CHAPTER I. INTRODUCTION

1.1 Background

Indonesia as a tropical country focuses its economy on the plantation and agriculture sectors. In 2019, it is known that the agricultural area in Indonesia reached 7 million hectares and the plantation area reached 9 million hectares with one of the largest types of plantations being rubber. Rubber plantations are one of the plantation commodities that contribute greatly to increasing the country's foreign exchange. Based on data from the Ministry of Industry of the Republic of Indonesia in 2014, the total area of rubber plantations in Indonesia reached 3.4 million hectares, making it the largest in the world and the second largest producer of natural rubber with production reaching 3.04 million tons and exports up to 2.4 million tons. This is certainly proportional to the amount of waste generated by the rubber industry in Indonesia.

The rubber industry produces quite a lot of liquid waste because, in its processing, water is used as much as 25-40 m^3 / ton of dry rubber. If not managed properly, this rubber wastewater can cause environmental pollution because this waste still contains many organic compounds with high concentrations (Sarengat *et al*., 2015). Some rubber industries produce effluent with BOD levels of around 2840 mg/L and COD of 1043 mg/L which of course do not meet the standard requirements to be released directly into the environment (Hatijah *et al*., 2010). The high levels of BOD and COD in rubber wastewater will result in environmental damage and the death of aquatic biota. Therefore, further management is needed to handle rubber wastewater.

So far, industrial wastewater treatment includes physical treatment, namely by using the principles of precipitation and filtering. Chemically by adding chemicals to the liquid waste so that pollutant compounds are oxidized. While biologically by using microorganisms with suspended culture and attached culture in processed with a pond system (Riffat, 2012). This biological method is considered less efficient because it requires a large area of land.

Environmental damage is not only caused by industrial waste, the use of fossil fuels as a power plant can also pollute the environment. Steam Power Plants (PLTU) produce CO_2, NOx, and SO_2 gases as well as radioactive pollutants that become pollutants in the air (Sasmita *et al*., 2021). The high pollution generated by the power generation process is in line with the high electricity consumption in Indonesia according to the Ministry of Energy and Mineral Resources report, which reached 1173 kWh/capita.

Microbial Fuel Cell (MFC) is one of the technologies to process waste while generating alternative electricity because so far energy needs mostly rely on fossil power which in its processing has an impact on environmental ecological disturbances. Based on these reasons, innovation and renewal are needed for alternative energy that is cheap, easy to process and does not damage the environment such as MFC (Logan, 2004).

Microbial Fuel Cell will produce energy from the metabolic process of microorganisms (Venkata Mohan *et al*., 2008). The production of alternative electrical energy by MFC is considered easy to apply, and efficient because the process is safe, does not produce toxic compounds, and uses the latest combination techniques. In recent years, MFC has shown the potential to convert chemical and organic materials into electrical energy while improving the quality of the waste (Logan, 2004).

In its application, the sediment system Microbial Fuel Cell (SMFC) requires a source of microorganisms as a catalyst for organic matter contained in waste to be broken down into simpler forms so that it can produce electric current. One of the sediments that can be used is paddy field mud. Paddy field mud also has abundant availability in Indonesia. According to data from the Ministry of Agrarian Affairs and Spatial Planning / National Land Agency, the area of raw paddy fields in Indonesia in 2019 reached 7,463,948 hectares. In addition, this paddy field mud also contains various organic materials that become a place for microorganisms to live. Especially exoelectrogen bacteria that function as electron conductors for SMFC (Fakhiruddin *et al*, 2018).

Research on Microbial Fuel Cell using paddy field mud has previously been conducted by Dharmawan *et al*., 2020 with the average voltage of 1.086 mV and when banana peel waste is added, the average voltage reaches 25.45 mV. Meanwhile, research by Ambar *et al*., 2020 using mud and molasses produced an electric voltage of 540 mV.

1.2 Problem Formulation

The problem formulation of this research are:

1. Is it possible for rubber wastewater to generate electrical energy through a Microbial Fuel Cell (MFC)?
2. Is it possible for paddy field mud to generate electrical energy through a Microbial Fuel Cell (MFC)?
3. How is the production of electrical energy produced by Microbial Fuel Cell (MFC) using a mixture of rubber wastewater and paddy field mud?
4. What are the characteristics of bacteria isolated from the anode in Microbial Fuel Cell (MFC)?

1.3 Research Objectives

The objectives of this research are:

1. Knowing the potential of rubber wastewater in producing electrical energy through Microbial Fuel Cell (MFC).
2. Knowing the potential of paddy field mud in producing electrical energy through Microbial Fuel Cell (MFC).
3. Knowing the production of electrical energy produced by Microbial Fuel Cell (MFC) using a mixture of rubber wastewater and paddy field mud.
4. Knowing the characteristics of bacteria isolated from the anode in Microbial Fuel Cell (MFC).

1.4 Research Benefit

The benefits of this research are:

1. Provide information about the process of processing rubber wastewater and paddy field mud into electricity using the Microbial Fuel Cell (MFC) method.
2. Contribute to providing environmentally friendly alternative electrical energy options using industrial waste.