

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

This research project started with a definite objective that the firewood used in rubber smoking industry must be taken care of. The original belief that firewood plays an important role in this kind of industry was ruled out after the analysis of data obtained from the survey (Chapter 2) revealed that the firewood contributed a negligible fraction to the production cost. Furthermore, availability of firewood in the rubber growing area is still abundant.

Eventhough shortage of firewood is unlikely to occur in the near future, price rising of firewood is possible because demand for rubber wood for manufacturing of consumer products will definitely increase. Fortunately enough, the rubber smoking industry is not sensitive to the price of firewood. Monitoring of the rubber smoking process was carried out (Chapter 3) to acquire knowledge which is vital for the research team to synthesize for process improvement. It is worth to realize that moisture content in the inlet air is a prime factor in controlling the drying time of the rubber sheets. This of course, leads to an acclaimed concept of inlet air dehumidification to accelerate the smoking process. Factors affecting the rubber drying behaviour was clearly understood by experiments (Chapter 4). Results obtained from the experiments support such acclaimed concept of inlet air dehumidification. Actual smoking with dry and green firewood was conducted and the advantageous of the absence of moisture in the firewood was obvious. Finally the ultimate objective of the research was set for a viable air drier for the rubber smoking industry. Heat pump air drier was studied both in laloratory scale and field trial test (Chapter 5). The air drier was simply a modified air conditioning unit. Although the air drier, due to many limitations in the adoption of the air conditioning unit, did not perform up to the required specification, the trial tests yielded a satisfactory result. Dehumidification of inlet air showed positive effect on the smoking

time. According to time and technical constraints this project has to finish. Findings from this project are summarized below.

a) Supply of fuelwood in rubber growing area are still plentiful but the demand is also increasing by the consumer product manufacturing industry. Firewood price will therefore increase in the foreseeable future. However, the rubber smoking industry is not sensitive to the firewood price.

b) Heat losses during the process are about 60-70% of input heat. The loss by conduction through back wall and front door, which is about 22.5%, can be conserved by installation of thermal insulation. Although such energy saving measure is economically feasible, the return benefit is not attractive enough. It is, therefore, unlikely that the factories' administrators will adopt the recommended energy saving measure.

c) Rubber smoking process can be accelerated by employing dry firewood and/or dry inlet (combustion) air. Implementation of air drier apparatus is, so far, believed to be a promising technique.

6.2 RECOMMENDATION

At the completion of the project, although many vital facts were found, there are some important aspects needed serious investigation before further commitment is implemented. The following activities are recommended.

a) Conduct a market survey for the demand of air drier in rubber smoking industry. Constraints and limitations of the demand side must be well understood. Competitiveness with the already commercially available model, both technical and economic points of view, must be taken into account for the research and development of the air drier.

b) Study on the application of air drier on other products especially the ones the are more sensitive to the energy cost. The interesting products include tobacco curing, food stuff drying, (low) humidity controlled room for industries such as cosmetic, pharmaceutical products and electronic parts.