CHAPTER 1. PRELIMINARY

1.1 Background

Need continuing energy increase is one of the challenges the Indonesian people must face. According to the Ministry of Energy and Mineral Resources of the Republic of Indonesia (2018), the distribution of energy sources in Indonesia in 2017 includes oil 42.09%, coal 30.33%, natural gas 21.3%, hydropower 3.49%, heat earth 1.51% biofuel 1.24% of the total use of energy sources. The full benefit of renewable energy is only 6.24% of the target of 23% in 2025, according to Presidential Regulation No. 79 of 2014 concerning Energy Policy. Dependence on Fossil Fuels causes the depletion of energy reserves. Therefore, alternative renewable energy is needed, which is biohydrogen.

Biohydrogen is a gas produced by the activity of microorganisms. Hydrogen produced biologically is a potential biofuel that does not cause CO_2 emissions (Sinha. 2011). Hydrogen is a gas with the potential as an energy source of 122 kJ/g. This means 2.75 times higher than hydrocarbon fuels (Sung et al., 2003), promising as substituent fuels.

Biohydrogen production involves microorganisms or enzymes (Hawkes et al., 2002), in the form of bacteria capable of synthesizing hydrogen-producing enzymes, such as hydrogenase and nitrogenase, in fermentation with or without light. Among all biological processes, anaerobic fermentation is the most straightforward technology for producing biohydrogen gas because it does not require external energy in the form of a light source and can be carried out at a

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minimal cost (Sreela *et al*., 2011). Anaerobic fermentation is the most studied technology for biohydrogen production due to its higher production rate and treatment capacity for organic wastes. From various literature studies that have been conducted, anaerobic fermentation has the potential to produce biohydrogen, with gas production ranging from 2.4-2.9 mol H_2/mol C_6 (glucose). The highest yield can be obtained at 4 mol H_2/mol C_6 with acetic acid as a by-product dissolved (Sompong *et al*., 2019). During anaerobic fermentation, complex molecules are converted into simpler compounds, such as free fatty acids (FFA), simple sugars, and amino acids, using the anaerobic sludge as inoculum during the hydrolytic phase of the process.

Raw materials for the production of biohydrogen can use organic waste. Previous research (Panjaitan. 2022) found that cow manure waste produces biohydrogen gas, which is 0.0932 grams. Molasses waste produces biohydrogen of 232 mLH2/L/H. POME processing waste has the potential to produce hydrogen, but only a few studies have used POME as raw material for the anaerobic biohydrogen production process. To maximize the yield of biohydrogen production from POME, chemical treatment such as NaOH and H_3PO_4 can be added and also added molasses as carbon source.

Using POME (Palm Oil Mill Effluent) and sludge as raw materials can reduce environmental pollution problems. POME contains an organic ingredient that anaerobic bacteria can ferment to produce hydrogen gas.

1.2 Problem Formulation

Based on the information that has been described in the research background, there are several problems in formulation, as follows:

1. Can POME produce biohydrogen as a raw material and inoculum source?
2. How does the addition of NaOH and H_3PO_4 at various concentrations affect the production of biohydrogen?
3. How does the addition of Molasses at various concentrations affect the production of biohydrogen?
4. Were isolates of bacteria involved in the anaerobic fermentation process in producing biohydrogen found?

1.3 Research Objective

The objective of this research is:

1. Testing POME as raw material and source of inoculum to produce biohydrogen.
2. Knowing the effect of adding NaOH and H_3PO_4 to biohydrogen production.
3. Knowing the effect of adding Molasses to biohydrogen production
4. Isolate the bacteria involved in the anaerobic fermentation process in producing biohydrogen.

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1.4 Benefit of The Research

The results of this research are expected to provide information about the waste that is not only disposed of but can generate economic value and benefits for the environment. This research will be the basis for further research on hydrogen production

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