

Conversion of Waste Biomass to High-Calory Fuels Using High Pressure Water or Carbon Dioxide

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Abstract

Waste biomass are promising raw materials in 21st century because they are produced much and carbon neutral for use. Furthermore the proper treatment of them realizes the environment protection at the same time. We show two techniques to convert waste biomass to high-calory fuels using high pressure water or carbon dioxide.

(1) Production of powder fuel with hot water

Mixture of waste biomass and plastics is one of refractory wastes. Typical examples are municipal waste from houses and waste mixture from supermarkets and convenience stores. New technique was developed to convert the waste mixture to clean solid fuel with high heat of combustion. The waste mixture was treated in hot water at around 200 oC and 2 MPa for 30 min. We obtained the powder fuel with several mm in diameter. It had 25-30 MJ/kg in heat of combustion and no bad smell. It could be dehydrated easily and stored for more than a year.

(2) Extraction of bio-oil with CO₂-expanded hexane

Expanded hexane with carbon dioxide (CO₂-expanded hexane) was used to extract bio-oil from agricultural wastes such as rice bran and the performance was compared with those of pure hexane, supercritical carbon dioxide and liquefied carbon dioxide. CO₂-expanded hexane had the maximum oil yield among them. Furthermore this extractant suppressed the phosphorus concentration in the extracted oil within 10 ppm, which causes the clogging of the fuel nozzle. As a result, CO₂-expanded hexane could extract more amount of bio-oil with low phosphorus concentration under mild extraction condition.



Biography:

Dr. 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 professor at 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 bio-fuels from waste materials using hydrothermal treatment and CO₂ extraction.

Speaker Publications:

1. "Depolymerization of Polyethylene Terephthalate to Monomers with Supercritical Methanol"; journal of chemical engineering of japan. / 1997 / 342-346
2. "Phase Equilibrium Study of Extraction and Concentration of Furfural Produced in Reactor Using Supercritical Carbon Dioxide"; journal of chemical engineering of japan / 1991, p. 449-455
3. "Metal-Catalyzed Dimethyl Carbonate Synthesis from Carbon Dioxide and Acetals"; ACS Publications, 4506-4508
4. "Selective Conversion of Carbon Dioxide to Dimethyl Carbonate by Molecular Catalysis"; ACS, 7095-7096.

[8th Global Summit and Expo on Pollution Control](#); Webinar- August 24-25, 2020, 2020.

Abstract Citation:

Takeshi Sako, "Conversion of Waste Biomass to High-Calory Fuels Using High Pressure Water or Carbon Dioxide", Pollution Control 2020, 8th Global Summit and Expo on Pollution Control; Webinar- August 24-25,2020, <https://pollutioncontrol.globalsummit.com/speaker/2020/takeshi-sako-shizuoka-university-japan-39127713>