

# PALM STEARIN AS PCM IN ENERGY STORAGE SYSTEMS: DIVERSIFICATION OF THE USES OF BIOMASS FROM THE PALM OIL INDUSTRY

Víctor Alexis Lizcano-González<sup>a</sup>, Viatcheslav Kafarov<sup>a,\*</sup> and Khamid Mahkamov<sup>b</sup>

<sup>a</sup>Department of Chemical Engineering, Carrera 27 Calle 9, Universidad Industrial de Santander, Bucaramanga, Colombia

<sup>b</sup> Department of Mechanical and Construction Engineering, Sutherland Building Newcastle-upon-Tyne NE1 8ST, Northumbria University, United Kingdom

\*Corresponding author. E-mail address: kafarov@uis.edu.co (V. Kafarov).

Palm stearin is the heavy fraction obtained during palm oil refining. It consists mainly of saturated fatty acids and is often an unwanted by-product that reduces the economic efficiency of the processes. Although it is currently used in the manufacture of margarine or industrial vegetable fats, the increase in palm oil production will lead to higher production of palm stearin. The composition, low cost and physicochemical characteristics of palm stearin make it an ideal raw material for obtaining phase change materials for thermal energy storage in solar thermal energy systems.

This work explores the hydrogenation and esterification of palm stearin as processes for obtaining phase change materials with suitable properties for application. The temperature and reaction time for the hydrogenation of palm stearin using Nickel by Raney type catalyst was evaluated. Likewise, the esterification conditions were studied using low and high molecular weight alcohols, according to Fischer's esterification principles. For hydrogenation the reaction monitoring included iodine value (NTC 283:2019) and FTIR analysis, while for the esterification study the monitoring was complemented with saponification value (NTC 335:2019). For both raw materials and products obtained, melting and solidification temperatures and enthalpies, and heat capacity were determined by DSC according to ASTM E793-06(2018) and ASTM E1269-11(2018).

A crude wax was obtained by esterification of the fatty acids present in palm stearin and cetyl alcohol. Furthermore, hydrogenation allowed the melting temperature of palm stearin to be increased by up to 17% under the best operating conditions. The thermal characterisation of these products elucidates an optimal performance for heat storage applications in low temperature solar thermal systems (60°C - 90°C), for hot water supply and space conditioning.

## References:

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