Night Soil Management and Decentralized Wastewater Treatment Systems in Japan

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Takatoshi Wako
Deputy Director, Water Environment Division
Environment Management Bureau, Ministry of the Environment, Japan

Night Soli Recycling Systems in Edo Era

- A sanitary city unlike any other in the world, where organics substances such as night soil and garbage were reused as suppliers of fertilizer in outlying farming village
- Less epidemics in Japan comparing to modern Europe

A farmer carrying tubs of night soil

Night soil recycling systems in Edo Era

Source: Annual Report on the Environment
The End of Night Soil Recycling Systems

- Urbanization (Farm land and urban area move away from each other)
- The Spread of Chemical fertilizer (Night Soil from as "fertilizer" to just as "waste"

Chemical fertilizer consumption (ammonium sulfate) in Japan

- Less epidemics in Japan comparing to modern Europe

History of Sanitary Treatment of Night Soil in Japan

- Storage of night soil and utilization for agriculture (1200s ~ 1960s)
- Decreasing demand for the traditional night soil recycling systems due to the urbanization and the spread of chemical fertilizer (1950s)
- Nationwide water pollution caused social problem (the late 1960’s ~ )
Urban area - Start of Sewerage systems -

- Population increase and Start of sewerage construction

Yokohama: Brick-made sewer line (1881)

Tokyo: Mikawa-jima Sewerage Disposal Plant
(First sewerage disposal plant in Japan, 1922)

Decentralized options - Night soil storage tank & Tandoku-shori Johkasou systems

Night soil storage tank

- Public health Problems (bad odor, overflow of wastes during times of flooding)
- Increasing demand for flushing toilet

Tandoku-shori Johkasou systems

- Treated black water and enabled installation of flushing toilet
- Spreaded rapidly in 1970s (over 7 million installation at maximum)

- Grey water still untreated
Water Pollution of Tokyo in 1970’s

Tokyo Bay in 1970’s  
A river of Tokyo in 1970’s  
The Kanda river (Tokyo) in 1970’s

"Crime" of grey water

Share of grey water in domestic wastewater & Pollutant loads are quite large!

- Treating black water only have a limited impact on improvement of water quality in public water body

Examples of liquid kitchen wastes with high pollutant loads

- For example, 100ml of grease oil require 20,000 l of fresh water to maintain a survivable environment for fishes.
"(Gappeli) Johkasou" as Decentralized Treatment System

• Designed for treating both black water and grey water

• Cost-effective in decentralized area (Low initial investment cost)
• Little topographic limitation, short installation time (roughly a week)
• Treats wastewater as clean as 10 ppm as BOD (2/3 of total), 5 ppm as BOD (40% of total)
• Invaluable contribution to maintaining sufficient water in small rivers
• Less vulnerable to disasters

Johkasou (Anaerobic filter contact aeration type)

Night Soil Treatment and Domestic Wastewater Treatment Systems in Japan

Centralized system
Both Black and Grey water
Grey water only

New Installation
Treatment Principles and Types of Johkasou

Wastewater are broken down biochemically by the catabolism of microorganisms such as bacteria and metazoan organism.

Background of Legislation and National Subsidy for Johkasou

(1960s~1970s)

- severe water pollution caused by domestic wastewater
- spread of septic tank to use flush toilets (tandoku-shori Johkasou)

The Johkasou Law (1983)

Regulation on installation and maintenance of Johkasou

Development of Johkasou

(advanced on-site treatment facility of domestic wastewater)

Increasing Role of Johkasou in the improvement of water environment

Establishment of national subsidy programs (1987)
Legislative Systems for Johkasou (Johkasou Law)

- **Objective**
  - To promote the appropriate treatment of domestic wastewater, to maintain good water quality of public water bodies and a healthy living environment, and to improve public health

- **Main contents of Johkasou Law**
  - Notification of installation of Johkasou
  - Regulations on construction, installation, operation and maintenance, desludging and examination
  - Qualification and licensing of technician and operators

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Johkasou Law (Continued)

- **Structure Standards for Johkasou (article 4)**
  - Established in accordance with the Building Standard Law (Establishment and change by MLIT are to be made after consultation with MOE)
  - i.e. Technical standards for effluent water quality
    - BOD: 20mg/l or less
    - BOD removal rate: 90% or more

- **Installation (article 5-7)**
  - **Notification**
    - Notification to the prefectural governor etc.
    - To understand a new installation or any change in the structure or size
    - Confirmation of any problems in terms of the structure and O&M
  - **Installation**
    - Johkasou shall be constructed by a Johkasou installation vendor
    - registered by the prefectural governor (effective for five years; Accredited by the government)
    - Complying with the "Technical Standards for Johkasou construction" (17 items)
    - Supervised by a certified Johkasou installation worker
Operation, Maintenance and Inspection of Johkasou

Inspection after construction

- Purpose: Confirm if the construction, installation, and treatment performance are good.
- Contents:
  - Visual inspection
  - Water quality inspection
  - Document inspection
- Timing of implementation: Three to eight months after starting operation
- Responsible organization: Specified inspection agency, which is a public service corporation of the prefecture.

Annual inspection

- Purpose: Confirm the maintenance and treatment performance is good.
- Contents:
  - Visual inspection
  - Water quality inspection
  - Document inspection
- Timing of implementation: Once a year
- Responsible organization: Johkasou desludging vendor, who is registered by the mayor.

Frame work of Johkasou management

- Requires periodical maintenance such as maintenance of biofilm and removal of sludge
- Requires certified technicians/engineers for maintenance

Qualifications/vendors

<table>
<thead>
<tr>
<th>Qualifications</th>
<th>Register number of vendors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johkasou Operator</td>
<td>66,668</td>
</tr>
<tr>
<td>Johkasou Inhabitant Worker</td>
<td>94,484</td>
</tr>
<tr>
<td>Johkasou Technical Supervisor</td>
<td>25,105</td>
</tr>
<tr>
<td>Johkasou Desludging Technician</td>
<td>4,782</td>
</tr>
<tr>
<td>Johkasou Inspector</td>
<td>1,119</td>
</tr>
<tr>
<td>Specified inspection agency</td>
<td>66</td>
</tr>
<tr>
<td>Johkasou maintenance vendor</td>
<td>7,010</td>
</tr>
<tr>
<td>Johkasou desludging vendor</td>
<td>5,573</td>
</tr>
<tr>
<td>Johkasou installation vendor</td>
<td>35,388</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Business content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation and maintenance</td>
</tr>
<tr>
<td>Desludging</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Legal Basis</th>
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<tbody>
<tr>
<td>Johkasou Law</td>
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<tr>
<td>Establishment regulations of Johkasou Law</td>
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<tr>
<td>Johkasou Law</td>
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Advisory and recommendations to managers by prefectural government

Technicians and private businesses to support D & M of Johkasou

Johkasou technicians and vendors in Japan (as of the end of FY 2009)
Subsidy programs for Johkasou Installation

• Johkasou Installation Promotion Program

For example...

• The cost of installing a Johkasou for 5 PE is supposed to be 840 thousand yen.

• In the case of 1., the user’s burden is 504 thousand yen.

• In the case of 2., the user’s burden is 84 thousand yen.

(※ PE: person equivalent)

An example of maintenance cost of BOD removal type Johkasou

<table>
<thead>
<tr>
<th>Item</th>
<th>A Johkasou for 5 PE</th>
<th>A Johkasou for 7 PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance fee</td>
<td>21,000 Yen</td>
<td>22,000 Yen</td>
</tr>
<tr>
<td>Desludging fee</td>
<td>26,000 Yen</td>
<td>35,000 Yen</td>
</tr>
<tr>
<td>Electricity fee</td>
<td>13,000 Yen</td>
<td>18,000 Yen</td>
</tr>
<tr>
<td>Inspection fee</td>
<td>5,000 Yen</td>
<td>5,000 Yen</td>
</tr>
</tbody>
</table>

Number and trends of installed Johkasou

Johkasou (Gappo) serves 11.3 million people i.e. 8.9% of the total population

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Population Trends for domestic wastewater treatment

Dissemination rates by size of municipalities
Plans of Prefectural Governments

- For efficient construction of wastewater treatment facilities in each region, a construction plan for wastewater treatment facilities has been formulated based on comparison of economic efficiency, etc., considering the characteristics of each wastewater treatment facility.

Japan's International Cooperation

- Disseminate Japan’s experience for night soil treatment and on-site waste water treatment system
- Build a capacity for these systems
- Suggest these systems/technologies which is applicable for various countries
- Provide relevant technical cooperation
Outline of Asia Water Environment Improvement Project with Japanese water-related companies

A project for comprehensive improvement and promotion of water re-use in an Indian industrial wastewater treatment facility
By Toyo Engineering Inc.
Venue: Haryana state, India

A project of wastewater treatment for an industrial complex in Da-nang
By Kajima Cooperation etc.
Venue: Da-nang, Viet Nam

Water Environment Improvement Project by introducing Bio-toilet
By Chodai Inc.
Venue: Viet nam national railway

A project for introducing zero-emission wastewater treatment system in pig farm
By Aqua Inc.
Venue: Penang, Malaysia

Water Quality Improvement Project by introducing Johkasou system in Djakarta
By Kubota Cooperation
Venue: Djakarta, Indonesia

Thank you for your attention
Contact: TAKATOSHI_WAKO@env.go.jp