Synergistic catalysis of bi-metals in the reforming of biomass-derived hydrocarbons: A review

Nor Shafiqah Mohd-Nasir[a], Osarieme Uyi Osazuwa[b,d], Sumaiya Zainal Abidin[a,c]
[a] Department of Chemical Engineering, College of Engineering, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300, Gambang, Kuantan, Pahang, Malaysia
[b] Faculty of Chemical and Process Engineering Technology, College of Engineering Technology, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300, Gambang, Kuantan, Pahang, Malaysia
[c] Centre for Research in Advanced Fluid & Processes, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300, Gambang, Kuantan, Pahang, Malaysia
[d] Department of Chemical Engineering, University of Benin, PMB, 1154, Benin City, Edo State, Nigeria

ABSTRACT
Biomass such as ethanol and glycerol has emerged as an alternative feedstock for hydrogen (H_2) production in recent years. Ethanol, which is high in H_2, can easily be derived from renewable biomass sources, whereas; glycerol is a by-product of biodiesel expected to be surplus in the coming years. Several catalytic reforming routes involving biomass such as steam, CO_2, auto thermal, partial oxidation and aqueous-phase reforming can produce syngas or H_2. Bimetallic catalysis is one of the potential solutions to reduce carbon formation and catalysts deactivation in reforming processes since it can produce more stable catalysts from the synergistic effect of the combined metals. There are many reviews on catalyst designs and reaction pathways reported in the literature; nevertheless, comparative literature is lacking on the metal configuration of bimetallic catalyst in biomass reforming particularly for ethanol and glycerol reforming reactions. Therefore, studies linked with the synergistic effects of various bi-metal combinations of catalysts used in biomass reforming processes have been reviewed in the paper. Moreover, the study provides data for the application of bimetallic catalyst for industrial biomass processes.

KEYWORDS
Bimetallic catalyst; Ethanol reforming; Glycerol reforming; Metal-support; Syngas; Hydrogen

ACKNOWLEDGEMENTS

The authors recognize the financial support from Ministry of Higher Education, Malaysia, for FRGS research grant with vote number FRGS/1/2018/TK02/UMP/02/12 (RDU190197) and Universiti Malaysia Pahang through the fundamental research grant (RDU1803118) and postgraduate research grant scheme (PGRS200361).