



## Potential Exploitation of Okara and Whey Permeate in Bioethanol Production by Yeasts

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*Received April 28, 2012; Accepted July 6, 2012*

**Abstract:** Discharging Okara (soybean pulp resulting from soy milk production) and whey permeate represents a major environmental problem. These wastes were exploited in this work for ethanol production using three yeast strains *i.e.*, *Saccharomyces cerevisiae* O-14, *S. cerevisiae* 2043 and *Kluveromyces marxianus*-1195. Okara saccharification was performed applying heat and/or chemical treatment with either 1.0N H<sub>2</sub>SO<sub>4</sub> solution or 70% ethanol solution. In addition, different weights *i.e.* 5, 10, 15 and 20 g of okara in 100 ml of either 1.0 N H<sub>2</sub>SO<sub>4</sub> or 70% ethanol solution were hydrolyzed at different temperatures for different periods of time. Hydrolysis of 10g okara in 1.0 N H<sub>2</sub>SO<sub>4</sub> at 121°C for 15 minutes resulted in a maximum total soluble sugars (TSS) of 2.86%. Using whey permeate (lactose 4.2%) or permeate-glucose mixtures as substrates for ethanol production, the most effective ethanol producer *K. marxianus*-1159 produced 5.89% of ethanol with an efficiency reaching up to 90.16%. Okara hydrolyzate (OH) (2.93%TSS) or OH-glucose mixture (20% TSS) was used as well in fermentation batches as carbon sources for ethanol production by the examined yeasts. In comparison with other strains, maxima amounts of ethanol either from OH or OH-glucose mixture (15%TSS) were produced by *S. cerevisiae* O-14. Okara suspensions containing increasing weights of okara (5-20g) in 100 ml aliquots of either tap water or whey permeate 200 ml permeate were directly used in batches for ethanol production using the examined strains. A maximum ethanol of 1.2% from okara-water suspensions was scored by *S. cerevisiae* O-14 meanwhile *K. marxianus*-1159 was the superior ethanol producer in okara-permeate batches.

**Key words:** *Bioethanol, yeast, okara, whey permeate*

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