Catalytic gasification of oil palm frond biomass in supercritical water using MgO supported Ni, Cu and Zn oxides as catalysts for hydrogen production

ABSTRACT

Non-noble metal supported catalysts such as 20NiO/MgO, 20CuO/MgO and 20ZnO/MgO were catalyzed the gasification of oil palm frond biomass in supercritical water for hydrogen production. All the catalysts are found to be pure with no impurities present. The specific surface area of these catalysts can be arranged in the order of 20NiO/MgO (30.1 m2 g–1) > 20CuO/MgO (16.8 m2 g–1) > 20ZnO/MgO (13.1 m2 g–1). Although catalysts with larger specific surface area are beneficial for catalytic reactions, in this study, the largest specific surface area did not lead to the highest catalytic performance. It is found that the 20ZnO/MgO catalyst (118.1 mmol ml−1) shown the highest H2 yield than the 20CuO/MgO (81.1 mmol ml−1) and 20NiO/MgO (72.7 mmol ml−1) catalysts. In addition, these supported catalysts also shown higher H2 selectivity with reached 83.8%, 84.9% and 87.6% for 20CuO/MgO, 20NiO/MgO and 20ZnO/MgO catalysts. Other factors such as dispersion, basicity and bond strength play more important roles in supercritical water gasification of biomass to produce hydrogen.

Keyword: Biomass; SCWG; Supported catalyst; Hydrogen