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Enhancing the brass smelting process and indoor air quality of the traditional brass cottage industry

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The traditional brass industry is one of the oldest cottage industries in Sri Lanka. It has developed over the centuries undergoing various changes. However there is a significant gap in technology transfer in this industry when compared to the other cottage industries in Sri Lanka. Due to inefficient manufacturing practices, traditional brass craftsmen face severe problems at present. However, there are a number of simple modifications or redesigns which can improve the efficacy of manufacturing processes in this industry. One such application is redesigning of the furnace in order to enhance the thermal efficiency of brass melting process and thereby reducing the fuel cost. In addition to the current practices, much indoor air pollution takes place in these cottages which has led to some long term medical problems as well. Therefore, this research aims at addressing dual problems of the indoor air pollution issue and the inefficient melting process by introducing a new portable furnace design.

The furnace used at present is a fixed graphite-clay crucible with a clay wall. Heat is generated in the chamber by burning fuel oil. Brass is melted by absorbing that heat. According to calculations, this furnace has a very low efficiency of below 5%. As a result a large amount of heat is wasted making the production cost high. On the other hand carbon dioxide emission becomes high causing negative environmental impacts. Therefore, redesigning of an eco-furnace gives a number of benefits from all aspects.

The redesigning process of the furnace consists of a mathematical model and a 3D CAD model. By the mathematical model, the structure of the furnace was optimized. By comparing actual indicators and estimated indicators for thermal simulation of CAD model, performances were estimated. The minimum efficiency expectation is 9%. The expected annual electricity reduction is 9414.8 KWh/year. The estimated fuel reduction is 932.72 L/year. By this eco innovative design, there is a possible reduction of 30027.91 KgCO2eq/year in the Global Warming Potential (GWP) .The furnace will be fabricated using firebricks as a lightweight, portable furnace with a low cost. An advanced optimization will be done through continuous experiments by melting.

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