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Liquid biofuel production from lignocellulosic biomass through syngas fermentation

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Statement of the Problem: Energy demand is increasing globally due to the revolutionized economic and population growth, energy-dependent lifestyles and trending to minimize the greenhouse gas emission. Non-renewable energy resources (oil, gas, coal, etc.) cover ~80%, whereas biomass (renewable) covers only 10-15%, although it is available. However, biomass with byproduct char co-gasification and further biofuel production through syngas fermentation has very limited studied previously. The aim of this study is to produce liquid biofuels from lignocellulosic biomass through syngas fermentation.

Methodology & Theoretical Orientation: Empty fruit bunch (EFB) of palm oil, coconut shell (CS) and forest residues (FR) were used as feedstock for the production of syngas which are massively available in Malaysia. Co-gasification process was carried out in a downdraft gasifier (DG) with different biomass and char ratios. An Aspen Plus simulator (V8.6) was used for optimizing gasifier operational conditions.

Findings: At the initial stage, clean syngas was produced through the co-gasification of biomass and byproduct char. In the final stage, produced syngas (CO, H₂, etc.) was stored and fermented using microorganisms to synthesize bioethanol.

Conclusion & Significance: Produced syngas and bioethanol are the alternative energy from biomass (CS, EFB and FR) that will fulfill the future world energy demand and also reduce the dependency on fossil fuel.

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