A Polygalactan sulfate from marine algae, *Eucheuma cottonii* and its anticoagulant activity

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Abstract

An anticoagulant of polygalactan sulfate was isolated from marine red algae, *Eucheuma cottonii*. It was isolated from insoluble fraction in KCl 2.5% solution with yield 43.33%. The properties of polygalactan sulfate were total galactose 37.7%, total sulfate 22.8% (highly sulfate, as OSO$_3$Na$^+$), total ash 26%, insoluble acid ash 1.65%, insoluble water ash 1.2%, and solubility in water is 1.2x10$^{-3}$ g.mL$^{-1}$. Based on the properties and supported by IR spectrum, the polygalactan sulfate is κ-carrageenan. Anticoagulant activities of the polygalactan sulfate were tested and compared with that of sodium citrate by assays of activated partial thromboplastine time (APTT) and prothrombine time (PT). On the test concentration, κ-carrageenan was indicated (indicated as) anticoagulant activities and stronger than sodium citrate at the same concentration.

Keywords: marine red algae, *Eucheuma cottonii*, κ-carrageenan, anticoagulant activity, APTT, PT

Introduction

Seaweed (marine algae) with many species is used as food and they have been also found use in traditional medicine because of their perceived health benefits. Seaweeds are rich sources of sulfate polysaccharides, including some that have become valuable additives. Sulfate polysaccharides in seaweeds are agar, carrageenan, alginate, and laminaran. In recent year, sulfate polysaccharides from different sources of marine algae are recognized to possess a number of biological activities, including as antiviral, anticoagulant, antioxidant, and immune-inflammatory activities (Magalhaes et al., 2011). Anticoagulant and anti-thrombotic activities are among the most widely studied properties of marine algae (Farias et al., 2000; Pereira et al., 2002; Mourao, 2004; Fonseca et al., 2008; Rodrigues et al., 2011). Result of these researches as a rule, molecular size and sulfate content are among the most important prerequisites for these polymers to have anticoagulant activity. There are few reports of anticoagulant activity for sulfate polysaccharides isolated from green algae. Matsubara et al. (2000) isolated a highly sulfate galacto-arbinogluconan from the green algae *Codium pugniformis* with anticoagulant activity. A sulfate polysaccharan with anticoagulant activity was also extracted from *Codium cylindricum* (Matsubara et al., 2001), *Caulerpa racemosa* with anticoagulant and antiviral (Ghosh et al., 2004), genus of *Monastroma* as anticoagulant (Mao et al., 2008; Zhang et al., 2008). In addition, Sutrisno et al. (2010) isolated a sulfate polysaccharan from the marine red algae *Eucheuma spinosum* and its anticoagulant activity assay. The sulfate polysaccharan is a carrageenan. Based on *Eucheuma spinosum* is one family with *Eucheuma cottonii*, belonging to the *Eucheuma* genus, are commonly found along the Madura coast. In this study, sulfate polysaccharan (as a carrageenan) was isolated from the marine red algae *Eucheuma cottonii*, and some characteristics and potential anticoagulant activity of the sulfate polysaccharides were investigated.

Materials and Methods

Marine red algae *Eucheuma cottonii*

The marine red algae *Eucheuma cottonii* was collected from sea of Madura (one of Indonesian island) East Java Indonesia. The materials was cleaned from epiphytes, washed with distilled water, dried by ultra violet light, and stored at cold-room until use. The specimen determined by Bogoriensis Herbatorium – Bogor – West Java (Indonesia).

Reagents

Sodium hydroxide, sodium chloride, hydrochloric acid, ethanol 96%, sulphuric acid, hydrogen peroxide, calcium chloride, phenol (it all from Merck), APTT and PT reagents, sodium citrate, blood as human plasma, and filter paper Whatman No. 42.