I. INTRODUCTION

1.1 Background

High community activity in the Bungus area, Padang City, West Sumatra from various sectors of goods and services can cause environmental disturbances, especially waters by pollutants. Heavy metal pollution in the sea waters of Bungus Bay comes from household waste, industrial waste, wood industrial waste, and ship loading and unloading waste due to oil transfer from tankers and oil spills from fishing boats (Dewata and Putra, 2021).

The pollution level of Bungus waters which is centered in three locations including PPS Bungus, Dempo Pertamina, and PLTU Teluk Sirih, shows a higher index value than the quality standard of KEPMEN LH No/5/2004. In PPS bungus, there are Cd (0,0031 with the quality standard 0,0013mg/l), Cr^{+6} (0,013 with the quality standard 0,008mg/l), Pb (0,017 with the quality standard 0,009mg/l), and Cu (0,014 with the quality standard 0,010 mg/l) (Dewata and Putra, 2021). According to the World Health Organization (WHO), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), nickel (Ni), mercury (Hg), and zinc (Zn) are included in the metal group that is harmful to the environment (Pandiyan *et al.,* 2021).

Heavy metals are dangerous because they can bioaccumulate in the body. Bioaccumulation means an increase in the concentration of a chemical in a biological organism over time. Compared to the concentration of chemicals in the environment, compounds accumulate in living things whenever metallic substances are taken up and stored more rapidly than they are metabolized or excreted. This can

disrupt the balance of the aquatic ecosystem. Heavy metal toxicity can cause damage or reduction in central nervous function, lower energy levels, damage the composition of the blood, lungs, kidneys, liver, and other vital organs (Verma and Dwivedi, 2013).

Various efforts need to restore the environment from pollutants but are environmentally friendly, one of which is through bioremediation techniques using microbial services. Bioremediation is an innovative and promising technology for the recovery of heavy metals polluted in water and soil. Microorganisms use detoxification mechanisms such as bioasorption, bioaccumulation, biotransformation and biomineralization, which can be utilized for ex situ and in situ bioremediation (Dixit *et al.*, 2015). Bacteria that are resistant to metals can be isolated from polluted sites and can be used as environmental bioremediation agents. The ability of bacteria to grow and form biofilms as a consortium of microbes is a form of defense for survival under unfavorable environmental conditions (Massora *et al*., 2017).

Bacterial biofilms are organized clusters of cells that clump in a self-produced hydrated matrix known as EPS (Exopolysaccharide). The protected bacteria cells in this sessile community have great potential to protect themselves from various environmental stresses such as changes in pH, salt content, and hydraulic stress. EPS is mainly composed of polysaccharides, proteins, uronic acids, lipids and humic substances. EPS becomes poly-anionic in nature forming organometallic complexes with multivalent cations by using of electrostatic interactions. More than 90% of metals are remediated with biofilm-forming microbes that have binding ability by EPS (Kumari, Mangwani, and Das, 2017).

Resistance test was carried out to determine the ability of isolates to survive in metal-containing media. According to Farisna and Zulaika (2015), it is necessary to carry out multilevel metal resistance tests to the maximum concentration that can be tolerated by isolates. In Sari and Zulaika's research (2015), the multilevel metal concentrations used were 0.1; 50; 100; 150; 200; 250; and 300 ppm. It is needed to increase the metal concentration further up to 400 ppm to prove whether the bacterial isolates can survive with higher metal concentrations.

Until now, heavy metal pollution in the Bungus area has not been resolved with the right solution. Therefore, it is necessary to conduct research on the bioremediation test of heavy metal waste using biofilm bacteria as an effort to solve the problem of heavy metal waste pollution in the Bungus area, Padang, West Sumatra.

1.2 Problem Formulation

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

1. Is bacteria found from heavy metal polluted waters in Ocean Fishing Port (PPS) Bungus, Padang City?
2. Is the bacterial isolate are resistant to heavy metals?
3. Is the heavy metal resistant bacteria isolates form biofilm?
4. How does the growth profile of heavy metal resistant biofilm bacteria isolate?

1.3 Research Objective

The objectives of this research are:

1. To find bacteria from heavy metal polluted waters isolated from Ocean Fishing Port (PPS) Bungus, Padang City.
2. To find bacterial isolates that are resistant to heavy metals.
3. To find heavy metal resistant bacteria that can form biofilms.
4. To observe the growth profile of heavy metal resistant biofilm bacteria isolate.

1.4 Benefit of The Research

The benefit of this research is to provide scientific information about the presence of biofilm bacteria found in Ocean Fishing Port waters (PPS) Bungus, Padang City, which are resistant to heavy metals, so that they can be a solution to heavy metal waste pollution.