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IOP Conf. Series: Materials Science and Engineering **716** (2020) 012001 doi:10.1088/1757-899X/716/1/012001

Potentials of sago fibre hydrolysate (SFH) as a sole fermentation media for bioethanol production

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Abstract. Sago wastewater which contains starchy fibres from sago starch processing mills is commonly discharged directly to nearby stream thus contribute to serious environmental pollution. Sago fibre which is known to be a local agricultural waste mainly contains residual starch of about (50 – 60 %) together with cellulosic component. These contribute to high carbohydrate contents which suitable to be used as substrate for ethanol production. Initially, sago fibre (SF) was converted into sago fibre hydrolysate (SFH) via enzymatic hydrolysis using commercial enzymes; Liquozyme SC DS and Spirizyme Fuel HS. This study emphasized on batch ethanol fermentation by commercial baker's yeast utilizing 50 g/L and 80 g/L glucose of SFH as the sole fermentation medium. The results indicate that 50 g/L glucose from SFH media is capable of generating maximum ethanol concentration at 20.33 ± 0.15 g/L, with highest glucose consumption efficiency (97.78 %) during 24 hours of fermentation. Similar concentration of bioethanol was obtained in 50 g/L glucose of commercial glucose (CG) media which is at 20.04 ± 0.06 g/L. However, lower ethanol concentration was obtained in both 80 g/L glucose from SFH (13.32 ± 0.12 g/L) and CG (12.98 ± 0. 04 g/L media), respectively. Addition of yeast extract at 3 g/L into 80 g/L SFH as well as CG significantly improve ethanol fermentability (SFH: 41.04 ± 0.04 g/L and CG: 33.96 ± 0.04 g/L). Based on statistical analyses, 50 g/L glucose of SFH media exhibit the highest ethanol yield (0.42 ± 0.003 g/g) and highest fermentation efficiency (81.35 ± 0.572 %) compared to 80 g/L glucose (0.24 ± 0.008 g/g; 46.65 ± 1.50 %). Conclusively, this study demonstrated that glucose in SFH was metabolized efficiently by commercial baker's yeast during ethanol fermentation, thus suggesting the capability of SFH to be a feasible and alternative substrate with less expensive nitrogen source for the renewable bioethanol production.

1. Introduction

The waste to wealth concept research has been practiced actively over the last few years, which widely focusing on the bioethanol production utilizing starchy lignocellulosic residue. Bioethanol (C_2H_5OH) or ethyl alcohol is a promising alternative source which is both renewable and environmental friendly [1]. Over the years, bioethanol production has increased dramatically due to high demand on green biofuel and crude oil shortage [2]. At present, global bioethanol production has reached about 5,340 million litres in 2017 and slightly increased to 5,380 million litres in 2018. This demand is met by using first generation bioethanol crops such as sugarcane and corn [3]. The research into new and alternative carbon sources such as industrial by- products and agricultural residues for uses in bioethanol fermentation is needed to sustain for the successful development of fermentation industries against traditional grain-based processes. Thus, a