Empirical Study on B-DASH Project (Hydrogen production / energy saving water treatment / biogas collection / CO_2 recovery / reclaimed water utilization)

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(Key words) sewerage, energy saving, resource saving, cost reduction, greenhouse gas, innovative technology

1. Introduction

Sewerage is social capital essential to public life and, utilization of its potential, such as utilization of sewage sludge and sewage heat as energy and utilization of phosphorus as resource, is increasingly sought in addition to the measures for reducing global warming gases in order to respond to the issues of global warming and the tight supply of resources and energy.

To respond to such social request and administrative needs, new technologies are being developed but are less used in practice and many sewerage service providers are cautious about introduction. 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. For study results, formulation of guidelines, etc. of the research, advice and evaluation are obtained from experts.

The paper introduces the outlines of empirical studies "Technology for producing hydrogen from biogas" and "Energy-saving water treatment technology," which were both adopted in fiscal 2014 and are under verification, and "Technology for separation / collection / utilization of CO_2 contained in biogas," "Biogas collection / utilization technology," and "Recycled water application technology," which were adopted in fiscal 2015 and have started verification.

3. Outline of verification technologies adopted in fiscal 2014

(1) Technology for producing hydrogen from biogas

○ Empirical study on the technology for producing hydrogen from sewage biogas raw material (Joint Research Organization of Mitsubishi Kakoki Kaisha, Ltd., Fukuoka City, Kyushu University, and Toyota Tsusho Corp.)

This study aims to establish a system for efficiently producing hydrogen from sewage biogas with combination of technologies for biogas pretreatment, hydrogen production, and hydrogen supply, and is verifying feasibility of commercialization by evaluating the performance of the hydrogen production technology in combination with the membrane separation method, quality of hydrogen to be supplied, etc. (Figure 1)

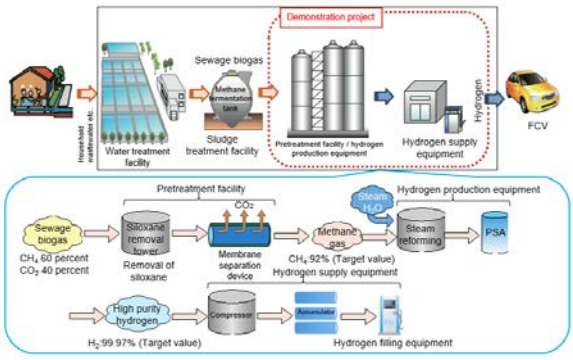

Figure 1: Hydrogen production technical flow

(2) Energy-saving water treatment technology

(i) Empirical study on the energy-saving water treatment technology using the high efficiency solid-liquid separation technology and the Dual DO control technology (Joint Research Organization of Maezawa Industries, Inc., Ishigaki Co., Ltd., Japan Sewage Works Agency and Saitama Prefecture)

This study is verifying stable nitrogen removal effect, energy saving effect from optimization of aeration air flow, etc. by removing solid matter in sewage influent with high efficiency and space saving using the high efficiency solid-liquid separation technology and by forming an aerobic zone / anoxia zone with the technology of controlling DO (dissolved oxygen) at two points in the circulating channel prepared by altering the existing channel (Figure 2).

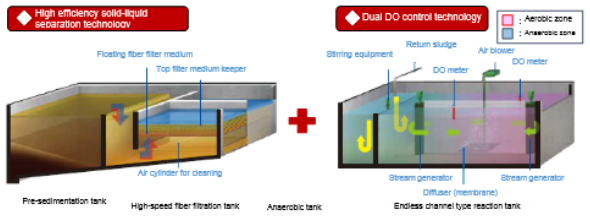

Figure 2: High efficiency solid-liquid separation technology and Dual DO control technology

(ii) Empirical study on non-aerated circular water treatment technology (Joint Research Organization of Metawater Co., Ltd., Kochi City, Kochi University, and Japan Sewage Works Agency)

This study is verifying the energy saving effect, etc. as the result of securing stable water quality and of reducing ventilation energy similar to that obtained by the conventional activated sludge process by conducting suspended solid / BOD removal using suspended carrier (pre-stage filtration facilities), BOD removal using microbe-attached carrier in the non-aerated oxygen supply system (High-speed carrier filter bed), and secure suspended solid removal (final filtration facilities) and by circulating biological treatment water (Figure 3).

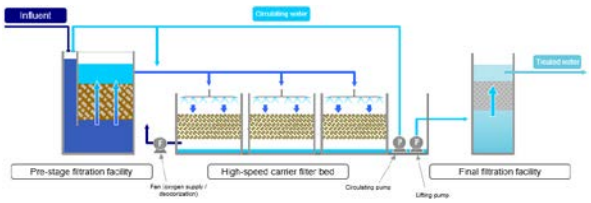

Figure 3: Non-aerated circular water treatment technology

4. Outline of verification technologies adopted in fiscal 2015

(i) Empirical study on the technology for separation / recovery of CO_2 in biogas and application to microalgae culture (Joint Research Organization of Toshiba Corp., Euglena Co., Ltd., Nikkan Tokushu K.K., Nihon Suido Consultants Co., Ltd., Japan Sewage Works Agency, and Saga City)

This study verifies the performance of CO_2 separation / recovery, performance of producing euglena, performance of removing nitrogen and phosphorus in dehydrated separated liquid, business potential of the entire system, etc. by separating / recovering CO_2 from biogas and culturing euglena using the recovered CO_2 and dehydrated separated liquid, etc.

(ii) Empirical study on the technology for efficient collection of biogas from multiple sewage treatment facilities and utilization (Joint Research Organization of JNC Engineering Co., Ltd., Adsorption Technology Industries Ltd., Kyudenko Corp., Sinko Co., Ltd., Yamaga City Gas Co., Ltd., Prefectural University of Kumamoto, Yamaga City, Otsu Town, and Mashiki Town)

This study verifies the effect of cost reduction, energy production, etc. from power generation using surplus biogas in small-scale sewage treatment facilities at three locations, which are refined and kept in storage vessels and conveyed by vehicle to one location.

(3) Empirical study on the regeneration system for sewage treatment water (Joint Research Organization of Nishihara Environment Co., Ltd., Tokyo Engineering Consultants Co., Ltd., Kyoto University, and Itoman City)

This study verifies the technology for utilizing safe, energy-saving, and economical reclaimed water by combining UF film (filtration film with the pore diameter of 0.01 μm), and ultraviolet disinfection.

2. Future development

The NILIM is going to continue to lead verification studies and formulate guidelines successively for considering introduction based on study results and promote the dissemination of guidelines.

[Reference]

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