

Abstract

Potential of Lignocellulosic Agro-Waste to Produce Value-Added Products [†]

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Abstract: This work focused on the effect of combustion on the yield, composition, and strength of food-grade bio-alkali from lignocellulosic agro-waste. Seven lignocellulosic types of agro-waste, including plantain stalk, plantain peel (green and ripe), empty palm bunch, palm fiber, coconut fiber, and cocoa pod were sun-dried and combusted using two methods: open-air combustion (OAC) and muffle furnace combustion (MFC). Ash and potash yield from the two methods of combustion were determined using simple proportion calculations. A two-stage hydrothermal extraction process was carried out on the ash using a deionized water ratio of 1:10 for food-grade bio-alkali, and the leachates were evaluated for pH, alkalinity, and metallic ion contents using standard analytical methods. The data obtained were statistically analyzed via a two-way ANOVA. The OAC samples had a higher ash content range (8.24–18.6%) compared to MFC samples (7.37–9.89%). Potash yield (%) is both biomass and combustion-method dependent, with MFC having a higher average yield (3.05%) than OAC (2.35%). The pH of the leachates for all samples ranged from 10.3 to 12.0. All the agro-waste exhibited a similar pattern in the order of magnitude of the metals of which they were composed (K > Mg > Ca > Zn > Na). For the minerals, PO₄ was highest (193.1 g/L) in plantain stalk, and KOH and K₂CO₃ were least (10.0 g/L) in coconut fiber, while the highest alkalinity was obtained in ripe plantain peel (62.1 mg/L). The yield and quality of bio-alkali produced were influenced by the combustion method and source of biomass. The bio-alkali from the different biomass types tested can be used as sources of food-grade emulsifiers due to their high nature of alkalinity. This signifies zero waste and is also a boost to the circular economy. The average alkalinity studied under MFC was 33.6 mg/L and for OAC was 27.3 mg/L, suggesting that MFC is a more promising approach. Worthy of exploration is the significant high content (19.3 mg/L) of chlorine in plantain stalk.

Keywords: bio-alkali; biomass; combustion; food additives; zero-waste



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