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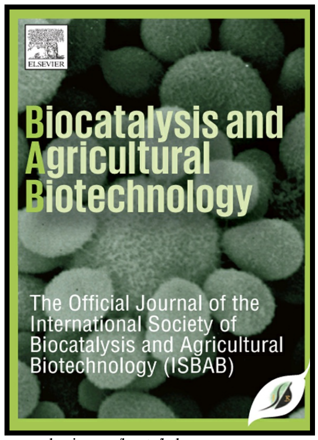

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Abstract
Bioethanol has been emerging from different types of renewable feedstocks as an alternative to reduce problems caused by the use of fossil fuels. Galactose is the major sugar obtained from the hydrolysis of seaweeds and can be fermented to ethanol by yeast. Wild-type *Saccharomyces cerevisiae* has been reported with good performance of galactose fermentation. The first part of the study focused on the isolation and characterization of wild-type *S. cerevisiae* with the ability to ferment galactose to ethanol. A wild-type *S. cerevisiae* strain with the ability to ferment galactose to ethanol was isolated from grape with ethanol tolerance of 15%. Immobilization of yeast cells has been performed to increase the ethanol production. The second part of the study involved the immobilization of the isolated wild-type *S. cerevisiae* in PVA-alginate beads. Batch fermentation of galactose by immobilized wild-type *S. cerevisiae* obtained ethanol concentration and yield efficiency of 9.57 g/L and 93.82%. The immobilized wild-type *S. cerevisiae* were used for four cycles of galactose fermentation and obtained ethanol concentration of 7.66 g/L with yeast relative activity of 79.07%. In short, bioethanol produced by galactose fermenting wild-type *S. cerevisiae* can be a future sustainable fuel.

Keywords Isolation; Immobilization; *Saccharomyces cerevisiae*; Galactose; Bioethanol production

1. Introduction

Bioethanol is a promising liquid biofuel generated from various biomass feedstocks through conversion technologies (Nikolić et al., 2017). It is the mostly used biofuel due to its renewable, non-toxic, biodegradable and oxygenated properties which reduce the emission of particulate in compression-ignition engines (Razmovski and Vučurović, 2012; Domínguez-Bocanegra et al., 2015). It is used as substitute fuel to reduce dependency on fossil fuels, ensure energy security and reduce the negative impact of fossil fuel consumption to the economy and the environment (Muruaga et al., 2016).

Saccharomyces cerevisiae is the most favoured yeast for ethanol production at industrial level because of its desirable traits such as inexpensive, osmotolerant, easy to handle, does not require high nutrition, produce high ethanol concentration with low level of by-products, has high viability for recycling and can tolerate high concentration of sugar and ethanol (Muruaga et al., 2016; Laopaiboon et al., 2009). Moreover, *S. cerevisiae* is known as generally recognized as safe (GRAS) which can be used for commercial processes including bioethanol production (Kim et al., 2013; Lee et al., 2015). Wild-type *S. cerevisiae* was reported to exhibit the exceptional performance on galactose which requires less fermentation time without catabolite repression by glucose (Keating et al., 2004; Kim et al., 2014; Wu et al., 2014).

Galactose is the main sugar obtained from the hydrolysis of marine algae especially red seaweed and can be gained in other industrial sources like cheese whey or molasses (Quarterman et al., 2016). In *S. cerevisiae*, galactose is metabolized to glucose-6-phosphate via Leloir pathway by five enzymes such as galactose mutarotase (Gal10p), galactokinase (Gal1p), galactose-1-phosphate uridyltransferase (Gal7p), UDP-galactose-4-epimerase (Gal10p) and phosphoglucomutase (Pgm1p and Pgm2p; major and minor isoform) (Timson, 2007; Bae et al., 2014). Other than these enzymes, galactose permease (Gal2p) is also needed to transport galactose across the yeast plasma membrane