

Bioethanol Production from Sour Orange (*Citrus aurantium*) Fruit Juice using Baker's Yeast

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ABSTRACT

There is a necessity to produce alternative types of fuel that are renewable and eco-friendly, since fossil fuel resources are limited. The production of bioethanol from natural sources such as fruit juice could be one such alternative. The current study was aimed at determining the potential of using sour orange juice to produce ethanol and optimizing the conditions to increase the yield. Sour orange juice was inoculated with *Saccharomyces cerevisiae* from baker's yeast in a fermentation media composed of 100 g/L sucrose, 5 g/L yeast extract, 10 g/L KH_2PO_4 , 2 g/L $(\text{NH}_4)_2\text{SO}_4$, and 0.5 g/L $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ in order to produce ethanol. Ethanol content produced from fermented orange juice was measured by an Ebulliometer. Initially the amount of ethanol produced from the orange juice was 5% (v/v) at room temperature (30 ± 2 °C) after 24 h of fermentation. Then different fermentation times (24, 48, 72, 96 and 120 h), inoculum sizes (0.5, 1.0, 1.5 and 2.0 g/100 mL), temperature (25, 30 and 35 °C) and pH (4, 5, 6 and 7) were used to find out the optimum culture conditions to produce higher percentage of ethanol from the juice. After the optimization of culture conditions such as fermentation time (24 h), inoculum size (1.5 g/100 mL), temperature (30 ± 2 °C) and pH (5.0), the production of ethanol increased to 6% (v/v). When sucrose was replaced by different carbon sources such as glucose, maltose, and lactose in the fermentation media, the highest amount of ethanol production (6.5%, v/v) was obtained in orange juice media with maltose as the C source. When $(\text{NH}_4)_2\text{SO}_4$ was replaced by different nitrogen sources such as, ammonium nitrate, ammonium chloride and urea in the fermentation media, the amount of ethanol production was significantly increased to 9% (v/v) in the orange juice media with ammonium nitrate. The current study concludes that 9% (v/v) ethanol can be produced from sour orange juice using baker's yeast under optimized conditions including maltose as the C source and ammonium nitrate as the N source. A large scale fermentation study should be carried out in a bioreactor to determine whether this finding could be commercialized.

Keywords: Baker's yeast, ethanol, *Saccharomyces cerevisiae*, sour orange juice