論文の要旨

題目　Supercritical water gasification of microalgae
（微細藻類の超臨界水ガス化）

D165238
Puji Rahmawati NURCAHYANI

The role of renewable energy is needed presently as alternative energy along with the depletion of fossil fuels. One of these renewable energies is biomass which has calorific value and hydrocarbon properties similar to fossil fuels. Wet biomass has its challenges, particularly the need for drying which can increase production costs. To handle these wet substance properties, the most appropriate conversion process is the hydrothermal process. In the hydrothermal process, the material contains high water content, then the water can be an oxidizing agent during the decomposition reaction. Therefore, supercritical water is a suitable method for the gasification of organic matter from biomass. In hydrothermal treatment, the treatment process is carried out at high temperatures and pressure. There are two hydrothermal process regions, i.e., in the temperature range of 180 - 350 ºC with a pressure of 10 - 22.1 MPa, which is called subcritical water condition. Another is when the temperature range that passes through the critical point of water, which is above the temperature of 374 ºC and pressure of 22.1 MPa, is called supercritical water.

Microalgae is wet biomass that contains oil which is potential for biofuel. Supercritical water gasification treatment at a temperature of 600 ºC and 25 MPa with a feedstock concentration of 0.1% wt obtained gas, liquid, and solid products. The main gas composition is hydrogen, carbon monoxide, carbon dioxide, and methane gas. The same treatment is given to biomass after oil extracted treatment, and the gasification results produce less methane gas but higher carbon monoxide. The overall decomposition reaction proves that oil contributes to accelerating the gasification process and the overall feedstock decomposition in supercritical water conditions.

The microalgae planted in inorganic fertilizer were then gasified in SCWG at a temperature of 400 ºC and 600 ºC with a pressure of 25 MPa, and the effluent liquid was obtained. In the liquid effluent, inorganic substances such as nitrogen and phosphorus are collected because they do not participate in gasification. A total of 10% by volume of effluent was added to the standard medium of *Chlorella vulgaris* microalgae (Bristol Medium) to cultivate *Chlorella vulgaris* microalgae. Surprisingly, the microalgae cells with the SC 600 produced 2.5 times more phosphorus than with the Bristol medium alone. It indicates that complete gasification under 600 ºC eliminates organic inhibitors that remained in the effluent. This process provides a possibility to combine SCWG with nutrient recycling in microalgae cultivation.