A review on glycerol reforming processes over Ni-based catalyst for hydrogen and syngas productions

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ABSTRACT

The rapid increase in energy demand coupled with the depletion of fossil-based resources has elevated the need for cleaner, renewable and sustainable fuels. Amongst alternative energies, hydrogen-based energy solution has become a promising replacement candidate due to its clean emission, high efficiency and it is considered to be a perfect substitute to reduce the dependency on non-renewable sources. Recently, the valorization biomass has become one of the attractive routes for hydrogen production and it has received growing attentions from worldwide researchers. Glycerol, the by-product from the biodiesel production faced oversupply crisis due to the high refining cost and this has affected the economics and sustainability of biodiesel industry. Hence, the most attractive way to boost the economic value of biodiesel is through the valorization of crude glycerol into value added products, i.e., H2 and syngas. Previously, the production of H2 from glycerol has been carried out using various reforming processes such as aqueous phase reforming, pyrolysis, steam reforming, partial oxidation and dry reforming reactions. In the large scale industrial applications, Ni-based catalyst has been reported as the most common catalyst used in reforming reactions since this type of catalyst is readily available, inexpensive and possesses high catalytic activity. Ni was also found to have a good intrinsic activity and easily dispersed over the support materials. Throughout the years, various production routes and catalyst design have been reported in literature; however, none of the literatures are specifically focusing on benefits, constraints, limitation and challenges faced by glycerol reforming reactions catalyzed by Ni-based catalysts. Therefore, the focus of this review is to highlight the recent findings on Ni-based thermochemical processes of glycerol reforming reactions and emphasis will be given on the recent advances in catalyst and reactor designs as well as discovering the main routes of catalyst deactivation.

KEYWORDS

Glycerol valorization; Hydrogen and syngas; Reforming reaction; Ni-based catalyst; Catalyst deactivation

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