# DESIGN AND FABRICATE HEAT EXCHANGER FOR DOWNDRAFT GASIFIER

**MOHD HEFNI BIN ABDUL HADI**

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**Faculty of Mechanical Engineering**

**Universiti Teknologi MARA (UiTM)**

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MAY ALLAH BLESS US ALL

## ABSTRACT

A heat exchanger is a device that used heat transfer to transfer of internal thermal energy between two or more fluids available at different temperatures level. The objectives of this project are to design and fabricate heat exchanger for downdraft gasifier system, develop and fabricate a mechanism by lab-scaled dimensions and investigate temperature requirement in gasification process. Heat exchanger is part cooling process in gasification system. Where, the cooling process is a part of producer gas treatment before it can use as a fuel or others applications. The selection of shell tube heat exchanger in this project due to high operating temperature and low fabrication cost. In selection of material, aluminium is the most appropriate materials for the fabrication of heat exchanger due to higher thermal conductivity ($k = 237m.K$), lightweight (density, $\rho = 2702\ kg/m^3$), corrosion resistance, and moderate cost. At the design stage, to achieved the optimal design some important parameter has been calculated such as required surface area ($0.06m^2$) and number of tube ($n = 4$). After the design stage, there are few fabrication processes involves in fabricated of heat exchanger which is cutting, joining, assembly and installation process. In testing stage, the temperature of producer gas has been reduced in range of ($39.1°C - 43.5°C$). Then, through the observation of gas flame the result shown the colour of gas was change from red to blue, this indicated the gas volume metric efficiency for syngas was increased due to the temperature drop in the cooling stage.

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# CHAPTER 1

# INTRODUCTION

## 1.1 Background of Research

Biomass is an alternative way to produce renewable energy through gasification process to replace energy source especially petroleum. Normally, the gas produced from gasification process is called syngas or combustible gas that produce from organic materials. By converting the energy from the gas combustion it's can be used for many applications such as electricity generation, rural energy services and transportation. Downdraft gasifier is one of the method that been use in biomass gasification in producing combustible gas. However, the gas that produced through gasification process in downdraft gasifier is not suitable for direct application. This is because the gas producer has high level of temperature and tar contain that not applicable for some application such as automotive engine. Therefore, cooling process is an alternative way for improving volumetric efficiency and reducing the