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Potential of Ethylene production from lignocellulosic biomass via Ethanol conversion

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Ethylene is one of the high composition chemicals derived from fossil fuels, mainly by steam cracking of naphtha and shorter hydrocarbons. The chemical has a diverse range of end-uses, especially in plastic manufacture. Basically, the chemical is a building block of a diverse range of petrochemicals. Continuous and excessive use of fossil fuels as the predominant feedstock has resulted in detrimental effects to the environment and also future energy security concerns as depletion of the natural resource is inevitable. The search for alternative, sustainable and renewable sources for the production of ethylene has led to the current suggested options for using renewable bio-ethanol from second generation feedstocks as a suitable precursor for eco-friendly ethylene. For the purpose of presenting a sustainable and efficient process for the production of ethylene, this study explores the potential of using lignocellulosic biomass feedstock of common reeds to produce 'green' ethylene via cellulosic ethanol. The paper focuses on the production of 1000 liters per day of ethylene with global financial benefits through reduction of raw material costs for plastic manufacture as well as improving the performance of the chemical industry. Experiments were performed using common reeds. They were initially milled and alkaline pretreated. This was followed by dilute acid hydrolysis, neutralization and co-fermentation. Saccharomyces cerevisiae was used for the co-fermentation process. From experiments, it was observed that pretreatment at higher alkali concentrations gave higher sugar yields. At 4% alkali concentrations, a Brix of 10% was obtained. Using an acid hydrolysis, a Brix of 13.5% was obtained at 10% acid concentration. Results also show that the sugar yield was dependent on temperature. Hydrolysis at 100^{o}C gave the highest sugar yield of 20.5% Brix. Conversion to ethanol via fermentation was found to be 49.58%. Ethanol to Ethylene conversion was done over aluminum oxide catalyst. From experiments, 25ml of ethanol gave 200ml of the gaseous product at 400^{o}C.

Keywords: Ethylene, Lignocellulosic, Biomass, Acid hydrolysis, Co-fermentation, Conversion

Biography:

Manyangadze Milton, is the current Head of the Chemical and Process Systems Engineering Department at Harare Institute of technology, Harare, Zimbabwe. He holds a Master of Technology Degree in Chemical Technology from Jawaharlal Nehru Technological University, Hyderabad, Telangana, India and a B.Eng. (Hons.) Chemical Engineering, NUST, Bulawayo, Zimbabwe. The Author has two publications and one Book Chapter in waste water treatment using nanoadsorbents. He has presented his work in 4 local and international Conferences, one of which he was a guest speaker. Apart from current trends in waste water treatment, the author has also research interests in current trends in sustainable renewable energy technologies, including production of petrochemicals from renewable sources. Several conferences were also attended which include:

- Research and Intellectual Outputs – Science, Engineering and Technology (2016)
- New Dimensions in Chemistry and Chemical Technologies – Application in Pharma Industry (2014)
- International Conference on Nano Science and Engineering Applications (2014)
- Recent Advances in Materials Characterization by Surface Analytical Techniques (2014)
- National Workshop on Recent Advances in Science and Technology (2014)
- International Conference on Advances in Biological Hydrogen Production and Applications (2012)