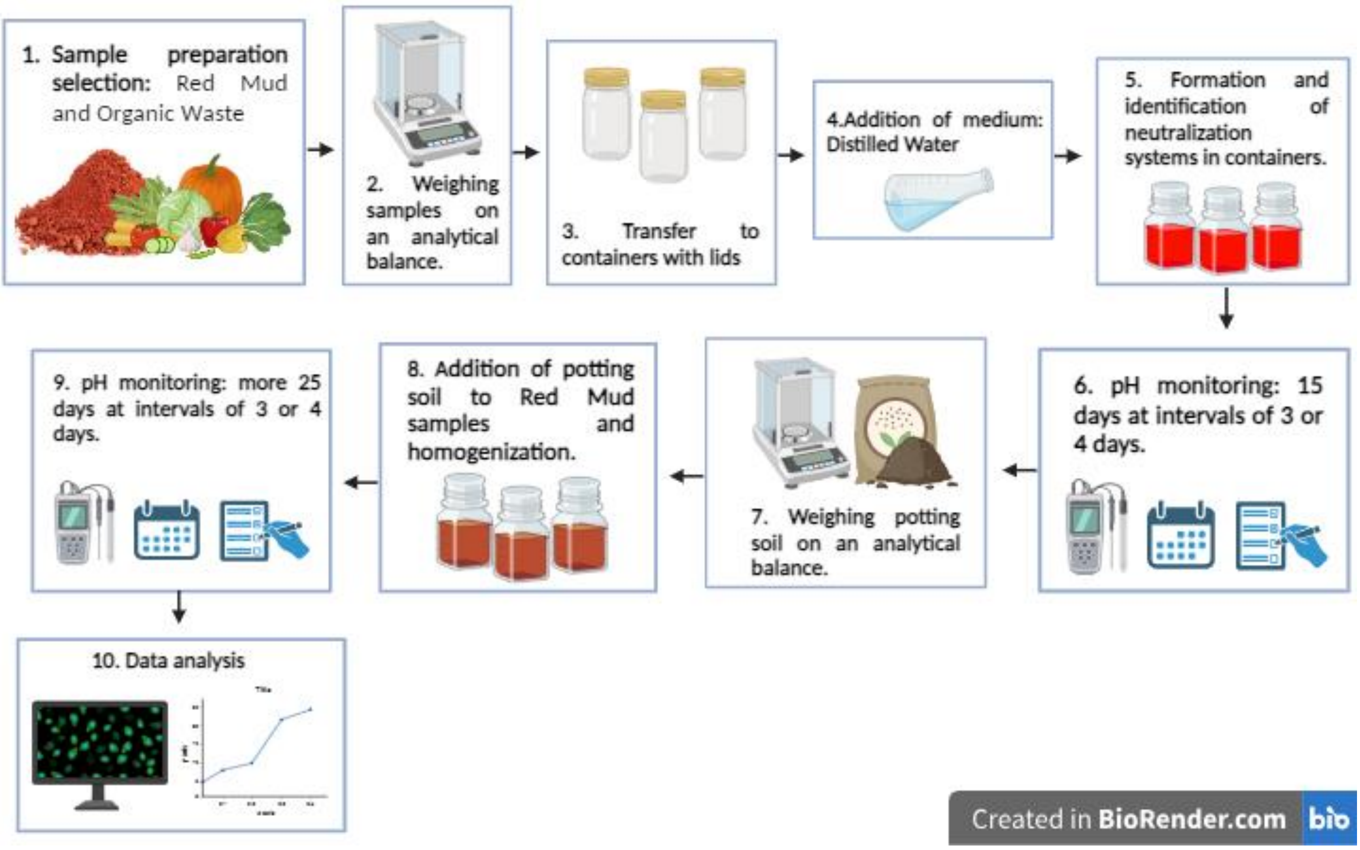

Figure 3 Methodology in flowchart form

3 RESULTS & DISCUSSION

Before starting the treatment, the pH of the RM was measured and showed a value of 10.8. With the insertion of biomass into the red mud, the pH gradually decreased as the 15 days passed, presenting values of 9.1 in the samples that obtained the greatest amount of red mud, to 7.3 in the samples that had the greatest amount of biomass.

With the application of potting soil it was possible to analyze, during the 40 days, the pH decreased significantly, reaching values of 6 in the samples. In addition it was possible to observe the samples dried out with the temperature of the stove but when received more water, pH values reached up to 4.5.

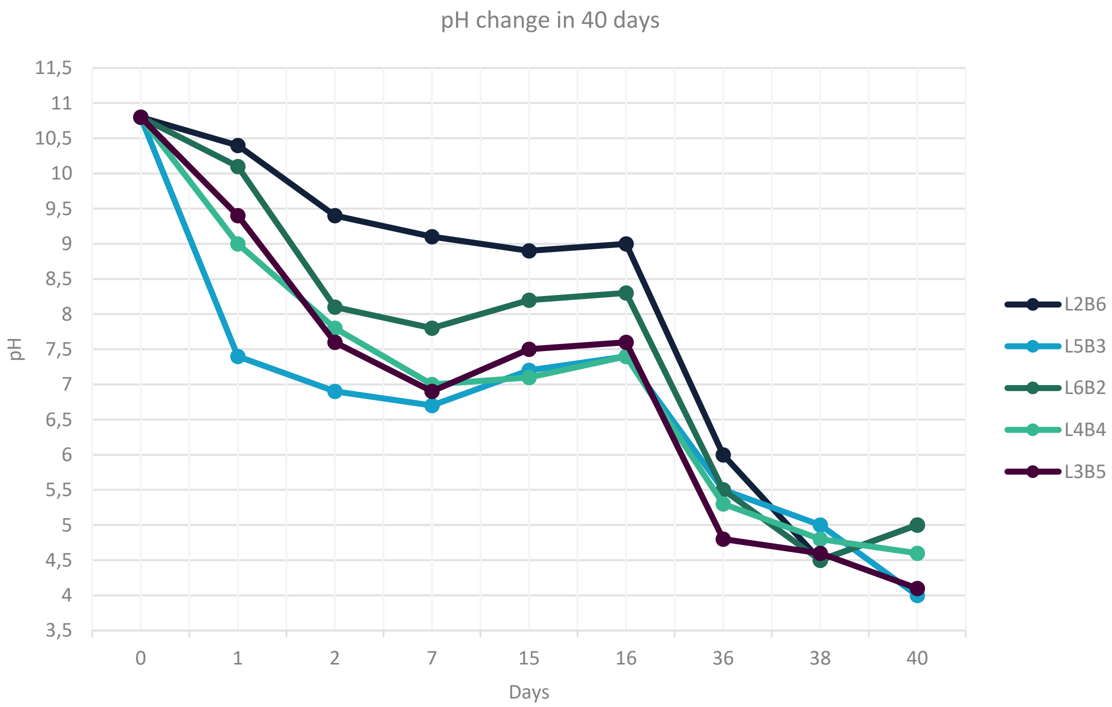

Figure 4 Graph of pH variation as a function of days

4 CONCLUSION

All groups showed effective neutralization proportional to the amount of organic matter added to the samples, group L5B3 and L4B4 with greater organic matter in relation to RM signaling higher neutralization rates, inferring that the carbon source influences the pH reduction rate. However, due to the action of tricalcium aluminate, the soil pH returns to the alkaline region, indicating that the use of organic waste as carbon sources is not sufficient to permanently neutralize the pH of the RM and to remove properties that may be harmful to the environment nor to state that the soils are safe for use.

Therefore, more studies are needed to develop a way to improve the neutralization of RM and verify the quality and safety of the land produced. Physicochemical tests, new material formulations and the use of bioindicators can help to understand the before and after properties of RM and thus indicate better function.

5 REFERENCES

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