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Characterization of a renewable extracellular polysaccharide from defatted microalgae *Dunaliella tertiolecta*

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HIGHLIGHTS

- ▶ Extracellular polysaccharide (EPS) was obtained from defatted biomass of microalgae *Dunaliela tertiolecta.*
- ▶ Monosaccharide composition analysis confirmed that EPS consisted of glucose residues only.
- ▶ This exopolysaccharide was defined by FTIR, NMR and enzymatic cleavage analysis to be (1 → 4)-α-D-glucan.
- ▶ EPS was characterized as suitable substrate for biotechnological production of glucose and ethanol.

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ABSTRACT

Extracellular polysaccharide (EPS) was isolated from defatted micro-algae *Dunaliela tertiolecta* and defined as linear (1 → 4)-α-D-glucan based on monosaccharide composition, enzymatic and spectroscopic analyses. Optimization and characterization of acidic and enzymatic hydrolyses of EPS have been performed for its potential use as a renewable biorefinery material. The hydrolytic methods were improved to assess the effect of substrate specificity, reaction time, pH, ionic strength and temperature on efficiency of glucose production. EPS was effectively converted into glucose within one-step enzymatic or acidic hydrolysis under optimized conditions. Over 90% recovery of glucose was achieved for both hydrolytic approaches. High potential production of EPS and high yield conversion of this substrate to glucose may allow further exploration of microalga *D. tertiolecta* as a potential biomass producer for biotechnological and industrial exploitation of bioethanol.

1. Introduction

Because of the gradual depletion of fossil resources, exploring of alternative energy sources such as renewable biomass is critical issue of global energy security and climate change. It is a big challenge to reduce the exploitation of fossil fuel and to protect the climate through the reduction of greenhouse gasses especially CO_2 released. In recent, the multi-stage screening and bioconversion of different biomasses to biofuel and other products including bioethanol based on the biorefinery concept of biomass in bioconversion is being considered as a more potentially powerful way to account sustainable bio-based economy (Chisti, 2008). These issues stimulated a demand for using human and animal harmless, eco-friendly and biodegradable materials (Octave and Thomas, 2009). Especially, the lignocellulosic feedstock biorefinery using cellulose-containing biomasses and wastes has significantly been focused much attention for the last decade operating large-scale biorefinery schemes (Duarte et al., 2007; Sanchez, 2009). Lignocellulosic feedstocks serves as the major source of polysaccharide in plants that finds wide applications not only in food but also in pharmaceutical or biomedical industries because of its biocompatibility, biodegradability, and non-toxicity. Particularly, isolation and identification of native fermentable biomaterial sources are required for determine its desired utility in the direct manufacturing of biofuels and bioethanol (Vertes et al., 2008; Zhang et al., 2008).

Since fossil fuels are becoming drained rapidly within couple of decades, the efficient process and bioconversion of polymeric

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