Formulation of Guidelines for B-DASH Project (Solid fuel forming, sewage heat utilization, nitrogen removal, phosphorus removal / recovery)

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1. Introduction

In order to achieve cost reduction, creation of renewable energy, etc. in the sewerage service by accelerating the research and development and practical use of new technologies, the Water Quality Control Department of the National Institute for Land and Infrastructure Management (NILIM) has been implementing the Breakthrough by Dynamic Approach in Sewage High Technology Project (B-DASH Project) since fiscal 2011 in collaboration with the Sewerage and Sewage Purification Department of the Ministry of Land, Infrastructure and Transport (MLIT).

Under B-DASH Project, in response to the research contracted out by the NILIM, the research organization (contractor) constructs a full-scale plant to verify cost reduction, decrease in greenhouse gas emissions, energy saving effect, etc. resulting from the introduction of innovative technology, etc. Based on the results of such verification, the NILIM formulates guidelines for sewerage service providers to consider introduction of the technology with the aim to disseminate the technology.

Based on the findings of the research on the four innovative technologies, i.e. technology for converting sewage sludge into solid fuel, technology for utilizing unprocessed sewage heat, technology for removing / recovering phosphorus derived from sludge treatment, and technology for removing nitrogen, which had been continuously demonstrated since fiscal 2012, we formulated the guidelines for technology introduction in August 2014.

2. Outline of demonstrated technologies

(1) Technology for converting sewage sludge into solid fuel using waste heat

The technology uses the low-temperature waste heat (250-350 ℃) from the existing incinerator in the treatment facility, such as white smoke prevention air, as heat source for drying sewage sludge to manufacture sludge solid fuel saving cost and energy. The effect of reducing the usage of supplemental fuel can also be expected from the use of this solid fuel as alteration of supplemental fuel for the incinerator (Figure 1).

(2) Sewage heat recovery technology for installation in pipeline

As compared with air, sewage is warm in winter and cool in summer, and is present stably and abundantly in urban areas.

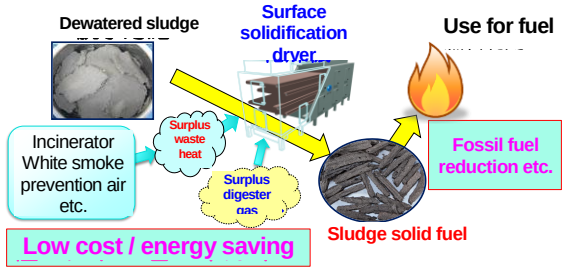

Figure 1. Technology for converting sewage sludge into solid fuel using waste heat

Therefore, effective use of sewage heat for air-conditioning, hot water supply, etc. leads to expectation for energy saving effect. This technology requires installation of heat recovery pipes in sewer pipeline at the time of pipe regeneration work and eliminates the necessity for sewage-dedicated intake facility and heat exchanger (Figure 2).

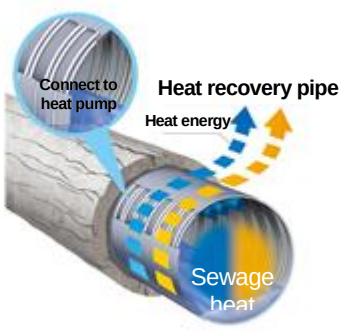

Figure 2. Sewage Heat Recovery Technology for Installation in Pipeline

(3) Technology for removing / recovering phosphorus derived from digested sludge

Technology for removing phosphorus from digested sludge before dewatering and recovering as $MgNH_4PO_4 \cdot 6H_2O$ (MAP). Using the complete mixing reactor with mechanical stirring, this technology enables efficient and stable phosphorus recovery even for digested sludge, which is more viscous than dewatered filtrate, and this leads to expectation for increase in phosphorus recovery as compared with the conventional method of removing phosphorus from dewatered filtrate (Figure 3).

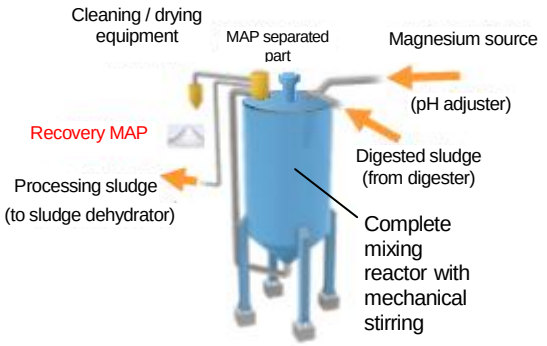

Figure 3. Technology for Removing / Recovering Phosphorus from Digested Sludge

(4) Technology for highly efficient nitrogen removal with fixed bed type anammox process

Anammox process is a biological response that converts ammonia nitrogen and nitrite nitrogen into nitrogen gas under anaerobic conditions. This technology has adopted a biofilm reactor, which uses a fixed bed type carrier for holding cells to be used in the nitritation process and anammox process, and is expected to bring such effects as reduction in aeration power, no need for addition of organic matter, and smaller space for installation of the equipment, in comparison with the conventional nitrogen removal method (Figure 4).

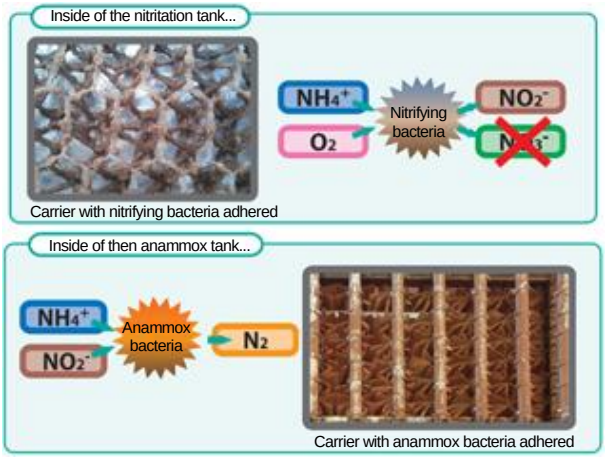

Figure 4. Technology for Nitrogen Removal with Fixed Bed Type Anammox Process

3. Outline of the guidelines

Based on the findings of the empirical study and opinions of local governments, we formulated guidelines according to each technology and had experts reviewed them.

Table shows the composition of the guideline (draft) formulated. Chapter 2 describes the characteristics, performance, etc. of the technology, and Chapter 3 estimates the effect of the technology when introduced in a treatment facility. Based on the results of estimation, possibility of introduction is discussed, and Chapter 4 examines basic planning, equipment design, etc. for introduction. Chapter 5 describes the items and frequency of check, etc. that will be required when the technology is introduced.

Table. Composition of Guideline (draft)

Chapter I. General Provisions	Objective, scope of application, definitions of terms
Chapter 2. Outline of the Technology	Characteristics of the technologies, conditions of application, evaluation results
Chapter 3. Examination for Introduction	Introduction examination method, examples for examination of introduction effect
Chapter 4. Planning and Design	Introduction plan, design
Chapter 5. Maintenance	Check items, frequency, etc.
Reference Data	Verification results, case study, etc.

4. Utilization of findings and future development

In order to introduce the guideline to local governments, sewerage-related companies, etc., the NILIM held a guideline presentation seminar in Intex Osaka in July 2014, attended by more than 100 persons.

We will continue to introduce the guidelines actively through such presentation seminars, etc. to promote utilization of sewage energy and secure phosphorus, which is a scarce resource.

Photo: Guideline Presentation Hall

[Reference]

1) Technical Note of NILIM, No. 802
Guideline for introducing the technology for highly efficient nitrogen removal with fixed bed type anammox process (Draft)
2) NILIM Document No. 803
Guideline for introducing the technology for converting sewage sludge into low-cost solid fuel using waste heat
3) Technical Note of NILIM, No. 804
Guideline for introducing sewage heat utilization using the sewage heat recovery technology for installation in pipeline (Draft)
4) Technical Note of NILIM, No.805
Guideline for introducing the technology for removing / recovering phosphorus from digested sludge (Draft)
http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn000.htm