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Utilization of waste biomass for fuel and energy productions using large-scale plants with hydrothermal treatment

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Waste biomass is promising raw materials in the 21st century because they are produced much and carbon neutral for use. We show several techniques to convert waste biomass to useful fuels and clean energy with hydrothermal treatment.

1. Production of powder fuel: Mixture of waste biomass and plastics is one of the refractory wastes. The new technique was developed to convert waste mixture to clean fuel with the high heat of combustion. The waste mixture was treated in hot water at around 200°C and 2MPa. We obtained the powder fuel with 1-2mm in diameter and 25MJ/kg in heat of combustion.

2. Production of hydrogen gas: Hydrogen gas was produced from waste biomass using superheated steam. Waste biomass was converted to a gaseous mixture of hydrogen, methane, carbon dioxide and others. Furthermore superheated steam itself was decomposed to hydrogen and, as the result, the hydrogen yield increased much.

3. Production of bio-ethanol: Effective bio-ethanol production was developed by using paper sludge as a raw material and the combined process of hot water hydrolysis and enzymatic saccharification. Combined process realized more than 80% of high glucose yield and no production of furfural compounds, which are inhibitors of ethanol fermentation.

4. Production of thermal energy: 2-step superheated steam oxidation using catalyst was developed to incinerate livestock waste completely and safely to carbon dioxide, water, and nitrogen gas. The toxic and bad-smelling ammonia was decomposed rapidly. The thermal energy was recovered using a high-pressure heat exchanger efficiently.

Biography

Takeshi Sako received his PhD from Tokyo Metropolitan University. He worked on chemical engineering at National Institute of Advanced Industrial Science and Technology for 22 years. He became a professor at the Department of Materials Science and Technology at Shizuoka University in 2000. He was deans of Faculty of Engineering and Graduate School of Integrated Science and Technology from 2013 to 2017. He has worked on the supercritical/subcritical fluid technology for more than 30 years. In particular, he has studied the production of many kinds of biofuels from waste/unused materials using hydrothermal treatment.

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