A Study on B-DASH Project (hydrogen production without digestive, high concentration methane fermentation, water treatment in case of a disaster)

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1. Introduction

Sewerage is social capital essential to public life and measures for reducing greenhouse gases are also sought as response to the issues of global warming. In addition, there is increasing expectation for effective use of sewage resources as sewage sludge was introduced in the Productivity Revolution Project as "Japan's original resource that can be used variously, such as biogas and sludge fuel."

For this reason, the Sewerage and Waste Water Management Department of the Ministry of Land, Infrastructure, Transport and Tourism ("MLIT") launched the "Breakthrough by Dynamic Approach in Sewage High Technology" (B-DASH) Project in fiscal 2011, and the Water Quality Control Department of NILIM serves as an executing agency of this empirical project. The objective of B-DASH is to realize cost reduction in sewerage projects, creation of renewable energy, etc. through the verification and dissemination of excellent innovative technologies and to support the overseas development of the water business by Japanese enterprises.

2. Outline of B-DASH Project

Under B-DASH Project, the NILIM contracts out studies on innovative technologies, which are solicited to the public and adopted by expert review, to research organizations (contractors), which construct a full-scale plant in their sewage treatment facilities to verify stability of treatment, applicability of the technologies, cost reduction / energy saving effect resulting from introduction of the technologies, etc. Based on the results of such verification, the NILIM formulates guidelines for introduction of the technologies. In fiscal 2016, as the preliminary stage of the B-DASH Project, the B-DASH Preliminary Survey started to study the possibility of dissemination including effect of introduction and confirm technical performance, etc.

This paper introduces the outlines of "Hydrogen production technology without digestive", "High-concentration methane fermentation technology", and "Water treatment technology in case of a disaster," on which we have started to study after they were adopted as the topics of preliminary survey in fiscal 2016.

3. Outline of the technologies adopted in fiscal 2016 (preliminary survey)

(1) Hydrogen production technology without digestive

○Investigation for production of high-purity hydrogen by sewage sludge pyrolysis (Consortium between Ostrand Corporation, iPL, Seikei University, National Institute of Advanced Industrial Science and Technology)

Technical performance such as hydrogen yield and required energy as well as business profitability are verified with an experiment on the process of producing high-purity hydrogen by heating the sewage sludge infiltrated with iron catalyst in the horizontally rotating cylinder furnace (Fig. 1).

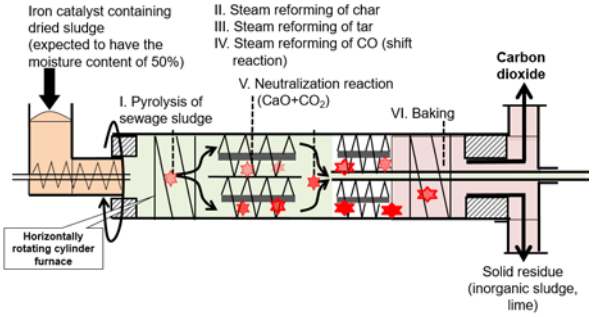

Figure 1: Flow of high-purity hydrogen production technology with horizontally rotating cylinder furnace

○Investigation for the practical application of hydrogen production process using salinity difference between treated wastewater and sea water (Consortium between Yamaguchi University, Seiko Electric Co., Ltd., Japan Sewage Works Agency)

Technical performance, such as the yield and the purity of hydrogen, is verified for the new hydrogen production technology using the salinity difference

between sewage treatment water and sea water (Fig. 2)

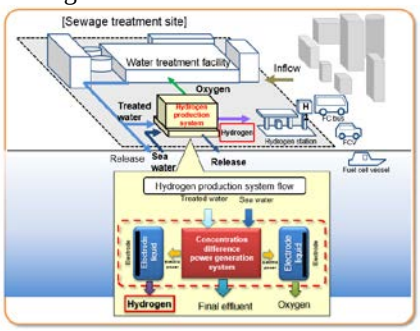

Figure 2: Flow of the hydrogen production technology using salinity difference

○Investigation for direct production of hydrogen gas from sewage sludge (Consortium between Tohoku University, CARBON FREE NETWORK Co., Ltd., YAMARO SANKO MFG. Co., Ltd., and Hirosaki City)

Business profitability and technical performance are verified for the technology of manufacturing hydrogen successively from sewage sludge using nickel hydroxide and calcium hydroxide. (Fig. 3)

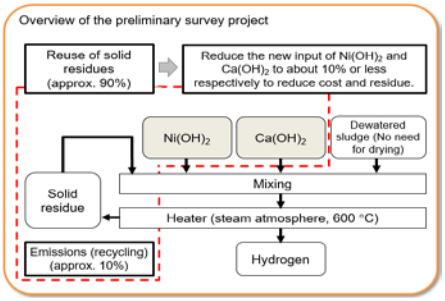

Figure 3: Flow of the pyrolysis hydrogen production technology using nickel

○Investigation for operation cost reduction utilizing electric generation using hydrogen gas from treated wastewater (Consortium between Shimizu Corp., Sekisui Chemical Co., Ltd., Power United, Osaka-Sayama City, Karuizawa Town, and Kobayashi City)

Business profitability and technical performance are verified for the technology of producing hydrogen and magnesium oxide from sewage treatment water and magnesium. (Fig. 4)

(2) High-concentration methane fermentation technology

○Investigation for high concentration methane fermentation technology for small and medium scale sewage treatment plants (Consortium between NISHIHARA Environment Co., Ltd., OHARA Corp., Hokkaido University, and Hamanaka town)

Business profitability and technical performance are verified for the technology of thickened sludge to about 10% using the existing dehydrator as a concentrator and implementing high concentration digestion in the unit-type compact horizontal sludge digester. (Fig. 5)

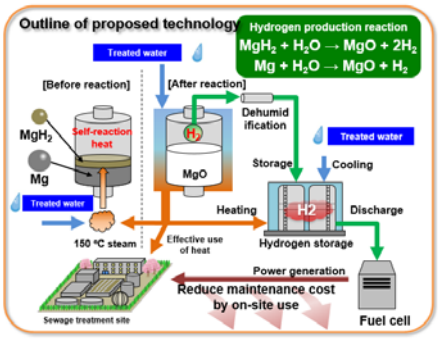

Figure 4: Flow of the hydrogen production technology using magnesium

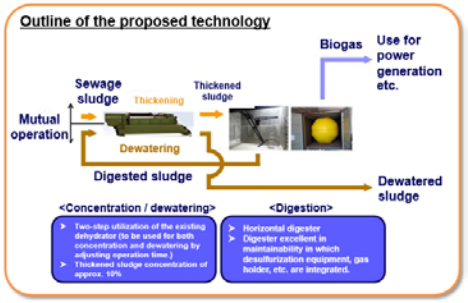

Figure 5: Flow of high-concentration methane fermentation technology

(3) Water treatment technology in case of a disaster

○Investigation for the bacteria removal of raw sewage using the non-woven fabric filter and ultrafiltration membrane (Consortium between Oji Holdings Corp., OJI ENGINEERING Co., Ltd., and KURARAY AQUA Co., Ltd.)

A system for releasing treatment water certainly disinfected with ultrafiltration membrane (UF film) through preliminary treatment of sewage with nonwoven fabric (prefilter) is studied and business profitability, etc. are evaluated. (Fig. 6)

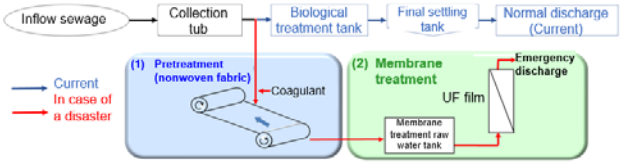

Fig. 6: Flow of the water treatment technology assuming a disaster

4. Future development

NILIM is going to continue to lead the preliminary survey and identify the possibility of dissemination and technical performance including the possibility of theme setting as full-scale verification technology.

[Reference]

http://www.nilim.go.jp/lab/ecg/index.htm