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Design and development of a domestic lamp for lighting using jatropha/castor oils

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Not the entire population in Sri Lanka has the access to grid electricity and about 35-40% will not have grid power within next 10-20 years to come. There is a large portion of population who use kerosene oil for lighting purpose and an ever-increasing fossil fuel prices make it difficult to afford purchasing kerosene at high prices. With that information in mind we have embarked on a project to design a lamp for illumination, which can use Jatropha or Castor oil, which are already available in the remote areas where the grid has not arrived. The main feature of designed lamp is that it can use high viscous oils such as Jatropha or Castor, which is not appropriate for existing kerosene lamp.

Properties of castor oil such as Viscosity, Density, Flash Point, Calorific Value Saponification Value, and Acid Value were found at the laboratory. By considering the properties and the availability of the oils, Castor oil is considered for further investigation as a fuel for the lamp to be designed. Two main designs namely, Slim Lamp, which based on the maximum absorbing height of the castor oil for the selected wick material and the Floater Lamp which based on the floatability on the oil with the help of the floater were designed. With the comparison of fabrication capability at domestic level, safety in the domestic environment, portability, maximum oil capacity, fabrication cost and maintenance the Floater Lamp is selected as the optimum design. Design calculations and experiments were done for the floater lamp to select a suitable wick from the available wicks, floater calculations to certify the floatability, chimney calculations to keep a better inlet and exhaust air flow.

The designed lamp was tested for its consumption of castor oil versus time which showed increased burning / illumination duration compared to the same quantity of kerosene oil. The designed lamp could be used to ignite highly viscous fuel oils where the specific gravity remains above 0.9 and with a flash point above 100^{o}C, which in terms prevents fire hazard ness in accidents.

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