Efforts at JFE Engineering Research Center

JFE Holdings				
JFE Steel	JFE Engineering	Kawasaki Microelectronics	JFE Urban Development	JFE R&D

High Speed Mass-Production Technology for Natural Gas Hydrate

Natural gas hydrate*1 (NGH) offers various advantages in comparison with liquefied natural gas (LNG). Because NGH can be transported/stored at near room temperature (-10 to -20°C), equipment specifications are simpler and a much smaller cooling capacity is required, reducing construction costs, which is essential for economical development of unexploited small and medium gas fields. However, problems remained to be solved, including removal of heat (cooling) generated in the NGH formation process and more efficient gas-liquid contact. Thus, establishment of a high speed, mass-production process, aimed at upscaling to the industrial level, has been desired.

In 2001, the Engineering Research Center started the research for "High Speed Mass-Production Technology for Natural Gas Hydrate" in order to improve production speed. Basic experiments using propane as a simulation gas have reached production rates 60 times faster than the conventional process.


Bench-scale experiment facility

In research commissioned by Japan Oil, Gas and Metals National Corporation (JOGMEC), the Engineering Research Center developed a high speed mass-production process for hydrate. Using methane, which is the main component of natural gas, JFE set a world record for hydrate formation rate in bench-scale experiments.

In the future, JFE Engineering plans to carry out R&D aimed at establishing a total NGH system, including production, transportation, and regasification, as a new long-distance transportation/storage system for natural gas, complementing LNG.

***1) Gas hydrate**
Crystal substance which forms when methane gas or other small gas molecules and water are placed under low temperature, high pressure conditions. When methane is converted to hydrate, its volume is reduced to approximately 1/170 that of the gas.

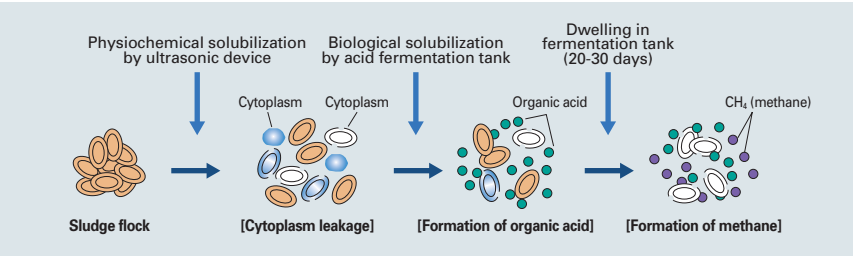
Promoting Biomass Utilization with Methane Fermentation Technology: "Sludge Solubilization System"

The Engineering Research Center developed an anaerobic digestion process for methane fermentation which generates a larger quantity of biogas than conventional technologies while reducing fermentation residue.

The "Sludge Solubilization System*1" is incorporated in this process as a preliminary process for the digestion tank where the organic matter in sludge is decomposed. Part of the sludge in the acid fermentation tank is subjected to ultrasonic treatment to destroy the cell membranes, and the organic matter (colonies of microorganisms), which is the main component of the sludge, is efficiently solubilized. This greatly increases the decomposition rate of organic matter in the digestion tank, while also reducing fermentation residue treatment requirements by reducing the concentration of solid matter in the residue.

***1) Sludge Solubilization System**
Solubilization is a process in which organic matter in sludge (in sewerage sludge, mainly colonies of microorganisms) is liquefied by physiochemical and/or biological treatment. This system was developed on consignment from the Japan Science and Technology Agency (JST) and has been certified as successful.

Total recycling system for sewerage sludge



Biomass CFB Gasification and Power Generating Process

In recent years, biomass has attracted attention as a carbon neutral form of renewable energy. Although practical direct-combustion power generating systems using a boiler/steam turbine have been developed for effective use of biomass energy, these systems have the drawback of low efficiency except in large plants. As biomass sources tend to be small in scale and widely distributed, biomass collection costs frequently make direct-combustion boiler/turbine systems uneconomical.

To solve this problem, JFE's Engineering Research Center is developing a "Biomass CFB Gasification and Power Generating System" for high efficiency generation in medium- and small-scale plants using the circulating fluidized bed (CFB) process, which has a wide record of use in combustion in gasification furnaces. With CFB, high efficiency gasification of biomass can be expected due to the mixing/stirring effect in a high speed fluidization condition.

Development of a low-cost dry-type gas refining technology for the generated gas is being carried out under NEDO's "Biomass Energy Conversion Element Technology Development" program, aiming at early practical application of a biomass gasification and power generating system based on the CFB gasification furnace.


CFB test device (biomass treatment capacity: 150 kg/hr)