I. INTRODUCTION

1.1 Background

Thermophilic bacteria are microorganisms that can live at high temperatures, with an optimum growth temperature, with optimum growth temperature that can reach over 60 °C (Ratri et al., 2009). These microorganisms have unique habitats and are capable of functioning and reproducing in those environments (Canganella & Wiegel, 2014). However, according to Panda et al. (2013), these thermophilic bacteria are still underexplored due to the difficulty in isolating and maintaining them in pure culture. Thermophilic bacteria are considered among the most significant types of extremophilic bacteria identified to date (Bhandari & Nailwal, 2020)

Thermophilic bacteria are commonly found across the world, particularly ini environments with geothermal activity, such as hot springs, terrestrial volcanic regions, underground oil reservoirs, sun-heated surface soils, and deep-sea hydrothermal vents (Muqarrahma et al., 2023). Their presence in these specific habitats is influenced by a range of biotic and abiotic factors. In addition, these bacteria can produce enzymes that retain their activity and remain stable even in hot environments and can be utilized in the industrial field (Irdawati et al., 2018)

Enzymes act as catalyst that accelerate specific chemical reactions. In cases where a reaction proceeds slowly without assistance, enzymes can serve as biocatalysts to enhance the efficiency of various industrial processes (Muqarramah et al., 2023). Industries using enzymes have been progressing very rapidly over time.

With the advancement of biotechnology, enzymes are even used to catalyze chemical reactions outside the cell (Irdawati et al., 2021).

Protease enzymes are among the most essential and commonly utilized enzymes across multiple industrial sectors. Hydrolytic enzymes represent about 75% of total enzyme sales in the industrial market, with proteolytic enzymes making up around 60% of that share. The application of proteases spans a wide range of industries, including both food-related and non-food products, such as detergents. Additionally, enzymes used in industry generally must be resistant to high temperatures and extreme environmental conditions, as enzymes can be damaged if exposed to inappropriate temperatures. Thermophilic bacteria are one source of enzymes resistant to high temperatures (Muqarramah et al., 2023).

Enzymes are utilized in various types of existing industries such as food, textiles, paper, detergents, cosmetics, and are used as biofuels. This is because enzymes have high effectiveness and efficiency, and their reactions do not produce by-products (Nugraha & Maulina, 2013). The utilization of potential thermostable enzymes produced by thermophilic bacteria is one way to overcome technical constraints in the industry.

Several studies on thermophilic bacteria that produce protease enzymes have been conducted. Firliani et al. (2015) obtained 10 isolates of thermophilic bacterial with the potential to produce neutral protease, with proteolytic indices ranging from 0.27 to 3.89. Sabaria et al. (2024) successfully isolated 7 thermophilic bacterial strains

that demonstrated protease activity, with proteolytic index values ranging between 0.12 and 4.65.

Solok Regency has several hot spring locations.Among them, Garara Hot Spring and Padang Dama Hot Spring, both situated in the Cupak Area, are considered potential sources of thermophilic bacteria capable of producing protease enzymes. In addition to these, Solok Regency aslso features other geothermal sites, such as the Batu Bajanjang Hot Spring. Based on the survey conducted, Garara Hot Spring, Padang Dama Hot Spring, and Batu Bajanjang Hot Spring have water temperatures of around 45°C – 55°C and a pH of around 6-7. Garara Hot Spring, Padang Damar Hot Spring, and Batu Bajanjang Hot Spring are surrounded by trees, ferns, moss, and litter that can serve as a source of nutrients for thermophilic bacteria.

Considering the ability of thermophilic bacteria from Garara Hot Spring, Padang Dama Hot Spring, and Batu Bajanjang Hot Spring to produce protease enzyme, research was conducted with titled "Isolation, Screening and Partial Characterization of Thermophilic Bacteria Producing Protease Enzymes From Cupak and Batu Bajanjang Geothermal Area, Solok Regency".

1.2 Research Problem

The research problems of this research are:

1. Do thermophilic bacteria obtained from the Geothermal Area of the Cupak and Batu Bajanjang, Solok Regency, produce protease enzymes?

2. What are the partial characteristics of thermophilic bacterial isolates indicated to produce protease enzymes from the Geothermal Area of the Cupak and Batu Bajanjang, Solok Regency?

1.3 Research Objectives

The objective of this research are:

1. To obtain thermophilic bacterial isolates indicated to produce protease enzymes from the Geothermal in the Cupak and Batu Bajanjang, Solok Regency
2. To determine the partial characteristics of thermophilic bacteria indicated by protease enzymes from the Geothermal Area of the Cupak and Batu Bajanjang, Solok Regency

1.4 Research Benefit

The benefits of this research are:

1. Obtaining bacterial isolates indicated to produce protease enzymes from Geothermal Area of the Cupak and Batu Bajanjang, Solok Regency, and determining their partial characterization.
2. As a source of scientific information for further research on thermophilic bacteria producing protease enzymes