

# A Study on B-DASH Project (sewage sludge intra-regional circulation system, energy-saving sewage advanced treatment, volume reduction of excess sludge)

(Research period: from FY2017)

TAJIMA Atsushi, Head, OHTA Taichi, Senior Researcher, ISHIKAWA Takeshi, Researcher, AWATA Takanori (Ph. D.), Researcher, SATO Takuya, Guest Research Engineer  
Wastewater and Sludge Management Division, Water Quality Control Department

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## 1. Introduction

Sewerage is a 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 demonstration and dissemination of excellent innovative technologies and to support the overseas development of the water business by Japanese enterprises.

In the B-DASH Project, the NILIM has been implementing real-scale demonstration for technical verification by building real-size facilities and FS (feasibility survey) (, which had been called "Preliminary survey" until fiscal 2016,) as a preliminary stage of the real-scale demonstration in order to confirm the profitability and technical performance including introductory effect. This paper introduces the technical summary of FS survey adopted in fiscal 2017.

## 2. Outline of the FS survey adopted in fiscal 2017

### (1) Technology for sewage sludge intra-regional circulation system

Outline of the research and study on the intra-regional circulation system centering on straw, high concentration mixture and thermophilic digestion of sewage sludge, and carbonization (Contractor: Joint Research Organization of Kanazawa University, Tottori University of Environmental Studies, Meiwa Industries, Ltd., and BIOGASLABO Co., Ltd.) Business profitability and technical performance are under verification for the intra-regional circulation system technology centering on high-concentration

thermophilic digestion by mixing straw in dewatered sludge and production of carbonized sludge fertilizer. Fig. 1 shows the flow of this technology.

The characteristics of this technology, including innovation, are as follows.

- 1) Downsizing and efficiency increase of facilities and reduction of sludge generation by high concentration mixture and thermophilic digestion of sewage sludge using straw.
- 2) Increase of digester gas generation by straw treatment before swelling & softening
- 3) Promotion of intra-regional circulation of biomass using straw-mixed sludge as carbonization fertilizer.
- 4) Study of proper collecting/ complementing system considering usage of straw

### (2) Energy-saving advanced sewage treatment technology

Outline of the study on the energy-saving advanced sewage treatment technology using anammox bacteria (Contractor: Joint Research Organization of Meidinesha Corp. and Kobe City)

In order to realize advanced treatment with energy used in the standard method, business profitability and technical performance are under verification for the technology for reducing total energy usage by removing nitrogen efficiently through treatment using anammox bacteria to reduce energy consumption and recovering energy from organic matter contained in sewage sludge more efficiently. Fig. 2 shows the flow of this technology.

The characteristics of this technology, including innovation, are as follows.

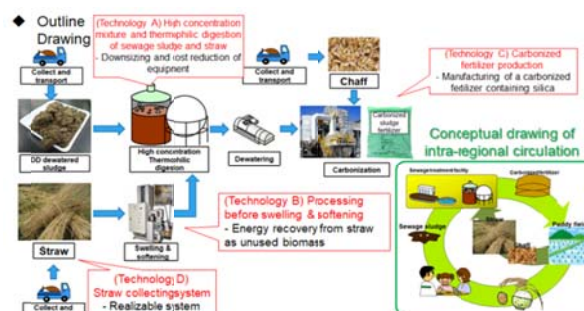


Fig. 1 Flow of the intra-regional circulation system technology

- 1) Power consumption reduction by highly efficient nitrogen treatment using anammox\* bacteria  
 \* Anammox (anaerobic ammonium oxidation; anaerobic ammonia oxidation) reaction is one of the nitrogen gas conversion reactions of ammonia. Compared with the general nitrification denitrification process ( $\text{NH}_4 \rightarrow \text{NO}_2 \rightarrow \text{NO}_3 \rightarrow \text{N}_2$ ), the process until ammonia is converted into nitrogen gas is shorter ( $\text{NH}_4 \rightarrow \text{NO}_2 \rightarrow \text{N}_2$ ) and less oxygen is required.
- 2) Improvement of the energy recovery rate by extracting much organic matter in sewage and increasing digester gas with the organic matter sludge adsorption treatment\*, which applied the oxidative dissolution reaction of organic matter by activity sludge  
 \* In the oxidative dissolution reaction caused by aeration, i.e., "(i) Adsorption of organic matter onto the surface of activated sludge" → "(ii) Intake of organic matter into activated sludge" → "(iii) Oxidization of an organic matter," treatment of remaining at (i) adsorption above by controlling retention time.

(3) Technology for excess sludge volume reduction  
 Outline of the study on the volume reduction technology for excess sludge in the advanced treatment by introducing high-pressure jet equipment (Contractor: Joint Research Organization of Tokyo University of Agriculture and Technology, Ishigaki Company, Ltd., and Public Works Research Institute)  
 The effect of reducing the production of excess sludge and oxygen supply is under verification and business profitability is under evaluation by introducing high-pressure jet equipment that reduces excess sludge at low cost into the flocculant addition / nitrified liquid circulation activated sludge system. Fig. 3 shows the flow of this technology.  
 The characteristics of this technology, including innovation, are as follows.

- 1) Effect of crushing microbial cells in activated sludge using the crushing / shearing / collision effect of high-pressure jet equipment. (Sludge volume reduction is possible with lower cost and higher efficiency than conventional technology)
- 2) Aeration assist effect from the return of sludge generated by jet with detailed air bubbles attached, into the aeration tank. (Expectation for reducing aeration power cost)

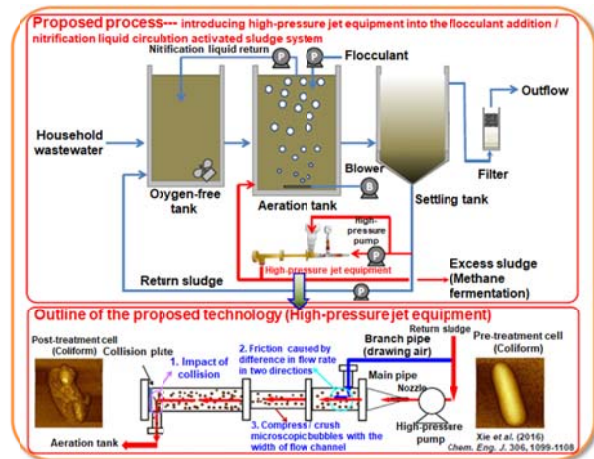


Fig. 3 Flow of the excess sludge volume reduction technology

#### 4. Future development

Studies on the three technologies above were finished in fiscal 2018 but the NILIM is going to continue to lead the FS survey and identify the possibility of dissemination and technical performance including the possibility of theme setting as real-scale verification technology.

See the following for details.

[Reference] Website introducing B-DASH  
<http://www.nilim.go.jp/lab/ecg/bdash/bdash.htm>

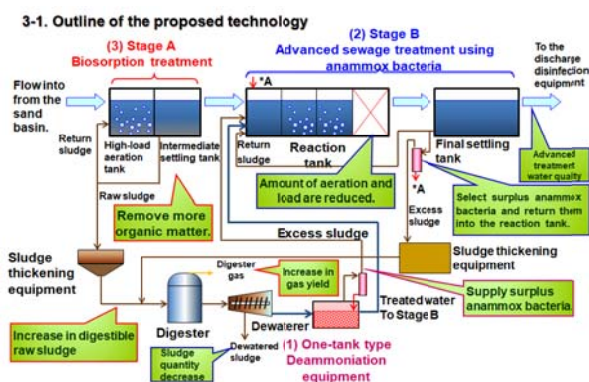


Fig. 2 Flow of the energy-saving advanced sewage treatment technology