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Progress in biofuel production from gasification

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ABSTRACT

Biofuels from biomass gasification are reviewed here, and demonstrated to be an attractive option. Recent progress in gasification techniques and key generation pathways for biofuels production, process design and integration and socio-environmental impacts of biofuel generation are discussed, with the goal of investigating gasification-to-biofuels' credentials as a sustainable and eco-friendly technology. The synthesis of important biofuels such as bio-methanol, bio-ethanol and higher alcohols, bio-dimethyl ether, Fischer Tropsch fuels, bio-methane, bio-hydrogen and algae-based fuels is reviewed, together with recent technologies, catalysts and reactors. Significant thermodynamic studies for each biofuel are also examined. Syngas cleaning is demonstrated to be a critical issue for biofuel production, and innovative pathways such as those employed by Choren Industrietechnik, Germany, and BioMCN, the Netherlands, are shown to allow efficient methanol generation. The conversion of syngas to FT transportation fuels such as gasoline and diesel over Co or Fe catalysts is reviewed and demonstrated to be a promising option for the future of biofuels. Bio-methane has emerged as a lucrative alternative for conventional transportation fuel with all the advantages of natural gas including a dense distribution, trade and supply network. Routes to produce H_2 are discussed, though critical issues such as storage, expensive production routes with low efficiencies remain. Algae-based fuels are in the research and development stage, but are shown to have immense potential to become commercially important because of their capability to fix large amounts of CO_2, to rapidly grow in many environments and versatile end uses. However, suitable process configurations resulting in optimal plant designs are crucial, so detailed process integration is a powerful tool to optimize current and develop new processes. LCA and ethical issues are also discussed in brief. It is clear that the use of food crops, as opposed to food wastes represents an area fraught with challenges, which must be resolved on a case by case basis.

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