CHAPTER I

INTRODUCTION

1.1 Background

The production of shrimp waste from shrimp processing industries and restaurants have increased dramatically in recent years. In Indonesia, the amount of shrimp exported from Indonesia increased upto 8.5%. According to Ministry of Marine Affairs and Fisheries (2016), the export of shrimp done after peeling of the shell and heads which contribute in 25% of the total production. These shells will contribute in the increased of the waste itself which reaching 12,000 ton of waste (KKP, 2016). The increased in the amount of waste in all around the world will be resulted in waste collection, disposal, and pollution problems. The waste itself constitute about 70-80% of the landed catch (Ms, *et al.*, 2013). Several methods have been used to reduce the waste of the crustacean especially shrimp such as ocean dumping, incineration or disposal to landfill sites. In recent years, techniques to utilize the biopolymer waste including shrimp has been developed. Shellfish waste will be mainly protein and chitin. The shrimp waste contains 8-10% chitin concentration hence increasing the development on how to separate this compound for better function (Islam, *et al.*, 2016).

Chitin is a polysaccharide which can be further processed into chitosan and glucosamine. Glucosamine itself has many benefits toward human health which is preventing and treating patient with osteoarthritis. Glucosamine can be found naturally in human body mainly in cartilage and present in 3 forms which is D-

glucosamine, N-acetyl-glucosamine and glucosamine hydrochloride. The three forms of glucosamine differ the production process of glucosamine. Glucosamine hydrochloride is produced from chemical reaction of acid hydrolysis of chitin while D-glucosamine and N-acetylglucosamine is produced by the help of microorganisms whether it is DNA recombinant or by using fermentation process (Mojarrad, *et al.*, 2007).

The conventional chemical treatment of glucosamine might have some limitation because of the variety of the raw material supply which makes researcher have developed fermentation process. The use of enzymatic reaction for glucosamine production has also been developed but the enzyme does not seem to hydrolyze the chitin efficiently because of its high production cost and the stability of the enzyme itself. Then the most recent method is the fermentation process. The principle of fermentation process is to use chitinolytic bacteria to break down and producing glucosamine (Liu, *et al.*, 2013).

Serratia marcescens is one of the chitinolytic bacteria which can be used for producing glucosamine. *Serratia marcescencs* itself can be found many in the soil and in the water (Hejazi, *et al.*, 2010). The chitinase enzyme activity of *Serratia* spp. has been analyzed including its production and activity affected by several factors such as pH, and temperature. The usage of the bacteria itself to produce glucosamine has not been conducted and the optimum condition of the bacteria to produce maximum amount of glucosamine has not been determined.

1.2 Research Problem

Glucosamine is known to maintaining strength, flexibility and elasticity of tissues such as cartilage, mucus membranes and synovial fluid which then used to treated symptoms of osteoarthritis and having properties of anti-inflammatory, antibacterial and anticancer effects (Bunaramrueang, *et al.*, 2016). Commonly, glucosamine is produced by chemical treatment and microbial fermentation of the shrimp waste. Chemical treatment is a popular method, however, a big concern come across in this method which is producing more concentrated acid waste to the environment and referring also to the concern of allergic reaction (Sitanggang, *et al*¸ 2012). Some researchers have developed fermentation process of glucosamine production using the crude enzyme of the chitinolytic bacteria such as *E. coli*. The enzyme will be able to degrade the chitin and convert it into glucosamine with the help of the enzyme (Lamine, *et al.*, 2012). Due to its high cost to extract and produce its crude enzyme, fermentation process by using its own bacteria rather than using the enzyme has to be developed and there are still a few researches regarding the fermentation process and its factor to produce glucosamine.

1.3 Objectives

1.3.1 General Objective

The general objective of this research was to produce glucosamine from *Penaeus monodon* shell by fermentation using *Serratia marcescens.*

1.3.2 Specific Objectives

The specific objectives of this research were:

1. To determine the optimum fermentation temperature for bacteria to produce glucosamine.
2. To determine the optimum pH of fermentation process for the bacteria to glucosamine.
3. To determine the optimum fermentation period for the bacteria to produce glucosamine.