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A Study on the Potentiality of Bioethanol Production from Selected Weed Species of the Asteraceae Family

Alwis W.L.N.S.[1]*, Pratheepkumar M.[1], Ranganathan K.[2]

[1]Department of Bioscience, University of Vavuniya, Vavuniya, Sri Lanka
[2]Department of Botany, University of Jaffna, Jaffna, Sri Lanka
**lukshialwis07@gmail.com*

Abstract

Increasing population growth, industrialization, and the harmful impacts of fossil fuel burning on the environment fascinated the researchers to find a low-cost, environmentally friendly alternative substitute. A potential substitute feedstock for the synthesis of second-generation bioethanol is the lignocellulosic biomass from invasive weedy plants. The aim of this study was to determine the potential of bioethanol production from two weedy plant species using physical, chemical, and physiochemical pretreatment methods, as well as to optimize the pretreatment and culture conditions to obtain a higher reducing sugar amount and ethanol yield. The collected invasive weedy plants, *Chromolaena odorata* and *Tridax procumbens,* were cleaned, then pretreated with different acids and bases (4% v/v) at 121^{o}C for 15 min. Then the filtrate was incubated with *Saccharomyces cerevisiae* (baker's yeast) in the peptone yeast extract and nutrient medium (PYN) at room temperature, the pH was maintained at 5.0. *T. procumbens* plant substrate with the performic acid pretreatment agent produced a significant amount (0.2%) of ethanol, and further studies were conducted with the same substrate and the pretreatment agent. The conditions were optimized successively by changing one factor at a time while keeping the other variables constant. Several important hydrolysis factors were studied for the optimization, including performic acid concentration (0.2–5%), hydrolysis time (10–60 min), fermentation time (24–120 h), inoculum concentration (1.25–7.5 g/100 ml), and rotation speed (50–250 rpm). The maximum ethanol yield of 0.47% was observed at 0.6% performic acid concentration, 30 min of hydrolysis time, 48 h of fermentation time, 5 g/100 ml of inoculum concentration, and 100 rpm rotation speed with *T. procumbens* using *S. cerevisiae.*

Keywords: Bioethanol, Lignocellulosic biomass, Acid hydrolysis, *Saccharomyces cerevisiae*