THE APPLICATION OF WASTE EGGSHELL DERIVED CALCIUM OXIDE IN BIODIESEL SYNTHESIS

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Poultry egg consumption is quite frequent worldwide which consequently causes large amounts of eggshell waste, approximately 8.58 million tons per year. Due to high disposal costs, recycling of the waste eggshells into an enviromentally-friendly catalyst is a potential solution [1,2]. Eggshell consists mostly of calcium carbonate ($CaCO_3$), which is transformed into calcium oxide (CaO) through the calcination process and used as a heterogeneous catalyst [1]. Such catalyst is suitable for the industrial production of biodiesel because of its easy separation from the reaction mixture and reusability, reducing the process costs. Biodiesel itself is a renewable energy source and is considered an alternative fuel to commercial diesel. It is primarily obtained via transesterification reaction, from vegetable oils or fats and an alcohol, in the presence of a catalyst. The use of a heterogeneous catalyst originating from waste eggshells, as well as waste cooking oil as feedstock, further contributes to the renewability of the entire biodiesel synthesis process and the recovery of waste materials [3]. This study compares the influence of CaO obtained by calcination at 900 °C from eggshell and commercial CaO on the conversion of waste cooking oil into fatty acid methyl esters (biodiesel). The reaction was carried out for 2 hours at 65 °C with 5 % catalyst by mass of oil. NMR analysis showed yields of 100 % for both catalysts.

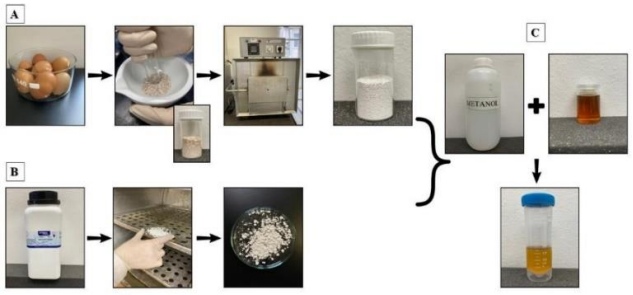

Figure 1. (A) preparation CaO from chicken eggshells; (B) drying commercial CaO; (C) the synthesis of biodiesel.

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REFERENCES

[1] A. Laca, A. Laca, M. Díaz, *J. Environ. Manage.* **197** (2017) 351–359.
[2] M. Waheed, M. Yousaf, A. Shehzad et al., *Trends Food Sci. Technol.* **106** (2020) 78–90.
[3] S. Niju, K.M. Meera, S. Begum, N. Anantharaman, *J. Saudi Chem. Soc.* **18** (2014) 702–706.