Catalytic supercritical water gasification of oil palm frond biomassusing nanosized MgO doped Zn catalysts

ABSTRACT

In this work, nanosized MgO doped Zn catalysts ($Mg_{1-x}Zn_xO$; x = 0.05, 0.10, 0.15, 0.20) were catalyzed the supercritical water gasification (SCWG) of oil palm frond (OPF) biomass for hydrogen production. Increased the amount of Zn in the catalyst enlarged the crystallite size, thus, reduced the surface area. Interestingly, all the synthesized catalysts have crystallite sizes of less than 50 nm. In-depth Rietveld refinement analysis revealed that the enlargement of the crystallite size is due to the phenomenon of cell expansion when the smaller Mg^{2+} ions being replaced by the larger Zn^{2+} ions during the doping process. Increased the Zn content also improved the basicity properties. Among the synthesized catalysts, the $Mg_{0.80}Zn_{0.20}O$ exhibited the highest total gas volume of 213.5 ml g^{-1} of the biomass with 438.1% of increment in terms of H_2 yield. The metal oxide doped materials serve as a new catalyst structure system for the SCWG technology.