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**For the Middle East, Azbil Provides Plant Lifecycle Solutions and Value That Only a One-Stop Solution Provider Can Offer**

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**Steam Quality Measuring System**



Special Feature

Innovation that turns plastic waste into "oil fields"  
**Converting plastic waste to oil!**

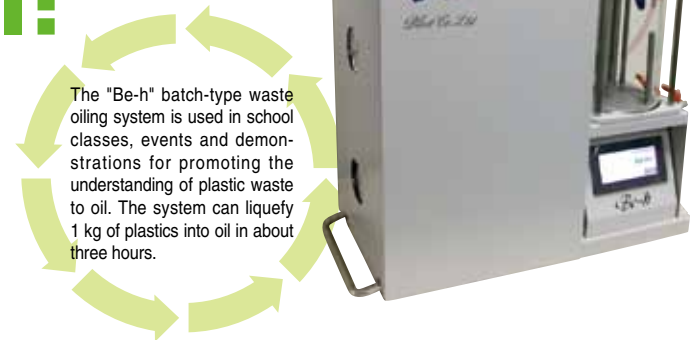


**Special Feature**

# Innovation that turns plastic waste into "oil fields"

## Converting plastic waste to oil!

Due to the modern style of living, we produce huge amounts of plastic waste through ordinary daily activities. Almost all plastic waste generated worldwide are incinerated or disposed of at landfill sites. Against this background, the plastic waste oiling systems developed by a venture company in Japan are drawing a great deal of attention from around the world.



### Turning 1 kg of plastic waste into 800 g of oil

Blest Co., Ltd., which was founded in 2001, is staffed with nine employees, and develops and sells plastic waste oiling systems. The company receives an avalanche of inquiries from countries around the world. A plastic waste oiling system is a means of converting plastics, which are produced from petroleum, to oil. Systems developed by Blest are capable of recycling 1 kg of plastic waste into 800 g of oil. The resulting product is a mixed oil containing oils with different characteristics. It can be used as fuel for boilers and incinerators. When blended with light oil, it can be used to operate diesel engines. Furthermore, the generators offered by Blest can use this recycled mixed oil to generate electricity. In other words, plastic waste can be converted to an energy source capable of powering almost all types of machines including automobiles and home appliances.

More than half of all plastic waste discharged in Japan are incinerated for disposal. Since plastic waste generate higher-calorie heat than ordinary refuse when incinerated, they can damage the incinerators. In addition, extra cost is required to process the hazardous substances discharged during combustion. Therefore, many waste processing companies prefer not to incinerate plastic waste in their plants.

### Be-h's oiling process steps



Loading of plastic waste



Operation



Extraction of oil

Ideally, plastic waste should be reused to the extent possible and useless plastic waste should be recycled back to oil.

### Compactness, safety, and simplicity as keywords

In 2001, when Blest began developing plastic waste oiling systems, plastic oiling was highlighted as a significant business opportunity. In those days, plastic waste oiling systems were installed in waste treatment plants to process tons of plastic waste per day. However, collecting a sizable amount of plastic waste requires large labor expenses and fuel expenses. In addition, plastic waste range widely and diversely in type, and some of them are dirty; therefore, collected plastic waste have to be sorted, washed, and dried be-

fore they are fed into the machine. Because profits could not be made from the plastic waste oiling business, most equipment manufacturers and waste processing companies withdrew from the business by about 2010.

Notwithstanding such a trend, Blest did not give up. The company continued to walk its own path. The main reason Blest was able to survive in this business field was its unique development concept, represented by the keywords, "compactness," "safety," and "simplicity." Blest excluded vinyl chloride, nylon, and polyethylene terephthalate (PET) bottles (which require large machines for processing) from the processing targets, and decided to focus on recycling polypropylene, polyethylene, and polystyrene, which make up the majority of plastic waste. Blest changed the heating



**Akinori Ito**  
PRESIDENT, Blest Co., Ltd.

device from burners to electrothermal heaters, thus achieving the downsizing of the system and improving safety at the same time. Blest is striving to downsize the equipment to the extent possible because the company wants its products to be small enough to be installed in places where large amounts of plastic waste are generated, such as food factories, supermarkets, and agricultural and fishery facilities. Operational costs can be reduced dramatically if plastic waste generated on a daily basis are processed on site for oiling.

Simple operation is essential for systems that are installed in various waste-plastic-generating places. If operation of the system required an engineer, it would not diffuse widely, and installed units might not be operated appropriately. Blest's systems are equipped with touch panels that support seven languages, and they are easy to operate by anyone. They are designed for easy and safe cleaning, and their simple mechanisms

are easy to repair. They are also manufactured with commonly available parts.

### Stressing the importance of sorting

Blest's development concept focused on compactness, safety, and simplicity was realized in the batch-type waste oiling system, "Be-h." It was developed for use in demonstrations. This compact system is light enough for two persons to carry, and it can be set up on a table.

No matter how great the performance of the system is, it is useless if plastic waste are not collected and sorted appropriately. Sorting is performed by people, and it is not a task everyone can conduct immediately when requested orally. Thus, it was imperative to raise the awareness of the importance of sorting plastic waste. Blest created the Be-h so people can see an actual machine and understand the need

for sorting.

Blest President Akinori Ito holds environment classes in schools and conducts demonstrations using the Be-h. He continues those awareness-raising activities.

"Children have the eyes and the hands for accurate sorting of plastics. When I explain the mechanism of oiling plastic waste and set up a recovery box named "School Oil Field," the children take great pleasure in the sorting. Then, parents and grandparents follow suit. Children have the power to diffuse new social rules," said Blest President Ito.

Blest hears the heartfelt voices of people from overseas who are concerned about the pressing problems relating to plastic waste. For example, rising sea levels are encroaching low-lying land of small islands. Waste is disposed of at limited landfill sites on the islands, but space is running out. This heightens concerns about the risk of undecomposed plastic waste in refuse flowing into the seas and polluting the waters. Plastic waste oiling systems are expected to solve the problem of increasing amounts of plastic waste and protect the natural environment. Small islands are mirrors that reflect the future of the entire planet Earth. Realizing the possibility that not recycling plastic waste will eventually cause great damage to the Earth's environment, Blest continues to develop compact, safe, and simple plastic waste oiling systems and conducts energetic activities to raise the awareness of the importance of sorting plastic waste, with a commitment to saving our planet.

### Recyclable plastics

Blest's plastic waste oiling systems liquefy the following three types of plastics.

#### Polypropylene



Containers (such as trash boxes and accessory cases), cable ties, snack package bags, CD/DVD cases, etc.

#### Polyethylene



Disposable plastic shopping bags, product package bags (for clothing, commodities, etc.), caps of clear plastic beverage bottles, etc.

#### Polystyrene

\* Includes foamed polystyrene



Cup-type instant noodle containers, polystyrene foam, etc.



# For the Middle East, Azbil Provides Plant Lifecycle Solutions and Value That Only a One-Stop Solution Provider Can Offer

As part of its efforts to strengthen global expansion, the azbil Group provides customers in Saudi Arabia and elsewhere in the Middle East with lifecycle solutions that ensure safe and reliable operations at petroleum and petrochemical plants. This article introduces Azbil Saudi Limited and its endeavors to support the customers.

## Base of operations established in Saudi Arabia as a part of efforts to strengthen global expansion

The azbil Group made a medium-term plan in May 2013 that is in effect through fiscal year 2016, when Azbil will be celebrating the 110th anniversary of its founding. Through the pursuit of “human-centered automation,” it has been emphasizing three initiatives: (1) becoming a long-term partner for the customer and the community by offering solutions based on our technologies and products; (2) taking global operations to the next level, with global expansion by moving into new regions and making a qualitative change of focus; (3) becoming a corporate organization that never stops learning, so that it can continuously strengthen its corporate structure.

Azbil has been making a special point of strengthening global expansion, steadily increasing its infrastructure for production, engineering, and maintenance services as well as establishing subsidiaries in major economies around the world.

As part of this initiative, Azbil established Azbil Saudi Limited as its overseas affiliate in Saudi Arabia, followed by a new factory that was constructed in November 2014 in Dammam 2nd Industrial City and has already started operation. The stage

is now set for manufacturing and selling valve products and offering maintenance and various other services to the petrochemical industry in the Middle East.

## Japan-style solutions for industrial plant operations ensure continuing safety and reliability

The history of the relationship between Azbil Corporation and industries in the Middle East began in the rush to construct large-scale industrial plants in that region that came about after the first oil shock, from the latter half of the 1970s to the 1980s. Azbil at that time had been delivering control systems and devices that were essential for plant operation to various customers via Japanese plant engineering companies.

As mentioned earlier, the azbil Group has been striving to implement its initiative of expanding business globally, and recently it took notice of the Middle East again, and in particular Saudi Arabia, where many Azbil products have been delivered.

Azbil Saudi Limited’s new factory can produce a variety of control valves ranging from small diameter valves to ones as large as 36 inches, in order to meet a variety of needs. Azbil Saudi Limited offers optimal maintenance services, and has the ability to analyze data and diagnose



**Tetsuya Kurasawa**  
Managing Director  
Azbil Saudi Limited

control valves while they are in operation, even those made by other companies, not to mention Azbil’s own control valves and instruments.

For example, one of the maintenance services needed most in Saudi Arabia is breakdown maintenance after a device such as a valve breaks and is replaced. This is a delicate task because it can upset the customers’ safe operation and steady production if something does not go well. Azbil Saudi Limited first identifies

improvement targets by doing a walk-through of the plant, and then applies analysis to understand the current situation of each device and to predict what symptoms will occur if there is a problem. Additionally, it gives customers a proposal for how to implement proper and systematic maintenance so as to reduce risks such as halting plant operations due to equipment problems. In this way, Azbil Saudi Limited helps its customers to achieve steady plant operation.

Perhaps it is only natural that this sort of thing is a strong point of Azbil Saudi Limited, whose parent company is Azbil Corporation, which has abundant experience in providing solutions to ensure the steady operation of plants in Japan and other countries. Also, as a business entity capable of providing a comprehensive range of products, including plant devices such as valves and sensors, systems such as the DCS\*, and applications closely tailored to the needs of the plant, along with engineering and related services, it is able to propose improvements for plants and their equipment throughout their lifecycle.

For the new factory, Azbil Saudi Limited obtained a foreign investment license from the Saudi Arabian General Investment Authority entitling it to do a broader range of

business than valve production alone, including maintenance of third-party products and instrumentation installation.

Furthermore, Azbil Saudi Limited has been approved by Saudi Aramco, one of the largest companies in the world in the oil and gas market, as a manufacturer of general-purpose control valves and an instrumentation installation company. It is now in Saudi Aramco’s database, broadening its appeal to global plant engineering and construction companies as a locally-approved company.

## Helping local industry and society with OJT and increased opportunities for employment

Azbil Saudi Limited has been helping to increase employment opportunities for people in Saudi Arabia and is sharing its technologies and know-how with them as part of its human resource development. It actively hires young people and gives them opportunities to learn practical skills through on-the-job training (OJT). Employees also have training opportunities at the azbil Group’s valve maintenance centers in Japan, and an internship program is offered for Saudi Arabian students. Azbil Saudi Limited also has a training facility of about 150 m<sup>2</sup> on the fac-

tory premises where it can also provide training opportunities for its customers.

The azbil Group intends to continue contributing to the long-term development of industry and society in Saudi Arabia and elsewhere in the Middle East. For that reason too it helps customers in this area through provision of lifecycle solutions and cultivation of the skilled personnel who are essential for the safe and reliable operation of industrial plants.



Back row from left: Saeed Al-Ghamdi, Safety & Health Manager; Isao Miyazaki, Vice President (sales); Yousuf Amoudi A. Rahman, QA Control Manager; Takashi Sugino, Plant Operation Dept. General Manager.  
Front row from left: Abdulaziz Al-Subaie, Vice President (administration & new business development); Tetsuya Kurasawa, Managing Director.

\* **DCS (distributed control system)**  
A system that monitors and controls the manufacturing process or production facilities at factories and plants. To achieve even distribution of load, the DCS distributes device functions over a network, resulting in safety and excellent maintainability.



Azbil Saudi Limited employees assembling a large diameter valve.

Key Points for Development

**Focusing on the difference between steam and water light absorption characteristics, Azbil has invented a dryness measurement method using light absorption analysis.**

Azbil Corporation has developed a new steam quality measuring system by focusing on the fact that water exhibits different light absorption characteristics depending on its phase, gaseous phase or liquid phase.

Generally, both gas and liquid have the characteristic of absorbing a different, particular wavelength of light. Therefore, measuring the spectrum of light passing through a material, such as a gas or liquid, helps to estimate the type and mass of that material. The ma-

terial's absorbance is proportional to its concentration and the length of the optical path through the material: if the optical path length is known, the concentration of the material can be calculated by checking the spectrum of light passing through it.

As to H<sub>2</sub>O, it has been known for some time that it exhibits a different adsorption spectrum particularly in the near-infrared region, depending on its form, vapor or liquid. First, the absorption spectrum is found by applying light of a certain wave-

length to a saturated vapor or saturated liquid. Then, the concentration of H<sub>2</sub>O molecules can be calculated to find the mass of saturated vapor. Finally the dryness can be calculated.

**Principles and algorithm for the steam quality measuring system**

Based on the light absorption characteristics of saturated vapor and saturated liquid, Azbil chose a wavelength that is hardly absorbed by saturated vapor or saturated liquid (reference) and a wavelength that is easily absorbed by saturated liquid (probe). Using these two types of wavelengths, the principles and algorithm for the measuring system were developed.

Achievements and Prospects

**Accelerated field testing in preparation for world-first practical implementation**

Using the absorption spectrum, Azbil has developed the principles for a steam quality measuring system that can accurately measure steam quality in real time. We have verified the compatibility of the system by using a prototype facility. Unlike a

conventional throttling calorimeter, which requires pipe branching for installation, the new system can be installed in-line. Azbil believes that the system's real-time measurement method can change the common understanding in the industry.

In order to put the system into practical use in 2016, Azbil is advancing field-testing for the system. It expects to be the pioneer that introduces a product with this

function into the market for the first time in the world.

If the dryness of the steam can be measured, systems that are losing steam energy can easily be identified, leading to energy conservation. In order to reduce the energy loss from steam systems around the world, Azbil is taking on a challenge the industry believes to be impossible, that of measuring dryness accurately in real time.

Background and Needs

**A simple and accurate way of measuring steam quality has never been seen before.**

High-temperature, high-pressure steam generated in boilers has been utilized for various applications in industry, such as hot air for heating, hot-water supply, electricity generation, thermal sterilization, etc. An H<sub>2</sub>O medium can easily be obtained, and among other advantages, the steam made in boilers is energy-efficient because the latent heat stored during change of phase from vapor to liquid can be used.

So, one of our challenges is to ensure constant and reliable delivery of saturated vapor that has been generated in boilers to heat exchangers.

The more saturated vapor in the same mixture is, the better it is. Steam with a

large amount of saturated vapor is considered to be high-quality steam. Quality, indicated by the dryness fraction, is defined as follows:

$$\text{Dryness} = \frac{\text{mass of saturated vapor}}{\text{mass of saturated liquid \& saturated vapor mixture}}$$

Dryness varies between 0 and 1. A dryness of 1 (100% gaseous phase in a steam pipe) is the most desirable value. Unlike relative humidity,\* which

is generally used to refer to the proportion of moisture in the air, dryness indicates the mass proportion of saturated vapor to total mixture.

In industry, it was believed that measuring steam quality directly in real time is extremely difficult. Only a device called a throttling calorimeter has been used to measure steam quality. However, installing one requires that the steam pipe to be branched, which affects the flow of the steam. Other disadvantages have also been pointed out. For example, it cannot measure steam quality in real time or steam that is close to the atmospheric pressure, and the measuring is not stable.

\*Relative humidity refers to the proportion of the water content in the air to the maximum water content the air can contain.

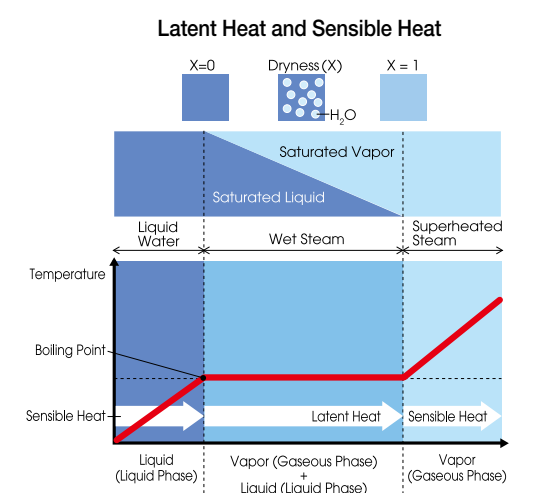
Column

Why is **latent heat energy-efficient?**

Steam can be in two different states: saturated vapor (gaseous phase) and saturated liquid (liquid phase). All substances absorb or emit heat during phase transition, including the H<sub>2</sub>O used in the system.

The energy that is necessary for such a phase transition is called "latent heat." Steam systems use a latent heat of 2258 kJ per kilogram of vapor at 1 atm.

On the other hand, the heat that is stored when a substance is in the gas or liquid form is called "sensible heat." The amount of sensible heat required is smaller than the latent heat. Saturated liquid water at 100 °C contains as little as 418 kJ at 1 atm. Obviously, latent heat is preferred to sensible heat because there is more energy that can be used.





**Indoor air quality (IAQ) refers to the quality of air within a room in a house or other buildings. It is determined mainly by factors such as dust, gases, temperature, and humidity, and it affects the health and comfort of those in the room.**

**IAQ in homes and offices affects health and state of mind.**

Have you ever had the experience of yawning repeatedly or being absent-minded or suffering headaches and other symptoms when spending a long time in your living room or in a company meeting room?

The effects of IAQ on people's health and state of mind are significant.

There are three factors that have a major effect on IAQ: the amount of particulates, the amount of gaseous substances, and the temperature and humidity.

The first factor, particulates (basically dust), includes lint from clothes and bedding, dead skin and hair from humans and pets, dead insects, bacteria, and pollen. Among the particulates, fungal spores and the dead bodies and excrement of mites cause allergic diseases in people, such as bronchial asthma and atopic dermatitis, if inhaled continuously.

The second factor, gaseous substances, refers mainly to carbon dioxide (CO<sub>2</sub>) and volatile chemical compounds (VOC) as well as carbon monoxide (CO), nitrogen oxides, and various odor-causing substances. Sick house syndrome became a big health issue around the year 2000 when it was pointed out that adhesives and paints used in construction materials and furniture are gasified into chem-

ical substances (such as formaldehyde) and cause various health problems.

The third factor, temperature and humidity, does not directly pollute air, but many people use air conditioners, humidifiers, or dehumidifiers to prevent excessively high or low temperature or humidity. Maintaining temperature and humidity at appropriate levels not only provides a comfortable room environment but also protects us from heat stroke in summer and "heat shock"\*1 in winter.

**Ventilation is essential for airtight houses. Energy conservation and removal of pollutants from air are also important.**

In Japan, government policy promotes the improvement of airtightness and insulation of houses and buildings to raise energy efficiency (efficient cooling and heating). Airtight houses and buildings, however, tend to cause the stagnation of indoor air. Thus, ventilation is essential for the improvement of IAQ. Currently in Japan the Building Standards Act mandates the installation of 24-hour mechanical ventilation equipment (extractor fans, air supply and exhaust openings, etc.) capable of replacing entire room air every two hours in newly constructed houses.

However, there is no guarantee that the IAQ will be improved by those ventilation

methods and conditions. Air pollution caused by fine particles (PM2.5\*2) has recently become a major problem. Hazardous substances and allergens should be removed from outside air before the air is introduced into houses and buildings.

At the same time, energy-saving measures are also necessary. The latest ventilation equipment utilizes heat exchange technology to recover exhaust heat for warming outside air before it enters a house or building in order to conserve energy.

Enhancement of IAQ cannot be achieved without improvement of the above-mentioned three factors in a balanced manner. When you ventilate or clean your room, keep in mind the importance of IAQ and pay attention to the quality of air.

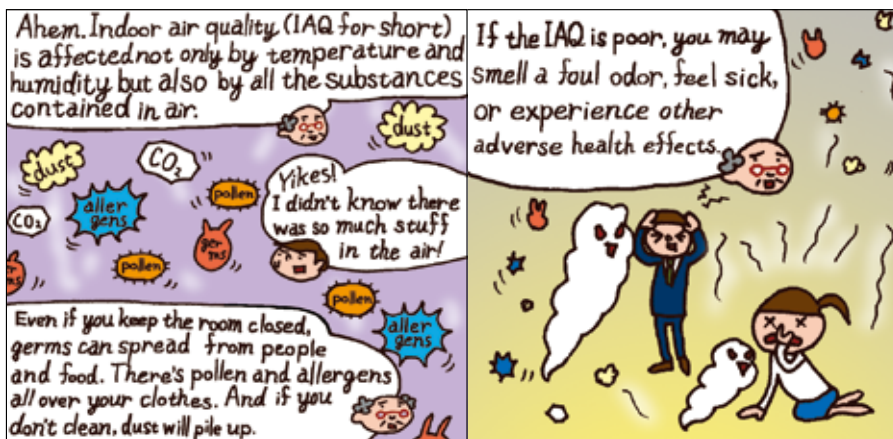
\*1. "Heat shock" in winter

Sudden temperature changes in winter, known as "heat shock" in Japanese, can cause health problems such as heart attack or irregular pulse. The risk is especially high for older people if they take a bath or use the toilet in an unheated bathroom in winter.

\*2. PM2.5

A general term for microscopic particles measuring 2.5 micrometers (0.0025 mm) or less in diameter. PM2.5 includes soot contained in exhaust gases from diesel engines and in cigarette smoke. Since PM2.5 can enter deep into the lungs, there is concern about its serious effects on the respiratory system and circulatory system.

Room temperature/humidity sensors not only measure temperature and humidity with high precision but also can detect and recover from measurement drift due to pharmaceutical substances in the air in research and production environments. These products offer long-term, reliable measurement of temperature and humidity in environments where organic solvents and pharmaceutical substances are present in the air.



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Yamatake Corporation changed its name to Azbil Corporation on April 1, 2012.

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 19F Tokyo Building, 2-7-3 Marunouchi, Chiyoda-ku, Tokyo 100-6419 Japan TEL: 81-3-6810-1006 FAX: 81-3-5220-7274  
 URL: <http://www.azbil.com/>



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