●Basic Stage

Others

(Fiscal Year 2002-2004)

Hachinohe Area

Development of High Energy Utilization System with Wood Biomass

INTELLIGENT PLAZA Hachinohe, Inc.
1-4-43 Kita Inter Kogyo Danchi, Hachinohe City, Aomori 039-2245 JAPAN
Tel: +81-178-21-2111

Core Research Organization

Hachinohe Institute of Technology

Major Participating Research Organizations

Industry…ULVAC TOHOKU, Inc., Sasaki Corporation, Ishikawajima-Harima Heavy Industries Co., Ltd
Academia…Hachinohe Institute of Technology, Hachinohe National College of Technology
Government…Aomori Industrial Research Center

Typical result of City Area Program

1. Development of the absorption refrigerator that manufactures subfreezing cold brine from low temperature heat source

In the conventional absorption refrigerator, a heat source with a temperature of around 110 ℃ or more is required. New absorption refrigerator which can be driven by a low temperature heat of less than 100 ℃ was developed by using the new working fluid. The new working fluid is made of LiBr-$H_2$0 adding 1,4-dioxane which changes the structure of water so that the saturation temperature is decreased. Moreover, it was succeeded to decrease the solidifying point of new refrigerant H_2O-1,4-dioxane to -5 ℃, and it was demonstrated to manufacture the subfreezing cold brine with single effect type absorption refrigerator. In addition, the densitometer was developed, which may measure the concentration of the working fluid on a real time basis.

Experimental setup equipment for absorption refrigeration principle model

2. Development of gasification furnace for woody biomass

It was confirmed that the gasification conversion efficiency was achieved 70% and the heating value of produced gas was 4,000kJ/Nm^3. The gas fuel has enough heating value for applying to gas engine and gas turbine. Moreover, new fluidized catalyst and reforming flow method are effective for high heating value of produced gas, improvement of conversion efficiency and control of tar generation. The guideline for basic design of the fluidized bed gasification furnace, such as optimal catalyst and chip particle sizes, was obtained according to the flow condition of catalyst and biomass chip.

Test equipment for wood biomass gasification

About the approach after the project

1. Toward the development of the energy saving type absorption refrigerator.

Based on the technology established by this research, we are now improving the elements of the absorption refrigerator principle model, and studying properties of the working liquid and the design of new cycles in order to develop an absorption refrigerator driven by the heat source temperature of the exit of a conventional solar collector and decrease the manufactured cold brine up to -10 ℃. According to this, we will be able to miniaturize the indoor fan-coil unit, use the cold brine for the freezer, and make chilled water(water of 0 ℃) which is necessary voluminously in the food manufacturing industry. In addition, it is aimed to develop the cold manufacturing system for the stand-alone air-conditioning combined with the solar cell or the wind power, which will make it possible to realize the zero emission air-conditioning in the tropical and poor electric power condition region.

2. Technical approach to high efficiency for woody biomass

In the supercritical water gasification process, previous liquefaction of woody biomass is useful for improving the conversion efficiency and inhibiting the tar generation. Therefore, the experiment was performed to investigate the characteristics of liquefaction of cellulose which was main component of woody biomass treated by hot compressed water, and the optimal temperature and pressure of water for liquefaction of cellulose were confirmed. Moreover, the chemical reaction process that the cellulose decomposed to the oligosaccharides, the monosaccharides and pyrolysis products was clarified. The research started for finding the reaction system of efficient hydrogen rich manufacturing. It is expected that the produced gas fuel will be utilized for the power generation system using fuel cells in the near future.

Test equipment for supercritical water gasification