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## **HEAT AND STEAM RECOVERY SYSTEM FOR PALM OIL INDUSTRY SUBJECTED TO REDUCE THE WATER USAGE**

Siriwardana S.S.G.C.\* and Dr. Bandara T.S.

Department of Mechanical Engineering, Faculty of Engineering, University of Sri Jayewardenepura, Sri Lanka  
geethal.japuraefac@gmail.com

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### **ABSTRACT**

Heat wastage and steam recovery are major problems encounter in the palm oil manufacturing industry. The manufacturing process of the palm oil requires a massive amount of water in the process of extracting oil from the kernel and the shell of the palm fruit. The objectives of this project to recover the waste heat and reduce the usage of water in the process by recycling boiler water and the process water. This emerging concern of reducing water usage lead Watawala Plantation PLC to seek efficient effluent treatment methods, which can reduce the amount of effluents in their palm oil mill. Initially, all the physical parameters of the effluent were tested. The results showed the pH value of effluent as 4.65 where the moisture content was 96.9 % (w/w). Outlet temperature was 70°C. Effluent flowing with a rate of 2 litres/min was dumped while the rate of production of effluent was 10 tons per shift (12Hrs). The waste steam pressure was 3.2 bars and the temperature was 133.56°C. This waste steam is used in the evaporation process. Finite Element Analysis and Computational Fluid dynamics modelling were carried out to achieve pre-planned results. Initially, the heat exchanger Air was used initially as the transfer medium in the heat exchanger. However, air could not transfer sufficient heat to evaporate effluent. Then palm oil was used as the transfer medium. Although it is a good transfer medium, the heat exchanger was modified to work directly with steam. A set of falling film evaporators in series connection were used to increase the amount of evaporation up to 40% as a further development. Thus condensed steam can redirect to the boiler and the evaporated water can reuse in the process of palm oil manufacturing.

**Keywords:** Effluent Treatment, Evaporator Design, Heat Exchanger, Waste Steam, CFD Analysis