

STUDY & BUSINESS MISSION TO JAPAN FOR WATER AND WASTEWATER TREATMENT SYSTEM

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ORGANIZED BY



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Saudi Arabian Water Environment Association



Japan Cooperation Center
for the Middle East



1. MISSION AT A GLANCE

The Saudi Arabian Water Environment Association (**SAWEA**) and Japan Cooperation Center for the Middle East (**JCCME**) organized a study and business mission for water and wastewater treatment systems in Japan. The purpose of this mission is to provide information on state-of-art technologies related to water and wastewater treatment and operation in Japan for water quality professionals working in the Kingdom of Saudi Arabia. The tour was scheduled from May 15 to 20, 2016. It included site visits to local government agencies, private factories and research centers related to water treatment.

On the first day, the team visited the **Center for Membrane and Film Technology** in Kobe University. This center is the largest center in the world focusing on membrane and thin film technologies.

On the second day, the team visited **Higashi Water Environmental Center** for wastewater treatment, **Tobu Sludge Center** for sludge management. The team members had a close look to the initiatives of those centers to protect environment and conserve resources. At the end of the day the team visited **Kobe City Waterworks Bureau**. Kobe city shared their best practices in water management which helped Kobe to achieve only 4.5% water leak in their system to supply 232 million gallons per day.

On the third day, the team traveled to Matsuyama to visit Ehime Plant of **Toray Industries Inc.** During this visit, Toray presented their latest products and future plan to support local market in Saudi Arabia. The team explored the process to manufacture reverse osmosis membranes and membrane bioreactors.

On the fourth day, the team visited **Kubota (Hirakata Plant)** and toured the pump and valve factories. Kubota is one of the major supplier of large scale pipe fittings in Saudi Arabia. Kubota provided a brief overview about their services and products and presented their services to support Saudi Arabia industries. On the same day the team visited **Advanced Treated Water Recycle Center** in Green Front Sakai city. This plant uses a new technology based on membrane treatment to recycle industrial wastewater from Sharp industries.

The mission was concluded by having B2B meetings with Japanese companies which are supporting water industries. The meeting started with a brief presentation by Mohammad Al-Abdulatif, the Assistance Director of SAWEA, about the Saudi Arabia's water demand and planned projects. He also highlighted the potential investment opportunities for Japanese companies in the water sector of Saudi Arabia. The Japanese companies that participated in these B2B meetings were **Sumitomo Corporation, JFE Engineering Corporation, Kubota Corporation, Mitsubishi Rayon Aqua Solution and Toyobo Co. LTD.**

This mission to Japan provided the SAWEA members with more knowledge about water treatment and utilization of treated water, and Japan's efforts for effective utilization of sludge. It also helps Japanese companies to gain more understanding of the Kingdom needs for water sector. This hopefully will increase the collaboration between Japan and Saudi Arabia to develop water industry and protecting environment.



2. ABOUT SAWEA

SAWEA is a non-profit organization founded on January 1, 2002 by a group of professionals working in Saudi Arabia in water and wastewater treatment. The Objective of SAWEA is to **preserve and enhance water quality in Saudi Arabia and the world.**

SAWEA is a professional self-directed group, predominantly within Saudi Aramco. The main sponsors of the association are the Saudi Aramco Utilities & Technical Support and Environmental Protection Departments. In addition SAWEA is the official local chapter of the International Water Environment Federation (WEF), which is the largest Water Association in the world.

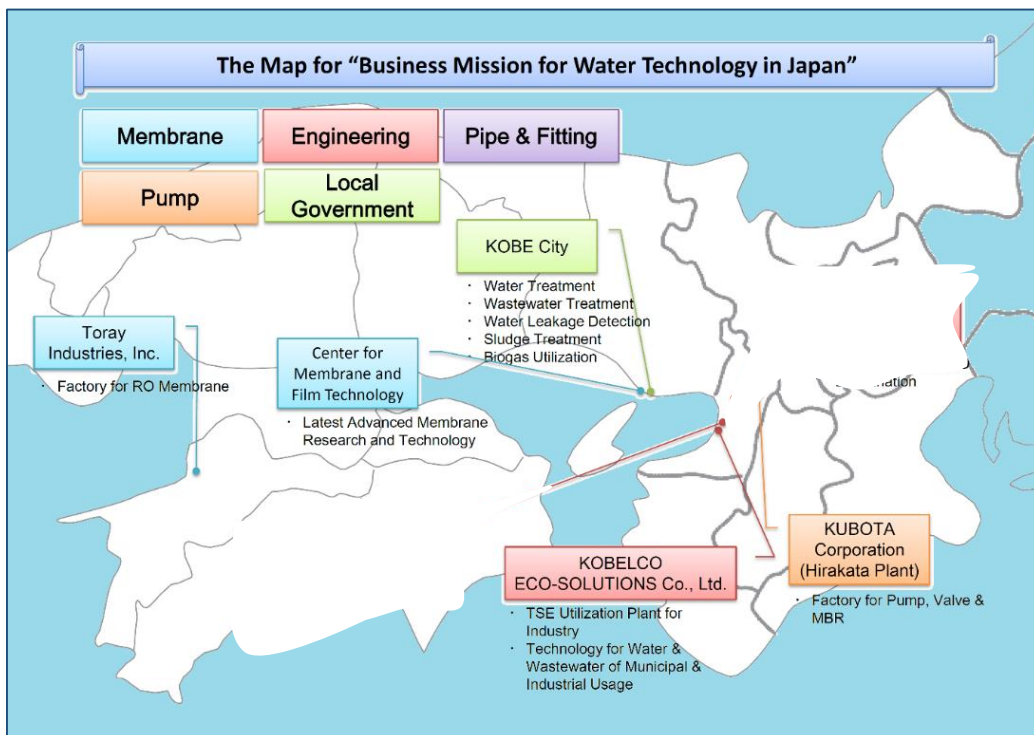
3. ABOUT JCCME-JAPAN WATER DESK

The objective of JCCME is to contribute to the promotion of Japan’s cooperation in the areas of trade and investment for the furtherance of industrial and economic development in countries in the MENA region. JCCME has set up a Water Desk in Jeddah to promote Japanese investment and technology transfer on water projects in Saudi Arabia. The Japanese Water Desk (JWD) was set up in early March 2005 at the premises of the Jeddah Chamber of Commerce.

The objective of JWD is to support promotion of technology transfer and direct investment from Japan to Saudi Arabia in the private sector in water resources and related projects.

4. MISSION OVERVIEW

Below map shows the industries and centers visited by the mission team.





5. MISSION TEAM

Below are the SAWEA members who participated in this mission trip:



Nidhal S. Al-Dossary



Mohammad H. Al-Abdulatif



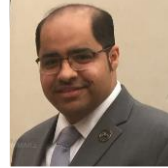
Fady A. Al-Shahwan



Mahmoud A. Al-Moaikel



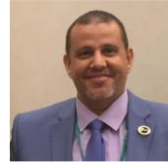
Bruno Valente Villegas Lira



Abdullah A. Al-Ammar



Abdullah M. Bfleh



Abdulaziz M. Al-Shahrani

6. MISSION AGENDA

- | | |
|--------------|---|
| May 15, 2016 | Arrival to Japan |
| May 16, 2016 | Center for Membrane and Film Technology |
| May 17, 2016 | Higashi Water Environmental Center
Tobu Sludge Center
Kobe City Waterworks Bureau |
| May 18, 2016 | Toray Industries Inc. |
| May 19, 2016 | Kubota (Hirakata Plant)
Advanced Treated Water Recycle Center |
| May 20, 2016 | B2B Meeting and Closing Ceremony |
| May 21, 2016 | Departure to Saudi Arabia |



7. OVERVIEW OF SITES VISITS

CENTER FOR MEMBRANE AND FILM TECHNOLOGY

The Center for Membrane and Film Technology was founded by the KOBE University. This center is the largest center in the world focusing on membrane and thin film technologies. This research center covers wide range of research and development from highly functional membrane and films to novel processes for producing them with the aid of material chemistry and chemical engineering. This center consists of the following four education and research groups.



- **Functional Organic Thin Films Group:** Current research activities include preparation and characterization of organic thin films and basic research of molecular nanotechnology.
- **Functional Catalytic Materials Fabricated in Thin Films and Membranes:** This research group aims for the developments of novel catalytic materials with high functions by synthesizing monolayer of active components or by combining nanocatalytic particles with micro- or mesoporous thin film layer to expect a new catalytic function or molecular sieving function, respectively, for hyper active and selective catalytic performance.
- **Functional Separation Membranes:** Research/education include the preparation of various types of porous membranes by phase separation methods as well as quantitative clarification of structure formation mechanism. In addition, gas separations for various systems by facilitated transport membrane using carrier are also targets in this research group.
- **Manufacturing Processes for Thin Films:** This research group aims for control of micro and/or nanostructure of thin films to have highly efficient function by coating and drying process engineering.



Mission Team with Professor Hideto Matsuyama, Director of Center for Membrane and Film Technology



HIGASHI WATER ENVIRONMENTAL CENTER

The Higashinada Sewage Treatment Plant received large-scale damage in 1995 Earthquake. At that time the plant was forced to suspend operation for around 100 days due to the fact that its water processing facilities were submerged in water. During that period, a variety of measures were taken, including temporarily using the canal that intersects the plant as a settling tank.



After successful reconstruction, the plant has received attention from both within Japan and around the world for its ability to produce renewable energy. In 2012, the Higashinada Plant was designated by the Japanese government as a "Water and Environment Solution Hub".



On the left are three anaerobic egg shape diagesters used to generate mentha. On the right, Mahound Al-Moaikel in the control room



Misison team in front of one anaerobic egg shape diagester



Methan Purification Unit



There are three initiatives implemented by the Higashi Water Environmental Center focusing on energy conservation and environment protection:

- 1. Kobe Biogas Project:** *After concentrating the sludge generated by the water treatment process, the concentrated sludge undergoes an anaerobic digestion process for the purposes of volume reduction and stabilization. The digestive gas (composition: approx. 60% methane, approx. 40% carbon dioxide) is then refined to a concentration of 98% methane. Since April of 2008, this gas has been used as an automotive fuel under the name "Kobe Biogas". Since October of 2010, the gas has been further refined and began to be injected into the city's gas pipes. Both of these efforts are the first of their kind in Japan.*



Methan gas generated from STP is used for public transportation

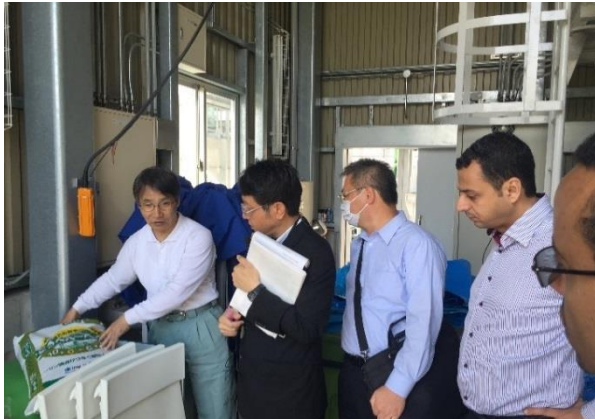
- 2. Kobe Green Sweets Project:** *Since January of 2012, Kobe has been adding unused local biomass (food waste, ligneous waste) to sewage sludge in an effort to increase the amount of gas produced and improve the effectiveness of sludge processing.*

3. Kobe Harvest Project

The aim of this project is to recover phosphorous from digesting sludge efficiently and make use of it as a raw material for fertilizer. This initiative will help to prevent red tide in the water area (OSAKA Bay). It solved the problem of disposition in the pipes and tanks of sludge handling units solving the problem of dewatering machine mesh clog. It will also reduce the volume of disposed sludge.



Phosphorus Recovery Unit



Sample of phosphours fertilizer manufactured by the STP

TOBU SLUDGE CENTER

The purpose of this center is to reduce sludge volume. It receives 228-ton of sludge per day from four sewage treatment plant. This sludge is reduced to 12 ton ash per day by using fluidized bed incinerator. This ash goes to a private company to make paving bricks and asphalt extender; some is also turned into fertilizer for the city's parks and flower beds.

A variety of energy-saving measures are built into this system. For example, the heat from the incinerator is further used to produce steam for drying some of the sludge and for preventing emissions of white smoke. Air for the combustion is used to send odors from the sludge pit to a preheater before being sent to the incinerator. This reduces fuel and deodorizing expenses.



Air scrubber



Mr. Al-Abdulatif near incinerator burner



Mr. Al-Shahwan and Mr. Befleh in front of Incineration Unit



Mr. Al-Dossary award a token of appreciation to Plant Manager



Plant Manager explain plant process

KOBE CITY WATERWORKS BUREAU

Kobe City Waterworks Bureau supply about 232 million gallons per day with only 4.5% water leak. This low percent is attributed to best practices implement in water management. Kobe city set up distribution block every 2 to 4 KM. In this part of the tour the team attended a workshop about leak investigation techniques implemented by KOBE City. This workshop was followed by hands-on experience to detect leak using automatic leak sound Detection, (L-Sign), acoustic bar, electronic acoustic bar and road surface sound.



Mr. Villegas Lira tries to find the leak point using electronic acoustic bar



Waterworks Bureau staffs during field training after the workshop



Mission team members try to hear the noise of the leak



Group photo with Management of KOBE City Waterworks Bureau



TORAY INDUSTRIES INC. (EHIME PLANT)

Toray Industries Inc. is one of the leading manufacture of RO membrane. The team visited the main Toray plant in Ehime. This visit allows the mission members to have a close look to the manufacturing process of RO membrane and membrane bioreactors and observe the quality measures applied in manufacturing processes. During this visit, Toray also presented to the team their products for water treatment such as spiral wound membranes and hollow fiber membrane and future plan to support local market in Saudi Arabia.



Team members wearing the safety uniform before accessing Toray membrane plant



Group photo with Toray Management of Ehime Plant



KUBOTA CORPORATION (HIRAKATA PLANT)

Kubota offers a wide variety of products and solutions in water, and wastewater field. The team visited Hirakata plant during which the team tour the pump department, valve department and MBR department. After that, Kubota Management shared with the team their business plan in Saudi Arabia and maintenance services to support Saudi Arabia's water and wastewater operation.



Group photo with Kubota managers of Pump Department, Valve Department, MBR Department, and Pipes and Overseas Department

GREEN FRONT SAKAI ADVANCED TREATED WATER RECYCLE CENTER

This is a water recycle center in SHARP Corporation Factory in Sakai City. This center is managed by Kobelco Eco-Solution Co. LTD. It treats wastewater generated from electronics and iron and steel industries. Kobelco adopted membrane treatment technology that had achieved satisfactory results to reuse treated wastewater on a large scale. The plant mainly consists of MF membrane unit followed by RO membrane unit and backwash wastewater recovery unit. The planned capacity is about 8.7 million gallons per day. The treated wastewater is currently used as make-up water for cooling tower with a future plan to use it in the manufacturing process.



The plant implemented several energy saving and energy creation consideration such as using hydraulic power generator to generate electricity utilizing the head difference between MF in 4th floor and RO in 3rd floor.



Group photo with Kobelco vice president and management staffs

8. B2B MEETING

On the last day of the event, JCCME organized B2B meetings with several Japanese companies. Mohammad Al-Abdulatif, the Assistance Director of SAWEA, gave a short presentation about Saudi Arabia's water demands and future projects. He also highlighted potential investment opportunities for Japanese companies in Saudi Arabia's water sector. The team conducted individual meetings with the followings companies:

1. Sumitomo Corporation
2. JFE Engineering Corporation
3. Kubota Corporation
4. Mitsubishi Rayon Aqua Solution
5. Toyobo Co. LTD presented products



Mohammad Al-Abdulatif delivering SAWEA presentation about Saudi Arabia's water demand



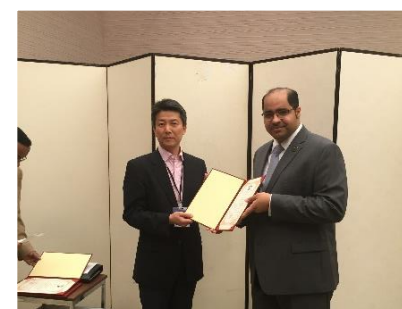
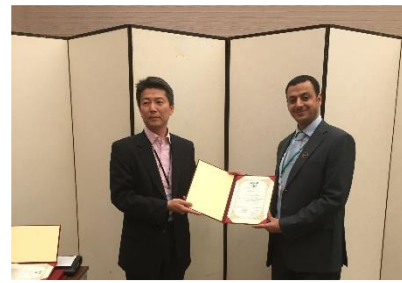
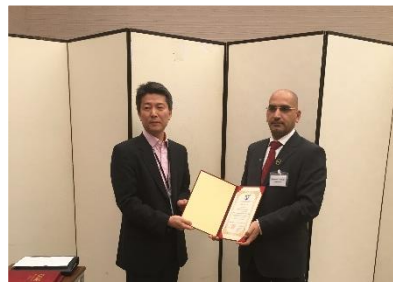
In these meeting, Japanese companies presented their latest technologies and services. Some presented technologies are confidential, therefore, they are not included in this report upon the request of the representatives.



Team members during B2B meeting



At the end, the mission team members were recognized by Mr. Toshiki Matsumoto the Director of JCCME Planning and Development.



9. CONCLUSION

In conclusion, the mission offered the participants an opportunity to see and experience some of the best practices in water and wastewater treatment and management. It was a very informative mission. It helped the mission's participants to gain more knowledge about water and wastewater treatment which can be implemented in the organizations of participants. On the other side, it helped Japanese companies to have more understanding of the Kingdom's needs for water sector. Hopefully, this will increase the collaboration between Japan and Kingdom of Saudi Arabia to develop water industry in the Kingdom of Saudi Arabia as well as protecting our environment.



SAWEA would highly recommend such missions to Japan. Finally, SAWEA would like to thank JCCME for the arrangements made to make this trip a very valuable experience, especially Toshiki Matsumoto the Director of JCCME Planning and Development Department, Go Takeuchi representative of Japan Water Desk and Waleed Bushara the Manager of Japan Water Desk in Jeddah.



Japan and Saudi Arabia flags at the entrance of Toray Plant