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Gasification of empty fruit bunch with carbon dioxide in an entrained flow gasifier for syngas production

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Abstract. The main objectives of this work are to study the gasification of EFB in an atmospheric entrained flow gasifier, using carbon dioxide (CO_2) as its gasifying agent and to determine the optimum gasification operating conditions, which includes temperature and the oxidant to fuel (OTF) ratio. These were evaluated in terms of important gasification parameters such as the concentration of hydrogen (H_2) and carbon monoxide (CO) produced the syngas ratio H_2/CO and carbon conversion. The gasification reactions take place in the presence of CO_2 at very high reaction rate because of the high operating temperature (700°C - 900°C). The use of CO_2 as the oxidant for gasification process can improve the composition of syngas produced as in the Boudouard reaction. Rise of reaction temperature which is 900°C will increase the concentration of both H_2 & CO by up to 81% and 30% respectively, though their production were decreased after the OTF ratio of 0.6 for temperature 700°C & 800°C and OTF ratio 0.8 for temperature 750°C. The operating temperature must be higher than 850°C to ensure the Boudouard reaction become the more prominent reaction for the biomass gasification. The syngas ratio obtained was in the range of ≈ 0.6 – 2.4 which is sufficient for liquid fuel synthesis. For the carbon conversion, the highest fuel conversion recorded at temperature 850°C for all OTF ratios. As the OTF ratio increases, it was found that there was an increase in the formation of CO and H_2. This suggests that to achieve higher carbon conversion, high operating temperature and OTF ratio are preferable. This study provides information on the optimum operating conditions for the gasification of biomass, especially the EFB, hence may upsurge the utilization of biomass waste as an energy source.