

ABSTRAK

Fermentasi Hidrolisat Kulit Pisang Kepok (*Musa paradisiaca*) Oleh *Zymomonas mobilis* Untuk Pembuatan Bioetanol

Msy. Rustinra Khairunnisa, 2026, 54 Halaman, 10 Tabel, 6 Gambar, 3 Lampiran

Penelitian ini dilakukan untuk memanfaatkan limbah kulit pisang kepok (*Musa paradisiaca*) sebagai bahan baku alternatif dalam produksi bioetanol melalui proses fermentasi menggunakan bakteri *Zymomonas mobilis*. Penelitian ini bertujuan untuk menganalisis pengaruh variasi waktu fermentasi dan persentase starter *Zymomonas mobilis* terhadap kadar etanol yang dihasilkan dari hidrolisat kulit pisang kepok serta mengetahui karakteristik bioetanol hasil distilasi pada kondisi fermentasi optimum. Penelitian diawali dengan proses delignifikasi menggunakan larutan NaOH 2%, kemudian dilanjutkan dengan hidrolisis menggunakan HNO₃ untuk menghasilkan gula sederhana. Hidrolisat yang diperoleh memiliki kadar glukosa sebesar 3,54% dan pH 5. Fermentasi dilakukan secara batch menggunakan *Zymomonas mobilis* dengan variasi waktu fermentasi 24, 48, dan 72 jam serta variasi persentase starter 10, 15, 20, 25, dan 30%. Parameter yang dianalisis meliputi kadar etanol, pH, densitas, dan karakteristik senyawa menggunakan metode *Gas Chromatography-Mass Spectrometry* (GC-MS). Hasil penelitian menunjukkan bahwa waktu fermentasi dan persentase starter memengaruhi kadar etanol yang dihasilkan. Kadar etanol hasil fermentasi berkisar antara 44–57%. Kadar etanol tertinggi sebesar 57% diperoleh pada fermentasi 48 jam dengan persentase starter 15%, sedangkan pada fermentasi 72 jam kadar etanol menurun menjadi 45–49%. Nilai pH hasil fermentasi berada pada kisaran 4,5–5,0. Sampel pada kondisi optimum kemudian didistilasi dan menghasilkan bioetanol dengan pH 6, densitas 0,8779 g/mL, serta kadar etanol sebesar 54% berdasarkan analisis GC-MS.

Kata kunci: Bioetanol, kulit pisang kepok (*Musa paradisiaca*), *Zymomonas mobilis*, fermentasi, distilasi, GC-MS.

ABSTRACT

Fermentation of Kepok Banana Peel (*Musa paradisiaca*) Hydrolysate by *Zymomonas mobilis* for Bioethanol Production

Msy. Rustinra Khairunnisa, 2026, 54 pages, 10 Tables, 6 Figures, 3 Appendices

This study was conducted to utilize kepok banana peel (*Musa paradisiaca*) waste as an alternative feedstock for bioethanol production through fermentation using *Zymomonas mobilis*. This study aimed to analyze the effects of fermentation time and *Zymomonas mobilis* inoculum concentration on the ethanol content produced from kepok banana peel hydrolysate and to determine the characteristics of the distilled bioethanol obtained under optimum fermentation conditions. The research began with a delignification process using a 2% NaOH solution, followed by acid hydrolysis using HNO₃ to produce simple sugars. The resulting hydrolysate had a glucose content of 3.54% and a pH of 5. Batch fermentation was carried out using *Zymomonas mobilis* with fermentation times of 24, 48, and 72 hours and inoculum concentrations of 10%, 15%, 20%, 25%, and 30%. The parameters analyzed included ethanol content, pH, density, and compound characteristics using Gas Chromatography–Mass Spectrometry (GC-MS).

The results showed that both fermentation time and inoculum concentration significantly affected the ethanol content produced. The ethanol content obtained after fermentation ranged from 44% to 57%. The highest ethanol content (57%) was achieved after 48 hours of fermentation with a 15% inoculum concentration, whereas ethanol content decreased to 45–49% after 72 hours of fermentation. This decline was attributed to the depletion of fermentable substrates, nutrient competition among bacterial cells, and ethanol accumulation, which inhibited bacterial metabolic activity. The pH of the fermentation broth ranged from 4.5 to 5.0. The bioethanol produced under the optimum condition was subsequently distilled, resulting in a product with a pH of 6, a density of 0.8779 g/mL, and an ethanol content of 54% as determined by GC-MS analysis.

Keywords: Bioethanol, Kepok Banana Peel (*Musa paradisiaca*), *Zymomonas mobilis*, Fermentation, Distillation, GC-MS.