# CHAPTER 5 GENERAL DISCUSSION

## 5.1 Introduction

This study aimed to find the alternative option to reduce waste generation from process operation at agro-based industry which causes various forms of environmental degradation. Hence, waste auditing was conducted at Kapar Coconut Industry Sdn. Bhd., where different types of coconut-based products were being processed such as spray dried coconut milk powder and low fat desiccated coconut. The scope of the waste auditing was determined. Waste auditing was conducted at the production site namely at the press station (separating milk from coconut) and desiccated coconut (DC) station. As for the administration sites, waste auditing covered marketing, quality assurance (QA) and human resource management (HR) sites.

In the paring station, the raw coconut was loaded in an open area and separation process was used to select mature and non-rotten coconuts. The coconut will be further processed through deshelling and paring to remove the coconut husk. The two main types of wastes in the paring station were coconut husk from dehusking process and coconut shell from deshelling process. Other types of wastes include used gloves and scrapped equipment. Waste reduction can be carried out by practicing good housekeeping to prevent excessive waste generation and conducting manual processes carefully during the loading of raw coconut, deshelling, paring into kernel and washing. On the other hand, a regular check on the machines is required to avoid leaking and breakdowns, which may reduce production efficiency.

In the production site, waste generated during production process is very low (approximately 13.5kg/week) due to monitoring by the supervisor, automated processing and regular checks on the pipelines and screw conveyor. Hence, waste reduction can be achieved via machinery maintenance to prevent leaking from the pipes and continuous monitoring.

During the packaging process, spillage of desiccated coconut, coconut milk powder and ink occurred since some of the processes were done manually. Also, other wastes like plastic-film, cardboard box, plastic bags, used gloves and bouffant caps were generated. Hence, more accuracy and the practice of good housekeeping such as reusing some recyclable items are necessary to minimize waste generation. At the storage section, wastes generated are spilled chloride (0.3kg/week), spilled Maltodextrin and Sodium Casseinate (0.6kg/week), broken drums (1 unit/3months), used cartons (0.5kg/week), used nylon bags (5.5kg/week), wooden pallet (1 unit/3months), steel and plastic pallets (1 unit/6months) and wastewater. Waste generation can be minimized by reusing and repairing damaged steel pallet and replacing the wooden pallets with high durable plastic pallet to reduce pallet damage.

At the administration office, the main types of wastes in all five sections were used paper (1.3kg/week), plastic bags (0.3kg/week), tissue paper (0.1kg/week), used stationary (2 units/week) and food containers (0.2kg/week). However, the amount of waste generated is very low (2.2 kg/week). Employees should be encouraged to use both sides of paper whenever possible and some recycling containers should be placed in the administration

office for recyclable items. Some types of wastes such as used paper, cartons and wooden pallets are mostly used as feed materials for steam generation at the boiler operation unit.

The two major organic wastes (coconut shell and coconut husk) generated in large quantities at Kapar Coconut Industry Sdn. Bhd., were organic waste. However, both of these wastes were sold to be further processed to produce charcoal and coconut oil. Yet, these wastes can still pose negative impacts to the environment. Hence, biological treatment seemed to be one of the best alternatives towards reducing environmental degradation. Additionally, it also can produce organic fertilizer (vermicompost) that can enhance plant growth.

Biological treatment was conducted for three types of waste, namely coconut husk, coconut shell and spent coconut flake using *Eudrillus euginea*. The two wastes, coconut husk and spent coconut flake, were decomposed completely after 50 and 16 days, respectively. The degradation process seemed to be very slow in that the coconut shell took more time than should be necessary for complete degradation. Generally, the chemical and physical parameters were determined. The earthworms' weight gain was achieved in all types of wastes, but earthworm numbers reduced in all of the treatments. Therefore, the weight of worms increased positively. Moreover, the goat manure also had an important role in earthworm weight gain by providing more nutrient and microorganisms as the worm's food. Three different ratios were used in this study and it was found that 70% waste and 30% GM showed the best result. In order to determine the effectiveness of vermicomposting as the alternative method (instead of selling off the waste), economic factors are being considered by agro-based industries.

## 5.2 Economic Aspect of Vermicomposting

In order to encourage vermicomposting by the industries, the study took into account, the economic importance of the process. The coconut shell is sold off at RM80/tonne, while coconut husk at RM 450/tonne. The cost for vermicomposting of 1kg coconut waste was calculated in order to compare it with the cost of coconut waste treatment by coconut-based industries as shown in Table 5.1. The total cost for mixture GM: CH (50:50) was chosen as the representative ratio in this study to find the maximum cost for the vermicomposting process.

**Table 5.1:** Approximate Cost of the Components for Vermicomposting of Coconut Waste.

| Ingredients | Cost (MYR/kg) |
|---|---|
| Worm | 150.0 |
| Goat dung | 10.0 |
| Soil | 0.30 |

The maximum cost for vermicomposting of 350g of waste was RM5.80 as shown in Table 5.2.

**Table 5.2**: Approximate Cost for Vermicomposting Process of 350g of Coconut Waste.

| Ingredients | Cost (MYR) |
|---|---|
| Worm (20 worms) | 3.75 |
| Goat dung (175g) | 1.75 |
| Soil (1kg) | 0.30 |
| Total | 5.80 |

The cost to covert 1 tonne of coconut waste into vermicompost is approximately RM7702.40, while the cost of producing 1 tonne of vermicompost is nearly RM11600.00 as shown in Table 5.3. However, the weight loss is 33.6% and only 66.4% of vermicompost will be available at final stage of the vermicomposting process. This is of high beneficial impact based on the fact that more than 50% of the starting vermicomposting mixture was recovered as nutrient rich by-product. Basically, vermicompost is completely green; hence eco-friendly and is on high demand in the agricultural sector/market.

**Table 5.3**: Summary of the Cost and Profit from Vermicomposting 1 tonne of Coconut Waste.

| | |
|---|---|
| Cost of producing 1 tonne of vermicompost (RM) | 11600.0 |
| Selling 1 tonne of vermicompost (RM) | 16513.6 |
| Net profit from 1 tonne of vermicompost (RM) | 4913.6 |
| Selling of 1 tonne of waste at the coconut-based industry (RM) | 450.0 |

The total cost of the vermicomposting process is expected to decline if it is conducted on a larger scale, because the price of the components will decline if they are bought in large quantities. Moreover, vermicomposting on a larger scale will provide more space and surface area that make the decomposition process faster than conducting vermicomposting on a small scale. Thus, the net profit for each tonne of vermicompost will be RM4913.6 besides its significant impact in mitigating environmental degradation.

# CHPTER 6 CONCLUSION

Waste audit was carried out at Kapar Coconut Industry Sdn. Bhd. The types of wastes generated at the company was identified and quantified. The main components of process wastes generated by the coconut–based industry were coconut husk and coconut shell, which were about 540kg/week and 1456kg/week respectively. Vermicomposting was carried out with three different types of coconut wastes to evaluate the possibility of the biological treatment as an alternative of a more environmental friendly approach.

In view of the above; this study therefore concludes that all three types of coconut wastes could be composted within different periods of time. The degradation process was relatively faster in spent coconut flakes (SCF) than other types. The success of *Eudrilus eugeniae* to vermicompost coconut wastes was also studied and it was found that generally, the number of worms declined during the process.

The physical and chemical parameters were determined and comparative data was obtained and it is concluded that the vermicomposts from three types of coconut wastes comply with EPA/EU standards in terms of colour, physico-chemical characteristics and odor. Yet, further study is required to prove the impacts of these vermicomposts on plant growth.