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Mohsen Ali Mandegari, Somayeh Farzad, Johann F. Görgens

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Economic and Environmental Assessment of Cellulosic Ethanol Production Scenarios Annexed to a Typical Sugar Mill

Mohsen Ali Mandegari^{1✉}, Somayeh Farzad and Johann F. Görgens

*Department of Process Engineering, University of Stellenbosch, Private Bag XI,
Matieland, 7602, South Africa*

Abstract

In this work different biorefinery scenarios were investigated, concerning the co-production of bioethanol and electricity from available lignocellulose at a typical sugar mill, as possible extensions to the current combustion of bagasse for steam and electricity production and burning trash on-filed. In Scenario1, the whole bagasse and brown leaves is utilized in a biorefinery and coal is burnt in the existing inefficient sugar mill boiler. Scenario2& 3 are assumed with a new centralized CHP unit without/with coal co-combustion, respectively. Also, through scenarios4&5, the effect of water insoluble loading were studied. All scenarios provided energy for the sugarmill and the ethanol plant, with the export of surplus electricity. Economic analysis determined that scenario1 was the most viable scenario due to less capital cost and economies-of scale. Based on Life Cycle Assessment (LCA) results, scenario2 outperformed the other scenarios, while three scenarios showed lower contribution to environmental burdens than the current situation.

Keywords: Biorefinery; Bagasse and trash; Centralized CHP; Economic evaluation; Water insoluble solid (% WIS); Life Cycle Assessment (LCA)

¹ (✉) M. Ali Mandegari, Phone: +27 21 808 9485; Fax: 27 21 808 2059; E-mail: mandegari@sun.ac.za

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