Welcome to The Joint Experiment Center for Water Purification on Lake Biwa-Yodo River

2009. 3. 6

Lake Biwa-Yodo River
Water Quality Preservation Organization
Kyoto city

- Japanese Academic & Scientific Capital (half (6/12) of the Nobel Prize Winners are from Kyoto (5 from Kyoto University, 1 from Private Cooperation (Shimazu))
- Source of World Heritage – Gold Temple,
- Venue of COP3 in 1997 – Kyoto Protocol
- Main Venue of 3WWF in 2003
- Ancient Capital of Japan
  (Since 794 AD. – 1866 AD)
BIRDS-EYE VIEW OF OSAKA CITY
Osaka Castle / Osaka Business Park / Yodo River
Osaka city – as the Capital of Water
- Mizu no Miyako -
the venue of 3WWF
Characteristics of Lake Biwa-Yodo River Basin (Kansai Region)

- Historical Capitals of Japan (Otsu, Nara, Kyoto)
- Big commercial and industrial city (Osaka) is located downstream of Yodo River.
- Relative small cities are located in upper-stream region surrounding Lake Biwa
- Medium-size Historical Japanese Capital (Kyoto) is located in the middle of the Yodo River Basin
- Almost all population in Kansai Region (16 millions people) depend upon water from Lake Biwa (27.3 km$^3$)
Map of The Lake Biwa-Yodo River Basin Kansai Region
Half of the Total Drainage Area of Yodo River is of Lake Biwa

63% of total discharge of Yodo River comes from Lake Biwa
Outlets of Sewage Treatment Plants Are located in the Upstream of Water Intake for the City of Osaka

High Ratio of Water Recycling!

- Sewage treatment plant
- Tap water intake

Downstream – The City of Osaka

Upstream
Kyoto City

Lake Biwa

Yodo River
Katsura River
Uji River

Distribution of Tap Water Intake and Sewage Treatment plant in Yodo River basin
Maximum Ratio of Water Recycling in Lake Biwa - Yodo River System

Graph legends:
Possible number of passages into sewage-treatment plant

Cited reference:
General Status of Lake Biwa

- **Area of Shiga Prefecture**: 4,017.00 km²
- **Catchment Area of the lake**: 3,174.00 km²
- **Area of the Lake**: 670.49 km²
- **Length (North-South)**: 63.49 km
- **Maximum width (East-West)**: 22.80 km
- **Minimum width (East-West)**: 1.35 km
- **Circumference**: 235.20 km
- **Altitude**: 85.614 m
- **Maximum depth**: 103.58 m
- **Mean depth Northern Lake**: 43.00 m
- **Mean depth Southern Lake**: 4.00 m
- **Capacity**: 27.5 billion m³
Water Quality of Lake Biwa

COD (average)

![Graph showing the COD (Chemical Oxygen Demand) levels in Lake Biwa from 1970 to 1995. The graph indicates the average COD levels in mg/l for both the Southern and Northern Lakes, with a comparison to the Environmental Quality Standard.]
COD and BOD of Northern Lake

![Graph showing COD and BOD levels from 1979 to 2004.](image)

- **COD**: Generally increasing trend from 1979 to 2004.
- **BOD**: Steady trend with some fluctuations.
Water Quality of Lake Biwa

T-N (average)

![Graph showing water quality of Lake Biwa over time, with Northern Lake and Southern Lake data compared against Environmental Quality Standard.](image-url)
Water Quality of Lake Biwa

T-P (average)
Problems of the water quality in Lake Biwa-Yodo Rever System

- COD of Lake Biwa has increased.
  
  T-N of Lake Biwa has flattened.

- Eutrophication of Lake Biwa or Dams are caused by Musty Odor, Freshwater Red Tide and Algal Bloom.

- The Influence of micro-toxic chemicals.
  
  (like environmental endocrine disrupting chemicals, PPCPs; pharmaceutical and personal care products)
By experiments for water quality purification, we aim to develop an effective scheme to water environmental preservation.

This center created on the lakeshore of Lake Biwa in July 1997.

Four founders:
- Kinki District Development Bureau of the Ministry of Land, Infrastructure and Transport
- Shiga prefectural government
- Kansai Branch of Japan Water Agency
- Lake Biwa – Yodo River Water Quality Preservation Organization
Overview of the facility

Plan of cooperative test center for purification of Lake Biwa and Yodo River water
Role of the Biyo Center

1) The center for research and development of water purification techniques.

2) The center for cooperation of different governmental agencies and researchers in various fields for water purification.

3) The center for providing public information and environmental education
1. Research and development of water purification techniques

We are studying the experiments of water purification on River, canal, dam and lake etc.
2. Venue for cooperation of different governmental agencies and researchers

◆ This center is a venue for cooperation aimed at improving water environment, of different governmental agencies and researchers in various fields in Lake Biwa watershed.
◆ This center is visited 600 to 2000 people per a year and we have discussion on the matter of water environment issue around the world.
3. Providing public information and environmental education

- This center is building a partnership with local citizens and Nonprofit organization, and providing information.
- This center held lectures and symposia in various regions.
Biyo center Entrance
Channel type purification test facility

- Width x Depth x Length: 2 m x 0.9 m x 24 m
- Maximum flow rate: 360 $m^3$/day
- 3 channels

➢ This facility simulates urban small rivers and agricultural drainage channel.
Deep pond type purification test facility

- Width x Depth x Length: 6 m x 2 m x 20 m
- Maximum flow rate: 960 m³/day
- 3 ponds

➢ This facility simulates lake banks and endorheic lakes. With this facility, purification tests of endorheic lake and reservoir are made, and purification effect of riparian and lake ecosystem is verified.
Shallow pond type purification test facility

- **Width x Depth x Length**: 5 m x 0.6 m x 20 m
- **Maximum flow rate**: 440 m³/day
- **4 channels**

- Purification-with-vegetation facility simulating purification of small and medium rivers in urban districts and purification of influent rivers to endorheic lakes.
Purification-with-soil test facility

- Width x Depth x Length: 6 m x 1.8 m x 20 m
- Maximum flow rate: 600 m³/day
- 4 ponds

This is an actual-field type test facility simulating purification using the soil percolation system that has filtration, adsorption, ion-exchange etc.
Lake Biwa type test pond

- Depth: 0.3 – 0.5 m
- Volume: 1,000 m³

➢ This is test facility of with a scale of 1/600 of Lake Biwa.
Multi-nature type water channel test facility

• Configuration:
  • Water channel lined on three sides: about 240 m
  • J-shaped water channel: about 160 m
  • Multi-nature type water channel
  • Upstream part (natural stone): about 50 m
  • Middle part (gravel): about 125 m
  • Downstream part (soil): about 165 m

• This is a multi-nature type water channel simulating Lake Biwa and Yodo River water system. The water channel is divided into upstream, middle and downstream portions, like a natural river, verifying self-purification of a river and

Fish living in the multi-nature type water channel

Oikawa (Zacco platypus)  Tairiku-baratanago (Rhodeus ocellatus)  Medaka (Oryzias latipes)
“Inner lake type test facility”

This is a semi-closed type test facility simulating *Wando* (creek) on the shore of Lake Biwa. Sheet piles are installed over about 30 m at both ends of the test yard.

The main purpose of this facility is research of reed planting and stability of ground.

“Beach type test facility”

This is an open type test yard simulating the beach of Lake Biwa.
Treated effluent (Purification-with-soil)
Water purification techniques using plants and soils, and their effect
Hydroponics Purification

Water Purification by using Eco-System

- Sedimentation, Filtration
- Adsorption, Absorption
- Reduction by Microorganisms
Water Purification by Using of Soils

- Water Purification by using Capacity of Soils
  - Filtration
  - Adsorption, ion-exchange
  - Reduction by Microorganisms

Akadama soil

Diagram showing water flow patterns:
- Down flow
- Up flow
Thank you for your attention!