Sustainable Process Design of Lignocellulose based Biofuel - DTU Orbit (09/11/2017)

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Worldwide energy demand has increased steadily as the world population has grown and more countries have become industrialized. The major energy sources of the world still depend on fossil fuels, which are also the main sources for carbon dioxide emission. As the fossil fuels always pass through a combustion processing step, carbondioxide and other important greenhouse gases are released. This is considered non-renewable and non-sustainable energy and may be one of the major causes of global warming and therefore, climate change concerns coupled with high oil prices. This isdriving efforts to increase the production and use of alternative and sustainable energy sources as rapidly as possible. Biofuel is a type of alternative energy that can be produced from many sources including sugar substances (such as sugarcane juice and molasses), starchy materials (such as corn and cassava), and lignocellulosic materials such as agricultural residual, straw and wood chips, the residual from wood industry. However, those sugar and starchy materials can be used not only to make biofuels but they are also food sources. Thus, lignocellulosic materials are interesting feed-stocls as they are inexpensive, abundantly available, and are also non-food crops. In this respect, Cassava rhizome has several characteristics that make it a potential feedstock for fuel ethanol production. It has high content of cellulose and hemicelluloses .
The objective of this paper is to present a study focused on the sustainable process design of bioethanol production from cassava rhizome using various computer aided tools through a systematic and effiicient work-flow, The study includes process simulation, sustainability analysis, economic evaluation and life cycle assessment (LCA) according to a well-defined workflow that guarantees the deermination of sustainable process options, if they exist. . The paper will highlight an improved alternative process design compared to a base case (published) design in terms of production cost, waste, energy usage and environmental impacts, criteria that are asociated with sustainable process design. The final process design includes 39 unit operations, has a capacity of 150,000 L/day and produces dry ethanol (approximately 13.0% of cassava rhizome is converted to ethanol)

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