

A Process Engineering Approach to Sustainable Biofuel Synthesis

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Project Abstract

Many countries including year plan to lower its energy consumption per unit GDP, and reduce its Green House Gases (GHG) emissions. This can be achieved by switching to renewable energy such as bio-energy, including bio-liquid fuels to account for a reduction of CO₂. Lebanon also wants to move towards ZERO solid waste policy where the intentions are to reduce, recycle and reuse domestic municipal solid waste (MSW).

The principal objective of this study is to develop a research base in the area of sustainable energy technology. This research aims to facilitate the development of a novel process by which total utilisation of cellulosic biomass can be achieved through the application of innovative green chemical technologies. Specifically, cellulosic and hemicellulosic fractions of solid waste are to be converted to two bio-fuels: bio-ethanol via hydrolysis and fermentation; and hydrogen fuel via sugar hydrolysis and catalytic aqueous phase reforming. Although these two important processes have received considerable attention, this project proposes innovative chemical technologies to improve their long term sustainability, particularly the direct application of unsupported catalysts in the form of nanometric-particles in liquid phase reactions. Moreover, in conventional processes, the lignin component is normally discarded as waste, opposing the principles of waste minimisation. This waste lignin offers the potential to be a feedstock and an energy source for the production of high quality activated carbon, the development of this aspect within the project aims to significantly improve the economic feasibility of the global process. The production of biofuels will become an increasing important sector of Lebanon and world economies, due to the long term instability of fossil fuel supply and increased legislation on greenhouse gases. This project aims at providing fundamental green chemical science and engineering research that will significantly improve the sustainability of biofuel technology in Lebanon.