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Development and evaluation of a combined roaster expeller for castor oil seeds for biodiesel production

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Abstract: A combined roaster and oil expeller was developed with locally available and accessible materials and the efficiency of the machine was evaluated. The obtained result shows that the efficiency of the machine is a function of the roasting temperature, the roasting duration, the moisture contents of the processed seeds and the machine feeding rate. The expeller is movable, simple in design for local fabrication, is easy to operate, requires few repairs and little maintenance and is cost effective. It is powered using a gear reduction electric motor of 5.5 Hp, the expeller has an average oil yield of 25.77% and an extraction efficiency of 70.26% and is designed to work for 8 hours per day of operation. The shaft diameter was designed to be 30 mm, while the roaster heater capacity was 2.8 kW. The designed machine is good for castor oil expression for both small- and medium-scale processing among rural and urban communities.

Keywords: design and oil yield; extraction efficiency; extractor; process parameters

Castor plants normally grow over a wide scope of geographical areas and may survive under severe physical and climatic conditions. The plant is, however, essentially a tropical crop, although it can grow in temperate regions. It has an oilseed which has numerous uses. It would be of great advantage if these waste seeds, that contain about between 35% to 55% of the oil, are used for biodiesel production that runs on a compression ignition engine (single cylinder engine) to test the performance and emission characteristics (Weiss 2000).

Increases in the demand for fossil fuels with the increasing world population coupled with environmental implications are the major factors for the increasing pressure on renewable energy. According to the information available in the open literature, over 80% of the global energy consumption is derived from fossil fuels, while the remaining is de-

rived from alternative sources of energy (Ezugwu 2015). The law of demand and supply on fossil fuels has resulted in its cost skyrocketing over the year as the population in Nigeria keeps increasing. However, alternative energy sources are either at the developmental stage or come at a higher cost. Hence, there is the need to expedite actions on scaling up the use of biofuels and their blends in thermal engines to make the availability of energy affordable and accessible. There is no gainsaying that energy is the driving force behind any nation's economical, technological, and social prospects. Presently, the sources of energy in Nigeria are mostly non-sustainable and non-renewable because of the overdependence on dwindling petroleum-based fuels which are the chief contributor to environmental pollution (Ezugwu 2015). Renewable energy offers a chance to reduce the emission levels of exhaust gases and