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Abstract

In this study, three different marine biomasses, i.e., microalgae-spirulina, chlorella and macroalgae- porphyra, were pyrolyzed in a laboratory-scale multimode-microwave cavity at 400, 550 and 700 °C. Ovalbumin and cellulose were also chosen as model compounds to simulate algae. The influence of heating rate on pyrolysis and the βi curves of different samples under different temperatures were studied in detail. The porphyra was found to be the most reactive and produced the most gaseous fraction (87.1 wt.%) amongst the three algae, which comprised of 73.3 vol.% of syngas. It was found that nitrogenated compounds in bio-oil were derived from protein in algae while carbohydrate in algae led to the formation of PAHs. For the production of bio-oil, protein-rich microalgae is favorable compared with porphyra due to their lower amount of PAHs, while porphyra is more suitable for the production of H_2+CO rich gas product, which is comparable with that of conventional gasification process.

Highlights

- Carbohydrate in algae led to higher gas yield whilst protein led to higher oil yield.
- Microwave-enhanced pyrolysis of porphyra resulted in the highest syngas production.
- Microwave-enhanced pyrolysis of spirulina and chlorella favored oil production.