# OPTIMIZATION OF ALGINATE EXTRACTION FROM *Sargassum siliquosum*

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**Abstract**

*Sargassum siliquosum* is brown seaweed (Phaeophyceae) produce alginate which is a piccoloid compound, alginate required by various industries that are currently imported. The aims this study was to determine the optimum concentration of the $Na_2CO_3$, $CaCl_2$, and HCl on alginate extraction. Response Surface Method model using Central Composite Design was used to see the effect of the $Na_2CO_3$, $CaCl_2$, and HCl for the maximum yield of alginate. The results showed that the optimum concentration of the $Na_2CO_3$, $CaCl_2$, and HCl to extract alginate are $Na_2CO_3$ 15,3 %; $CaCl_2$ 15,6 %; and HCl 3,7 %. The yield of alginate obtained was 26.8 g / 100 g.

***Keywords:*** *Sargassum siliquosum, alginate, chemical extraction,*

## 1 Introduction

Indonesia has a marine area that contains abundant biodiversity. One of the marine biological resources that has the potential to be developed is the *Sargassum sp*, which is a type of brown algae (Phaeophyta), because it has a high economic value, which contains alginate which is currently needed by the food and non-food industries. To meet this market demand, Indonesia still relies on imports of sodium alginate, so that research related to this is very important.

Alginate, laminarin, cellulose, ficoidin, and mannitol produced from brown seaweed, this type has a pigment that gives brown color. The composition of these components is highly dependent on the species, period of development, and place of growth (Maharani & Widyayanti, 2009). The main components of algae are carbohydrates, proteins, fats, and ash (sodium and potassium) and 80-90% air (Chapman & Chapman, 1980).

Phaeophyceae produces alginate which is a piccoloid compound. Macrocytis, Laminaria, Aschophyllum, Nerocytis, Eklonia, Fucus, Turbinaria, and Sargassum are the Phaeophyceae. In Indonesian founded Sargassum and Turbinaria are alginophyte seaweed species (Zailanie et al., 2001). Alginate in seaweed Sargassum ranges in content ranging from 8-32% depending on the conditions of the waters (Anggadireja et al., 1993).

Alginate is found in cell walls and between cells as a mixture of salts of alginic acid (calcium, sodium, or potassium). Alginate is a pure uronic acid polymer consisting of chemically long linear

alginic acid (Stephen, 1995). This pure polymer is unbranched and contains 1,4 D-mannuronic acid bonds and 1,4 L-guluronic acid bonds. The alginate form is generally sodium alginate, alginate salt is soluble in water. Potassium alginate or ammonium alginate is another water-soluble form of alginate, whereas calcium alginate is an alginate that is insoluble in water. Alginate is used in the cosmetic industry, biomedical, pharmaceutical and in the textile, paper, because of its water-binding properties like a gel, viscosity, and dispersion stabilization (Draget et al., 2006). On the other hand, sodium alginate has colloidal, gelling, and hydrophilic properties compounds that are widely used as stabilizers and emulsifiers and in industry (Subaryono, 2010). While the hydrophilic nature of alginate is used to bind water to the food freezing process. These polymers maintain the food web in frozen foods. Alginate is needed for the food and cosmetic industry. The purpose of this research is to study the effect of $Na_2CO_3$, $CaCl_2$, and HCl on chemical extraction method.

## 2 Materials and methods

The study use the Response Surface Methodology (RSM) model the Central Composite Design (CCD) with 3 (three) variables, namely the concentration of $Na_2CO_3$, $CaCl_2$, and HCl. The midpoint of the treatment was taken from the best results of previous studies. RSM was used to see the effect of the treatment on the maximum of alginate yield. The data obtained were analyzed using Design Expert 6.0 software.

Sargassum siliquosum obtained from Lae-Lae Island, South Sulawesi. The chemicals used were 10% formaldehyde, $Na_2CO_3$, $CaCl_2$, HCl, these chemicals were obtained from chemical stores in Makassar City. The production process of the sodium alginate extraction process can be seen in Figure 1.

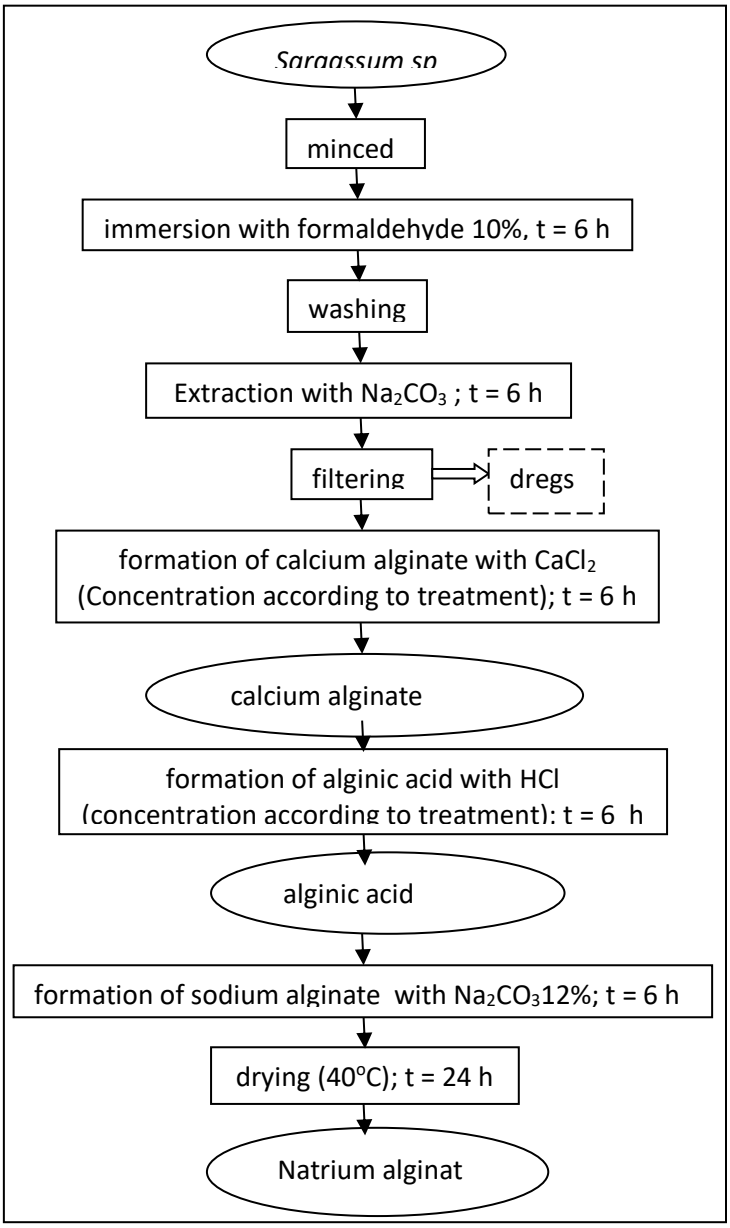


Figure 1. The production process of the sodium alginate extraction process

## 3 Results and Discussion

The results of optimization of the concentration of chemicals used in the alginate extraction process from Sargassum siliquosum to obtain alginate products with maximum yields showed an increase, this means that the combination of concentrations of chemicals have an effect on increasing the yield of the alginate yield.

According to ANOVA, a P value (Prob > F) = 0.0001 so it is significant at the 0.99%. The model has a value of $R^2$ = 0.96, this means that the variability of the data can be explained by the

model, so that the equation model can be used as a model to determine the optimization of the chemical concentrations which was used for alginate extraction from Sargassum siliquosum to obtain maximum alginate yield. Based on the ANOVA, the value for the concentration of $Na_2CO_3$ is 15,3 %, the concentration of $CaCl_2$ is 15,6 %, and the concentration of HCl is 3.7%. At these points the estimated of the alginate yield value at the stationary point is 26.8 g/100 g of Sargassum siliquosum.

## 4 Conclusion

The effect of the concentration of $Na_2CO_3$, $CaCl_2$, and HCl on the alginate extraction process is known that the optimum concentration of $Na_2CO_3$ for alginate extraction was 15.3%, $CaCl_2$ was 15,6 %, and the concentration of HCl was 3.7%. At these points the estimated of alginate the yield value at the stationary point is 26.8 g/100 g of Sargassum siliquosum.

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