PRODUCTION OF 2,3-BUTANEDIOL FROM MOLASSES

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Abstract

2,3-Butanediol is an important chemical, which is used in the manufacture of products such as synthetic rubber, printing inks, perfumes, fumigants, moistening and softening agents, explosives and plasticizers. It has been known as a bacterial fermentation product since early part of the 20th century. *Klebsiella oxytoca* is an organism, which can convert a variety of sugars to 2,3-butanediol. Available literature shows that principal monosaccharides of cellulosic substances as well as major hemicellulosic compounds have been used as carbon source. However, there is very little information on the application of waste material as carbon source for fermentation of butanediol.

In this work, blackstrap molasses, which is the residual liquor after crystallization of brown sugar from sugar cane juice, has been used as the carbon source in fermentation of 2,3-butanediol. Blackstrap molasses was procured from a local sugar refinery. It is readily available in Malaysia, and a high value added industrial commodity like butanediol would be a more attractive alternative to fermentation of ethanol from blackstrap molasses.

Shake flask studies were conducted to examine the viability of fermenting butanediol from blackstrap molasses. Further studies were conducted in a 5-L fermenter to perform the experiment under controlled pH, temperature, mixing

and aeration. Significant improvement in product yield was obtained with fed batch operation. The yield in the present case was 0.44 g diol per g of sugar as against the maximum value of 0.42 g diol per g of sugar reported in literature for fermentation of butanediol from blackstrap molasses.

Abstrak

2,3-butanediol adalah suatu bahan kimia penting yang digunakan dalam penghasilan getah tiruan, dakwat pencetakkan, air wangi, fumigan, bahan pelembab dan pelembut, bahan letupan, bahan pemplastik dan sebagainya. Bahan ini dikenali sebagai produk penapaian semenjak awal kurun ke-20. *Klebsiella oxytoca* adalah organisma yang dapat menukarkan berbagai jenis gula kepada 2,3-butanediol. Rujukan yang sedia ada menunjukkan bahawa monosakarida utama dari bahan selulosa (glukosa, mannosa dan galaktosa) dan juga kebanyakkan sebatian hemiselulosa utama (xylosa dan arabinosa) telah digunakan sebagai sumber karbon. Walaupun demikian, maklumat mengenai penggunaan bahan sisa sebagai sumber karbon dalam penapaian butanediol adalah terhad.

Dalam kajian ini, molases hitam (sirap pekat gula) yang merupakan baki cecair selepas proses penghabluran gula perang daripada jus tebu telah digunakan sebagai sumber karbon dalam penapaian 2,3-butanediol. Molases hitam didapati daripada kilang gula tempatan. Bahan ini mudah didapati di Malaysia, dan dengan itu komoditi industri bernilai tinggi seperti butanediol akan menjadi alternatif lebih menarik daripada penapaian etanol daripada molases hitam.

Kajian kelalang goncang telah dijalankan untuk mengkaji keberkesanan penapaian butanediol daripada molases hitam. Penyelidikan seterusnya dijalankan dalam penapai 5L dibawah kawalan pH, suhu, pengadukan dan pengudaraan. Kemajuan signifikan dalam hasil produk didapati dari operasi 'fed batch'. Dalam kes ini, hasilnya adalah 0.44 g diol setiap g gula berbanding nilai maksimum sebanyak 0.42 g diol setiap g gula yang dilapurkan dalam rujukan mengenai penapaian butanediol daripada molases hitam.

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