Developing Aqueous Phase Reforming Catalysts via Doping Platinum on Various Carbon Materials for Hydrogen Gas Production from Lignocellulosic Hydrolysates.

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Hydrogen is a clear energy carrier which can be used for transportation and stationary power generation. However, hydrogen is not readily available in sufficient quantities and the production cost is still high for transportation purposes. The technical challenges to achieve a stable hydrogen economy include improving process efficiencies, lowering the cost of production and using renewable sources as feedstock. Renewable lignocellulosic biomass being a non-edible abundant plant source is a promising renewable energy feedstock for producing biofuels.

The present study was designed to develop active catalysts for use in Aqueous Phase Reforming (APR) of biomass hydrolysates to produce hydrogen gas. A very important point for the economic use of precious metal catalysts is recovery, refining and recycling of the metal. This procedure is simplified by the use of a support for the metals. Typically, the support provides a physical surface for dispersion of small metal particles, which is necessary for achieving high surface area.

Catalyts made of Pt precious metal doped by using supercritical carbon dioxide deposition technique on activated carbon, single walled carbon nanotube: SWCNT, multiwalled-carbon nanotube: MWCNT and on mesoporous carbon supports were developed. Hydrogen gas production activity and selectivity of the catalysts were tested by APR of lignocellulosic biomass hydrolysates.

Pt was doped as the only active metal to different carbon supports so as to differentiate the performance of various Pt/C catalysts. It was observed that the overall catalytic activities of these Pt/C catalysts when used in the APR of lignocellulosic hydrolysates for hydrogen production decreased in the following order: Pt/SWCNT > Pt/activated carbon > Pt/MWCNT > Pt/mesopore carbon. It was also observed that no CO gas had been detected when the APR experiments were carried out by using Pt/SWCNT and Pt/MWCNT catalysts which was an indication for effective water-gas shift reaction in addition to the decomposition reactions of the lignocellulosic hydrolysates.

Key words: Pt/C catalysts, performance, selectivity, APR, hydrogen production