

UNIVERSITI TEKNOLOGI MARA

**PYROLYSIS OF MUNICIPAL
PLASTIC WASTE**

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ABSTRACT

Since the over-used of plastic is becoming a major issue in the world nowadays, efforts of recycling the plastics into useful materials are being developed. One of the most common methods used in converting the plastic into valuable product is pyrolysis. This study aims to produce oil from the PET plastic bottles. The PET type of plastics is chosen as the raw material of the research since the plastic can be easily collected and recycled. The plastic slowly went through pyrolysis at four different temperatures of 300, 400, 500 and 600°C to produce the oil. At the first part of the study, the thermal degradation study was carried out with Thermogravimetric Analyser (TGA) from room temperature to 1000°C with heating rate of 10°C/min. The result from the TGA also is used to determine the content of moisture, volatile matter, fixed carbon and ash through proximate analysis and the appropriate range of temperature was determined. The pyrolysis process of the PET plastic in fixed bed reactor was done at the same condition in order to produce the solid, liquid and gas products. The highest yield of oil was produced at temperature of 400°C. The pyrolysis product was characterized by using FT-IR and GC-MS characterization techniques. Experimental results showed that pyrolysis could be an important method for the determination of the operating conditions and also an environmentally-friendly way for the transformation of the plastic wastes into valuable chemicals which later can be used as alternative fuel.

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CHAPTER 1

INTRODUCTION

1.1 Research Background

Plastic is widely used in many sectors including in automotive, packaging, electronic and healthcare. The demand for plastics keeps on increasing from day to day due to the growth in world population. Besides, the continuous demand of the plastics led to the increasing amount of municipal plastic wastes (MPW) in landfill and the uses of petroleum as the raw material for plastic production had caused the depletion of the fossil fuel. In the plastics production, different types of plastic such as poly-propylene (PP), poly-ethylene (PE), polystyrene (PS), low density polyethylene (LDPE), polyvinyl chloride (PVC) and polyethylene-phthalate (PET), are developed in order to meet the needs of different industries. Usually, the highest amounts of available plastic types among MPW are PE and PS [1].

With the amount of plastics used and left to degrade in landfill, many efforts are being looked out to reuse the plastics waste. One of the plastic wastes that are currently being on research is Polyethylene-Phthalate (PET) plastic. PET plastic is widely used in plastic packaging of the food industry such as mineral water bottles, soft drink bottles and fruit juice container. Plastics can take up to billion years to degrade and the breakage of the bonds of many substances in the plastics occurs gradually. In order to reduce this massive breakout of plastic disposal, methods of reducing the production of waste are introduced. Methods such as recycling and reusing the plastic are not significant enough to be chosen as the best alternative. The rate of recycling for certain countries is still at the lowest. In Europe, about 38% of the plastic wastes are still going into landfills and 26% were recycled. Recycling is proven to be difficult when the pre-treatment process needs a specific separation process. Usually the manufacturers will prefer to select transparent plastics to be used again since the transparent one can be dyed easily for another use [2].

Although recycling is preferable to reduce the amount of plastic wastes, the world is in need for new reliable technology or method to overcome the arising problem. Since the amount of plastics produced kept on increasing years by years, the amount of fossil fuel is depleted. Since plastics are made of the fossil fuels, many researchers are doing researches on