

Evaluating the potentials of adopting cleaner production techniques to reduce the manufacturing cost of rice flour and coffee

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Introduction

The increment of cost of production (COP) whilst consumer pressure for a lower price is a major constraint for the sustainable growth of rice and coffee processing sector in Sri Lanka. Several studies have been investigated to find effective ways of minimizing COP, (Brezet and Schelleman, 1995) however literature do not evidence any use of cleaner production, a waste zeroing system. This study was aimed to evaluate the cleaner production concept in rice and coffee processing sectors, as a solution for minimizing COP. Cleaner production is the continuous application of an integrated preventive strategy to processes, products and services, to increase eco-efficiency and to reduce risks to humans and the environment (Brezet and Schelleman, 1995).

Methodology

Using Ruhunu Foods (Pvt). Ltd flour and spice processing factory as the host, the production process was analyzed to identify possible waste streams and their causes. Using direct measurements and material balance calculations, the waste streams were then quantified. This was done during a period of one month batch production from both processing sections. The quantified wastes were then expressed in terms of their monetary value. Significant waste streams were identified using Pareto analysis. Control measures for them were suggested using CP philosophy and CP techniques as a guide. Ten minute power logger data were obtained from both hammer mill machine and flour mill machine. Then the power factor correction was done to find the payback period for the energy saving process.

Result and Discussion

According to the findings of this study, both avoidable and unavoidable wastes occur in the coffee flour manufacturing process. The average loss per batch of money due to avoidable wastes of red rice, white rice and coffee processing are respectively LKR.3885.07, LKR.7612.5, and LKR.1529.39. Significant waste streams which contribute to this monetary loss are stuck red and white rice flour and coffee powder inside the milling and grinding machines (89.75%, 93.59%, 97.46%), rejected coffee beans (59.51%). The possible control measures for these waste streams are good housekeeping, better process controlling and equipment modifications. Ten minute power logger data were indicted both flour mill and hammer mill have a low power factor. According to the power

factor correction both milling process takes less than 4 years payback period to recover the cost of the energy upgrade from the energy savings. Usage of premium efficiency motors and capacitor banks will save the energy. Immediate implementation of cleaner production will uphold the company image and increase the quality, productivity, worker satisfaction and profit.

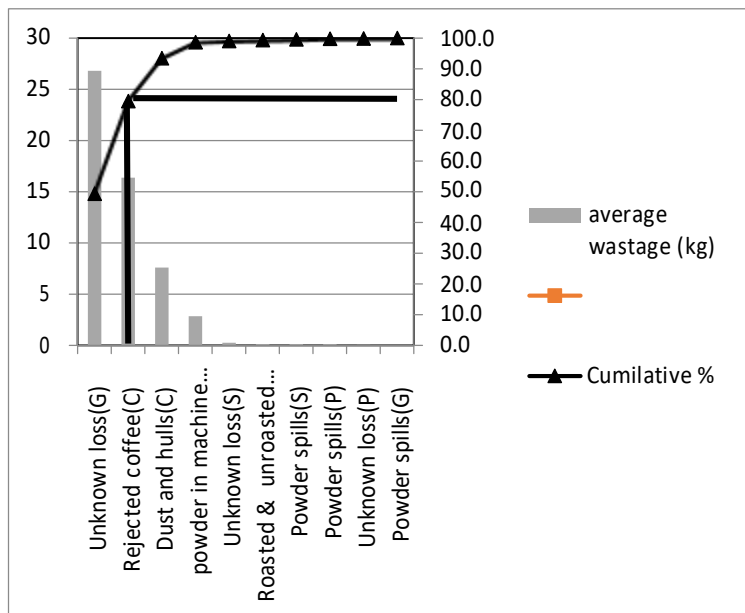


Figure 01: Pareto Diagram of monetary losses of wastage during the coffee processing

Table 01: Energy Saving in Hammer mill machine by power factor correction

Maximum kVA	34.2	kVA
Maximum kW	15.14	kW
Original Power Factor	0.45	
Desired Power Factor	0.99	
Multification factor	1.589	
Reactive power required	24.05746	kVAr
Desired kVA	15.29293	kVA
Recommended capacitor bank	25	kVAr
Desired kVA reduction	18.90707	
Desired saving	19800	LKR/month
Investment	62500	LKR
Payback period	3.156566	Less than 4

Conclusions

Avoiding of flour packet weighing process done under the packing process can save LKR. 211 per batch, also the all wastages occurred in processing steps emphasize even the low material loss percentage can lead to considerable monetary loss due to the value of its final product. In terms of monetary losses, the highest waste streams occur from the rice milling, coffee grinding and cleaning processes. During those steps, 89.75%, 93.59%, 97.46% and 59.51% of total money loss of wastes occurs as red and white rice flour, coffee powder and rejected coffee. The possible control measures for these waste streams are good housekeeping, better process controlling and equipment modifications. Less power factor (PF) in both milling machines it could be corrected by using premium efficiency motors instead of old motors used in the factory and also designed active and passive PF correction circuits will bring the PF of a system closer to unity ($PF = 1.0$) (Nalbant and Klein, 1990). Highly efficient electrical systems have the advantage of supplying less current to drive a load. This will be beneficial to the factory that have low power factor problems because utilities sometimes charge penalties for low power factor. Both milling processes take less than 4 years to recover the cost of the energy upgrade from the energy savings as a result of financial decision for the company.

Acknowledgement

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References

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