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Case Study of Mechanised Shea Butter Production in South-Western Nigeria Using the LCA Approach from Gate-to-Gate

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Abstract : Agriculture and food processing, industry are among the largest industrial sectors that uses large amount of energy. Thus, a larger amount of gases from their fuel combustion technologies is being released into the environment. The choice of input energy supply not only directly having affects the environment, but also poses a threat to human health. The study was therefore designed to assess each unit production processes in order to identify hotspots using life cycle assessments (LCA) approach in South-western Nigeria. Data such as machine power rating, operation duration, inputs and outputs of shea butter materials for unit processes obtained at site were used to modelled Life Cycle Impact Analysis on GaBi6 (Holistic Balancing) software. Four scenarios were drawn for the impact assessments. Material sourcing from Kaiama, Scenarios 1, 3 and Minna Scenarios 2, 4 but different heat supply sources (Liquefied Petroleum Gas 'LPG' Scenarios 1, 2 and 10.8 kW Diesel Heater, scenarios 3, 4). Modelling of shea butter production on GaBi6 was for 1kg functional unit of shea butter produced and the Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI) midpoint assessment was tool used to was analyse the life cycle inventories of the four scenarios. Eight categories in all four Scenarios were observed out of which three impact categories; Global Warming Potential (GWP) (0.613, 0.751, 0.661, 0.799) kg CO2¬-Equiv., Acidification Potential (AP) (0.112, 0.132, 0.129, 0.149) kg H+ moles-Equiv., and Smog (0.044, 0.059, 0.049, 0.063) kg O3-Equiv., categories had the greater impacts on the environment in Scenarios 1-4 respectively. Impacts from transportation activities was also seen to contribute more to these environmental impact categories due to large volume of petrol combusted leading to releases of gases such as CO2, CH4, N2O, SO2, and NOx into the environment during the transportation of raw shea kernel purchased. The ratio of transportation distance from Minna and Kaiama to production site was approximately 3.5. Shea butter unit processes with greater impacts in all categories was the packaging, milling and with the churning processes in ascending order of magnitude was identified as hotspots that may require attention. From the 1kg shea butter functional unit, it was inferred that locating production site at the shortest travelling distance to raw material sourcing and combustion of LPG for heating would reduce all the impact categories assessed on the environment.

Keywords : GaBi6, Life cycle assessment, shea butter production, TRACI
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