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Microalgae biorefinery high-value chemicals: Polysaccharides

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Many renewable energy technologies had been developed such as Aeolian wind and solar (1). However, there is a need to develop renewable fuels for transportation without compromising food security. Land crop is currently the main source of food and biofuels (2,3), and it will not be able to respond to all the fuel and food demand in the future. Microalgae could be a potential biomass alternative. Microalgae is a micro-crop that produce oleaginous biomass where no land crop can grow, can use seawater instead of fresh water, and use sun light to convert CO_2 into high-value chemicals (4). The microalgae biorefinery could then establish a positive association between bioenergy and food security leading to a significant positive impact on the socio-economic development. A viable microalgae biorefinery should be designed in a way to improve high-value chemicals yield such as polysaccharides (Figure1). Methodology and Results: Polysaccharides were extracted from *Botryococcus braunii* by alkaline hydrothermal treatment solution for 10 h. Ethanol (2 volumes) was used to precipitate water-soluble polysaccharides for characterization. The glycosyl-linkage analysis showed that polysaccharides polymers are less branched and dominated by (1-4) linkage. The viscosity behavior was measured at 25°C (5), at the concentration 10% (w/v), the profile of viscosity versus shear rate showed a non-Newtonian pseudoelastic viscosity. It is a shear thinning behavior in the shear rate range of 0.01 to 1000 1/s. This property indicated the alignment of the less branched polysaccharide polymer in the direction of the flow under increasing shear rate. The polysaccharides solution (10%) viscosity test was also performed with a temperature range from 25°C to 100°C and showed also a decreasing viscosity.

Conclusion: The low viscosity, shear thinning and water solubility properties of extracted polysaccharides demonstrated potential applications in supplements, cosmetics, food, and beverages industry to improve commercial microalgae biorefinery feasibility.

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