

UNIVERSITI TEKNOLOGI MARA

**TECHNO-ECONOMIC EVALUATION OF MSW
GASIFICATION FOR POWER GENERATION**

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ABSTRACT

Energy recovery from biomass and municipal solid waste (MSW) by gasification technology has attracted significant interest because it satisfies a key requirement of environmental sustainability by producing near zero emissions. Though it is not a new technology, studies on its integrated process simulation and analysis are limited, in particular for (MSW) gasification. This paper develops a gasification process by using the Advanced System for Process Engineering (Aspen) Plus software for evaluation of its technology performance. Using the develop model, computational model was developed on the basis of Gibbs free energy minimization. The model of gasification process the effect of operating conditions, gasification temperature, air to fuel ratio and moisture content was developed and investigated. Gasification temperature and air to fuel ratio affect the synthesis gas produce while moisture content only gave minimal change toward the gas composition. By using pilot scale downdraft gasifier, tar was collected and analysed. Cleaner gas collected after flow through series of filter bed consists of sawdust and activated carbon. In terms of economic, all the calculation and result was based from small scale of 10 tonne/day MSW plant. The operation of this plant can generate RM 1.124 million of revenue per year with payback period of 6.85. The rate of return of investment (ROROI) is positive at 6.31% per annum and cumulative cash flow is positive.

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CHAPTER 1

INTRODUCTION

1.1 RESEARCH BACKGROUND

Solid waste management (SWM) is one of the major threatening environmental issues in the world especially in developing countries. The biggest fraction of the solid waste generation is municipal solid waste (MSW). MSW can be defined as type of solid waste generated from community, commercial and agricultural operations. This includes wastes from households, offices, stores and other non-manufacturing. As a developing country, Malaysia population continue to increase from year to year. According to the Department Of Statistic Malaysia (2016), as of 2016, Malaysia's population is 31.7 million with a growth rate of 1.5% per year. These indicate that there will be an increase in the generation of MSW from year to year.

A study by World Bank reveals that by the year of 2025, Malaysia will generate 1.4 kg of MSW per person in day. By assuming that, the population of Malaysia at that time is around 36.5 million, this will cause of 5103.7 tonne of MSW generation per day. A step need to be taken for handling this serious problem. Integrated solid waste management (ISWM) refers to the strategic approach to sustainable management of solid wastes covering all sources and all aspects, covering generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner, with an emphasis on maximizing resource use efficiency. Many governments around the world have implements this strategy in handling their waste, including the MSW. They emphasis on the reduction of the waste and reuse it whenever possible. A recycle culture is being teach to the citizen to create awareness toward the environment. Waste prevention and minimisation also include under the ISWM.