

Air & water pollution prevention 102-15, 103-1, 103-2, 103-3

Protect human health and the natural environment by preventing pollution of water and air through the manufacture or use of our products.

Kao's creating value to address social issues

Social issues we are aware of

It goes without saying that air pollution, water pollution and soil pollution can have a significant negative impact on human health, on agricultural crops and other plants, and on ecosystems. In order to create a sustainable Kirei life for all, besides conducting our business activities in a way that does not exert negative impacts, we also aim to work together with stakeholders to address pollution that has already had a negative impact, and to restore things to a sustainable state.

Atmospheric pollutants such as nitrogen oxides (NOx), sulfur oxides (SOx), particulate matter (PM) and volatile organic compounds (VOCs) are known to increase the prevalence of pulmonary diseases such as asthma. Most atmospheric pollutants derive from burning of fossil fuels or usage of organic solvents. Worldwide, around 8.8 million people die prematurely each year because of atmospheric pollution. In Europe alone, the figure is believed to be over 790,000 (according to a study by the University of Mainz in Germany). At the same time, in recent years there has been a trend for indoor spaces to be made as airtight as possible in an effort to make homes more energy-efficient. As a result, chemical substances in indoor spaces remain in those spaces for long periods, and their concentration levels rise. A

report (by Yokohama National University in Japan) suggests that this can have a negative impact on human health.

The vast majority of living organisms, including human beings, cannot live without water. Humans also need access to sanitary water in order to maintain Kirei Lifestyles. The main cause of water pollution is various substances contained in wastewater from plants and household sewage.

Negative impacts on human health resulting from soil pollution include the effects of both direct contacts with polluted soil by touching it or eating it and indirect contacts by using groundwater that has been polluted with harmful substances that have leached out from polluted soil. Significant characteristics of soil pollution include the fact that, once soil pollution starts to occur, harmful substances can accumulate in the soil over a long period, and the fact that people are less likely to be aware of soil pollution than they are of air pollution and water pollution.

We need to speed up the initiatives we are taking, and expand their scope in order to realize the SDGs by 2030. In January 2020, the United Nations started the Decade of Action in relation to the achievement of the SDGs.

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Risks related to realization of What Kao Aims to Be by 2030

Items		Content
Risks	Transitional risk	<p>Policies, laws and regulations</p> <p>Various policies and legal restrictions on air and water will be enacted, management costs may increase to comply with them. Investing in better facilities and developing of new technologies to comply with policies and regulations will mean higher equipment and operating costs, which could negatively impact our profitability.</p> <p>Additionally, the delayed production schedule could negatively impact sales, if national and local governments are urged to pass restrictions on operations due to the state of air pollution in areas where our plants are located and the state of water pollution from plant wastewater discharged in public water.</p> <p>Examples of possible policy or regulatory restrictions</p> <ul style="list-style-type: none"> •Air pollutant regulations •Regulations on substances depleting the ozone layer •Plant wastewater regulation •Regulation of use of chemical substances in products •Product labeling programs for environmental performance or chemical substance
		<p>Technology</p> <p>Increasing R&D expenses to address the risks posed to the air and water will mean higher operating costs, which could negatively impact our profitability.</p> <p>Risk of failing to increase sales if technologies developed do not work out</p>
		<p>Markets</p> <p>When regulations on air pollutants are tightened at a national or regional level, demand for chemical products that contain few or no substances causing air pollution (like organic solvents) increases, whereas sales for conventional chemical products are at risk of decline.</p> <p>When regulations on water pollutants are tightened at a national or regional level, demand for commercial-use products that contain few or no substances causing water pollution (like alkali) increases, whereas sales for conventional commercial-use products are at risk of decline.</p> <p>Sales could be negatively impacted if technological capabilities for products in development are not on a par with market demands.</p>
		<p>Reputation</p> <p>Our brand owner's reputation is at risk of decline due to so-called fragrance pollution from scents in fabric softeners and others.</p>
	Physical risk	<p>Acute</p> <p>Our plants may suspend operations and be unable to continue manufacturing products due to air pollution from forest fires or water pollution from oil tanker accidents. Similar conditions at suppliers' plants could make it impossible for us to procure raw materials, with the risk that we could not continue manufacturing products. There is also the risk that supply chains, from suppliers to our plants, and from our plants to our customers, could be interrupted. These risks, meaning that we could no longer supply our products to the market, would negatively impact sales, and if such risks actually materialized, would require special measures at additional cost, thus reducing our profits.</p> <p>In addition, if restrictions for large-scale air and water pollution significantly impact on the lives of consumers, consumption might fall, which would negatively impact on sales.</p>
<p>Chronic</p> <p>There's a risk that production may be unable to increase at the rate required for future growth due to our plants or supplier's plants being located in areas where air and water pollution are likely to become more severe.</p>		

Opportunities related to realization of What Kao Aims to Be by 2030

Opportunities	<p>Resource efficiency</p> <p>Optimizing logistics and reducing the distances that trucks are travelling without loads will curtail emissions of air pollutants and lower transportation costs, which means improved profits.</p>
	<p>Products, services</p> <p>PM, an air pollutant, has health consequences and in terms of beauty, is one of the causes of dull skin. The coal-fired power generation is expected to decline, decreasing the amount of PM in the atmosphere in the medium to long term with the objective to reduce greenhouse gas emissions. However, PM disappearing from all regions around the world is expected to take some time, which presents an opportunity for products that respond to PM in Health and beauty care and Hygiene and living care.</p> <p>In the industrial sector, there are opportunities for chemical products that reduce organic solvents and dust causing air pollution at worksites.</p> <p>Many of our products are discharged into the water environment after use. Surfactants powerful enough to reduce the usage of surfactants and alkali-free professional-use detergents offer an environmental value that improves water environments.</p>
	<p>Markets</p> <p>The manifestation of air pollution caused by PM presents increased sales opportunities by attracting attention to consumer products that respond to PM. Strengthened regulations on worksite organic solvents and dust present an opportunity to expand demand for chemical products that comply with such restrictions.</p>
	<p>Resilience</p> <p>Ongoing measures for air pollution and water discharge pollution at plants help increase our resilience to issues with air and water quality in terms of product manufacturing.</p> <p>In addition, the resilience of our businesses needs to be improved with activities suggesting new products by predicting consumer trends based on consumer feedback from the last 60 years or more and a database built for more than 40 years.</p>

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Kao's creating value

We are working to prevent air pollution and water pollution in the areas near Kao production plants by reducing emissions of atmospheric pollutants such as NO_x, SO_x and VOCs from our plants and reducing organic matter and other substances in wastewater discharged from our plants, by complying faithfully with the relevant laws and regulations in each country and region in which we operate, and by setting reference values that are even more rigorous than those required by law to strictly manage pollutants.

We propose various products for air pollution in Chemical, paying attention to maintain the health of people working around the world.

In order to ensure the groundwater used by locals is not polluted, we periodically survey the soil conditions at each plant for water pollution.

Additionally, we propose various products to help prevent water pollution in all our business units for household, commercial-use and chemical products.

Contributions to the SDGs



Policies

We utilize a wide range of chemical substances in our products, from home-use products to industrial products, and we continue to implement activities to minimize negative impacts of chemical substances at every stage from development to post-use disposal.

In our Basic Principle and Basic Policies on Environment and Safety, we undertake to “assess environment and safety aspects throughout the entire lifecycle of the products, from manufacture through disposal, when developing products and technologies” and to “offer products with a lower environmental burden.” Furthermore, the Kao Group Responsible Care Policy contains the following declarations: “We will strive to develop technologies for products that consumers and customers can use with peace of mind, as well as striving to provide products that have a low environmental impact” and “We shall strive to continue to reduce the environmental impact of our business operations by ... disposing of wastewater and waste gas appropriately.”

Our Environmental Statement embodies our commitment to ensuring that “Kao products utilize original Kao-developed technologies to minimize the impact they have on the environment, not just in the manufacturing process, but in the daily life of the customers who use them. From materials procurement and manufacturing, to distribution, sales, usage and final disposal, we want to engage in ‘eco together’ with stakeholders and consumers worldwide.”



Web

Basic Principle and Basic Policies on Environment and Safety

www.kao.com/content/dam/sites/kao/www-kao-com/global/en/sustainability/pdf/environment-safety-principle-policies.pdf

Kao Group Responsible Care Policy

www.kao.com/content/dam/sites/kao/www-kao-com/global/en/sustainability/pdf/responsible-care-policy.pdf

Kao Environmental Statement

www.kao.com/content/dam/sites/kao/www-kao-com/global/en/sustainability/pdf/environmental-statement.pdf

Education and promotion

We recognize the importance of giving our employees who handle chemical substances a variety of opportunities to obtain knowledge about the relationship between our business activities and products and air and water pollution, and to actively engage in pollution prevention activities of their own accord. We have created many opportunities for employee education accordingly.

Our employees take responsibility for air and water pollution prevention activities at plants and R&D on low VOC products and highly biodegradable products. Strengthening employees' air and water quality awareness helps to enhance the overall level of our activities in this area. A further point is that employees are also consumers, and in their role as consumers it is important that they take steps to prevent air and water pollution.

Specifically, we conduct environmental education including on air and water pollution prevention for all

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employees as part of our Responsible Care activities. We also provide education encompassing the importance of legal compliance pertaining to air and water pollution to all employees working at plants and research institutes that have obtained ISO 14001 or RC 14001 certification.

Collaboration and engagement with stakeholders

We recognize that, in order to help consumers realize the Kirei Lifestyle, it is vital for us to deepen mutual understanding with a wide range of stakeholders and collaborate with them, by developing two-way communication.

As the substances generated by our production activities that lead to air and water pollution have an impact on local communities, having good communication with local communities is also vitally important. Many of our plants compile an annual environmental report, and communicate with local residents.

Emissions of substances linked to air pollution and water pollution, which are from business activities, are regulated by government agencies. We have established our own voluntary management criteria which are even more rigorous than the statutory requirements, and we comply with these to monitor pollutants. Additionally, we continue to conduct water quality surveys not as a single company but as an industry group.

Distribution initiatives are required to help make improvements to air pollution. We are taking part in programs established by the Cabinet Office in collaboration with other companies in this industry.

Consumer behavior needs to change in order for consumers to attain the Kirei Lifestyle. We provide opportunities to think about the Kirei Lifestyle through visits to museums and plants that take as its theme the water that all consumers use daily. For example, the Eco-Lab Museum has displays on household sewage and wastewater treatment.

Smart Distribution in partnership with Lion Corporation

We are participating in the Cross-ministerial Strategic Innovation Promotion Program (SIP) promoted by the Cabinet Office. We started regular shuttle deliveries between Kao and Lion Corporation in October 2020. This new initiative will reduce the distances that trucks are travelling without loads, by comparison with conventional transportation methods, and is expected to result in a 45% reduction in atmospheric pollutants emissions for both companies combined.

Framework

Emissions of pollutants into the air or into bodies of water in relation to our business activities, and the current state of progress in addressing this issue, are managed under our Responsible Care promotion system.

→ Fundamental section > Responsible care activities > Framework
P276

→ Kirei Lifestyle Plan—Kao's ESG Strategy > ESG governance structure
P16

Mid- to long-term targets and performance

2025 mid-term targets

Index	Scope	2025 targets
% of plants which disclose VOC and COD emissions	All Kao Group sites	100% disclosure

Anticipated benefits from achieving mid- to long-term targets

Business impacts

Disclosing VOC and COD emissions pertaining to our business activities will improve the transparency of occupational safety measures and pollution measures. Maintaining employees' health and mitigating risks posed by pollution will contribute to lowering operational costs and improving profitability.

Social impacts

We anticipate that disclosing VOC and COD emissions pertaining to our business activities and engaging in an ongoing dialogue about this will improve communication with the residents around our plants and lead to reduced reputational risks concerning these emissions throughout society.

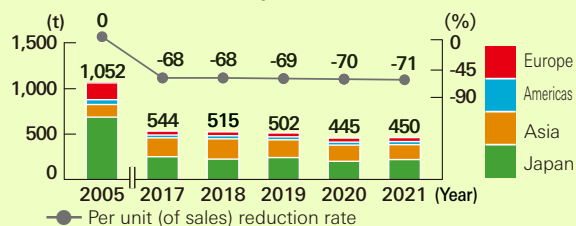
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Performance in 2021

Performance*

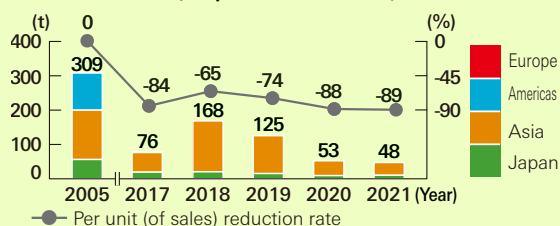
* Per unit of sales is calculated based on Japanese GAAP in FY2005, and on International Financial Reporting Standards from FY2017 onwards.

NOx emissions (all production sites)



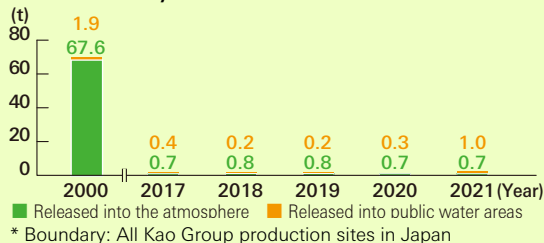
* Boundary: All Kao Group production sites
* Assurance provided for NOx emission figures

SOx emissions (all production sites)



* Boundary: All Kao Group production sites

Total emissions of chemical substances subject to the PRTR system



* Boundary: All Kao Group production sites in Japan

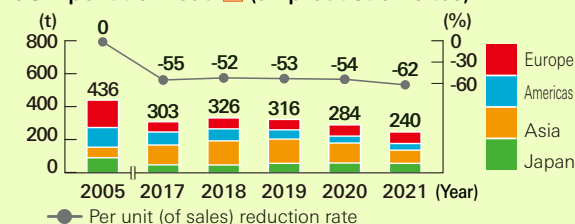
Emissions of VOCs

Although we have no facilities subject to the VOC emission regulations provided in the Air Pollution Control Act, we work to voluntarily cut VOC emissions.

For the 100 VOC substances defined in the notice issued by the Director General of the Environmental Management Bureau, Ministry of the Environment, we set voluntary targets on the annual atmospheric emissions from each plant for each substance (5 tons or less in 2005, 3 tons or less in 2009, 1 ton or less in 2010), conducted emission reduction activities and accomplished our targets. We are managing VOC emissions with the current target of maintaining our activities.

The group in Japan handled 33 types of VOCs in quantities over 1 ton in 2021, with total emissions into the atmosphere of 6.5 tons .

COD pollution load (all production sites)



* The amount of COD pollution load for wastewater entering sewer systems takes into account the removal rate from sewer systems. For some sites in Asia, it had not previously been possible to take into account the removal rate; improvement in this regard starting from 2021 is reflected in a 15t reduction.

* Assurance provided for COD pollution load

Compliance with environmental legislation

In 2020, there was an omission of the notification for minor changes to wastewater treatment facilities (sludge dewatering facilities) at the Kawasaki Plant, an omission of the regular inspection of the dust collector at Kao Specialties Americas LLC and insufficient water flow in the scrubber water (fine of 146,000 yen), and a leakage of ammonia water at Quimi-Kao, S.A. de C.V. (fine of 460,000 yen).

In 2021, there was a failure to install sufficient gas detection equipment at Kao Huludao Casting Materials Co., Ltd. (fine of 542,000 yen), an omission in reporting by the designated manager (fine of 1,444,000 yen) at the same company, and an instance of hydrogen sulfide levels exceeding the permitted value at Kao USA Inc. (fine of 1,192,000 yen).

Compliance status with environmental laws and regulations

Category	Unit	2019	2020	2021
Number of violations*1	incidents	0	4	3
Of which, number of leaks	incidents	0	1	0
Total fines**2	1,000 yen	0	607	3,178
Of which, number of leaks	1,000 yen	0	460	0

*1 All incidents detected by authorities during the reporting period

*2 Fines paid during the reporting period

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Our initiatives

Initiatives to prevent air pollution

Efforts at plants

Compliance with laws and regulations

The amounts and densities of pollutants emitted into the atmosphere are regulated by government agencies. We have established our own voluntary management criteria which are even more rigorous than the statutory requirements, and we comply with these to monitor pollutants.

Using cleaner fossil fuels

As burning of fossil fuels is accompanied by emission of NO_x, SO_x, PM, etc., we use natural gas—which is a clean fossil fuel—at all plants outfitted with the necessary infrastructure. Our plants do not use any coal.

Reducing emissions of chemical substances subject to the Japanese PRTR system

We began activities in this area by setting a voluntary target for annual emissions of one ton or less for each substance from each plant in FY2000. We achieved this target in FY2002. Since then, we have continued to achieve this voluntary target, excluding leaks of chlorofluorocarbon and similar emissions.

The number of chemical substances subject to the Japanese Pollutant Release and Transfer Register (PRTR) system of which we handled over 1.0 ton in 2021 was 71, and the total discharge of such substances into the atmosphere and public water areas was 1.6 tons. In addition, we are voluntarily

monitoring and controlling releases and transfers (in the same way as would be done for chemical substances subject to PRTR) of chemical substances that the Japan Chemical Industry Association has specified as being subject to voluntary surveys.

Reducing emissions of VOCs

Our production plants outside Japan include some plants where they have not been possible to monitor VOC emissions, or where the emissions are relatively high. We are working to monitor and reduce VOC emissions at these plants.

Initiatives taken in relation to logistics

Smart Distribution in partnership with Lion Corporation

We are participating in the SIP promoted by the Cabinet Office. We started regular shuttle deliveries between Kao and Lion Corporation in October 2020. This new initiative will reduce the distances that trucks are travelling without loads, by comparison with conventional transportation methods, and is expected to result in a 45% reduction in atmospheric pollutants emissions for both companies combined.

Initiatives taken in relation to our products

LUNAJET water-based pigment inkjet ink

Using the pigment nano-dispersion technology that we had previously developed, we successfully developed *LUNAJET*, the world's first water-based pigment inkjet ink, featuring a VOC-free design*

which ensures that only very small quantities of VOCs are emitted during printing operations, thereby helping to prevent air pollution and also making a major contribution toward improving the working environment of printing workers. We also confirmed that this water-based pigment inkjet ink technology can be applied to water-based gravure-printing ink.

* VOC-free design: "VOC-free" is defined as emitting less than 700 ppmC (in carbon conversion terms) of VOC during the printing process.

VOC is a collective term for organic compounds that are volatile and are transformed into gaseous form in the atmosphere. In Japan, VOC emissions are regulated by the revised Air Pollution Control Act.

Visco Top UT thickener for concrete spraying construction

We developed then launched full-scale sales for *Visco Top UT* thickener which significantly decreases dust generated when spraying concrete for mountain tunnel construction. *Visco Top UT* is able to substantially reduce the amount of dust generated even when using powder accelerator, which tends to stimulate dust dispersion. With only half as much thickener as would be needed with a conventional dust reducer, the dust concentration level can be reduced to 2mg/m³ or less (as recommended by the new dust guidelines that came into effect in April 2021). This is registered in NETIS*, the new technology provision system (Number: KT-200035-A) and is anticipated to be utilized in the various tunnel construction commissioned by national and local governments.

* NETIS: Database system operated with the objective of the Ministry of Land, Infrastructure, Transport and Tourism sharing and providing information on new technologies

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Initiatives to prevent water pollution

Initiatives taken in relation to product development

In product development, we incorporate considerations for impacts on the water environments of discharged water after product use. More specifically, we have investigated the biodegradability of raw materials that may be discharged into the environment and their impacts on common aquatic organisms using river water and activated sludge used at wastewater treatment plants. Through this investigation, we are actively promoting the development and use of raw materials with reduced environmental impact. We also plan to use AI and other technologies to investigate chemical substances with high environmental compatibility.

Efforts at plants

Compliance with wastewater related laws and regulations

The amounts and / or densities of pollutants discharged into rivers, the ocean and sewage systems are regulated by government agencies. We have installed and conduct high-level maintenance and management of wastewater treatment facilities at many plants. After properly treating plant wastewater, it is discharged outside the plant. We have established our own voluntary management criteria which are even more rigorous than the statutory requirements, and we comply with these to monitor pollutants.

Surveys of groundwater and soil contamination

In light of our past history of chemical substance use,

every year we voluntarily measure the levels of substances regulated by environmental standards in the groundwater within plant premises.

Initiatives relating to wastewater after product use

We are focusing on understanding the actual situation in relation to wastewater discharge after product use and we are conducting our own field surveys on an ongoing basis, such as environmental monitoring of river water to get an idea of the ecological risks of chemical substances.

To respond to globalization, we collaborate with experts to verify the effectiveness of mathematical models and develop new models for monitoring environments outside Japan and predictions of chemical substance concentration in rivers, aiming to ensure our business activities are environmentally friendly on the local environment. Recently in Japan, we are analyzing in detail the impact of chemical substances on ecosystems using data gathered from the river environment.

We are also participating in environmental monitoring that has been undertaken by the Japan Soap and Detergent Association since 1998. Currently we assess the environmental risks posed to ecosystems targeting four major surfactants in municipal rivers (measured four times per year at seven sites in four rivers). In the surveys conducted so far, the results show that these surfactants have consistently low risks to aquatic organisms.

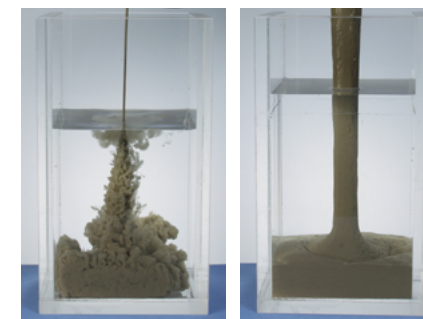
Initiatives taken in relation to our products

Visco Top high-performance specialty thickener

When undertaking civil engineering work near water (for example, on riverbanks or on the coast), it is vitally important that measures are taken to protect

the water from being contaminated. In the case of bridge pier construction for long bridges or suspension bridges that cross ocean straits, because the piers are actually built in the riverwater or seawater, special underwater concrete that has high viscosity and is resistant to washout is used. Furthermore, when construction is undertaken near underground watercourses, care must be taken not to contaminate the groundwater. For work in this kind of water-related environment, the use of additives to increase the viscosity of inorganic materials such as grouting materials and concrete can enhance underwater anti-washout performance.

We have developed *Visco Top*, a high-performance specialty thickener that provides un-precedented viscosity for grouting materials and concrete, and makes it possible to undertake construction work without polluting the riverine or ocean environment. *Visco Top* has been also used in the removal of high concentration contaminated water from trenches at the Fukushima Daiichi Nuclear Power Plant.



Without the addition of *Visco Top*

With the addition of *Visco Top*

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***Smash* alkali-free commercial use detergent**

Alkali detergent used for hard-to-remove kitchen stains must adjust (neutralize) its pH when the cleaning liquid is discharged to prevent water pollution, whereas neutral detergent without alkali generally does not have sufficient cleaning effects.

Smash, the newly debuted kitchen oil stain detergent, works safely with a neutral formula that has the same cleaning power as an alkali detergent, and contributes to preventing water pollution with its gentle ingredients.



Smash kitchen oil stain detergent

Employees' voice

Safe contamination removal technology for the disabled reactors at the Fukushima Daiichi Nuclear Power Plant



Noriaki Ushio

Material Science Research Laboratory 5

We are undertaking R&D work to develop safe contamination removal technology for the disabled reactors at the Fukushima Daiichi Nuclear Power Plant (Fukushima Daiichi NPP), which suffered extensive damage from the tsunami that accompanied the Great East Japan Earthquake of 2011. More specifically, we are undertaking the development of efficient technology that will reduce the risk of radiation exposure for the operatives, to facilitate speedy decontamination of the disabled reactors. We are proceeding with this research with the conviction that the cleansing technology research results that we have accumulated over the years can be utilized effectively in the decontamination of Fukushima Daiichi NPP.

We are challenging ourselves on a daily basis with the goal of helping restore Fukushima's beautiful natural environment as soon as possible, and of making it possible for people to live in the region with peace of mind.

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Stakeholder engagement



Kenji Furukawa

Professor Emeritus, Kumamoto University

Kao's response to the views expressed last year

Regarding the use of Tubifex worms to realize reduction of wastewater sludge, we are examining the question of which Kao plants would be suitable candidates for the full-scale application of this method, in terms of how suited they are to stable growth of the Tubifex worms. We are considering strategies for preventing the pH level from falling too low when using microorganism treatment on wastewater with a high nitrogen content.

At Quimi-Kao in Mexico, an adequate supply of water is ensured by using treated water from the local government authority's wastewater treatment facility, due to restrictions on groundwater usage. Kao plants in Taiwan are starting to be affected by drought risk, and so consideration is being given to reusing treated water. We feel that a significant issue here is how to ensure safety when using treated water.

With regard to VOC emissions at overseas plants, we have begun to disclose the VOC emissions of those plants that have calculated their emissions on a dedicated emissions webpage. Besides working to reduce emissions, we are also proceeding with efforts to determine emissions levels at those plants where emissions measurement has not been performed due to there being no statutory requirement to do so.

Assessments of and expectations for Kao's initiatives on prevention of air and water pollution

By reading the Kao Sustainability Data Book 2021, I was able to develop an understanding of Kao's business management, which emphasizes an ESG perspective. Kao's initiatives in this area have secured the company a Triple A rating (the highest possible) for the Climate Change, Forests and Water Security aspects of environmental data disclosure through CDP for two consecutive years, in 2020 and 2021. Out of 12,000 organizations throughout the world whose data disclosure was evaluated, only 14 companies secured a Triple A rating, and only 2 of those were Japanese companies. The CDP's evaluation thus represents recognition of Kao's status as a world leader in environmental data disclosure.

In the following sections, I would like to comment on Kao's initiatives in FY2021 to prevent air and water pollution.

1. Initiatives to prevent air pollution

SOx and NOx emissions from worksites in Japan remained at roughly the same level as in the previous year. NOx emissions from the Wakayama Plant, which is Kao's most important production site, were noticeably high, so Kao will need to

focus its attention on the Wakayama Plant if it is to achieve further reductions in NOx emissions. Kao has accurate data regarding VOC emissions from its worksites in Japan. Hereafter, while continuing to accumulate VOC emissions data, ideally, Kao should also clarify the methods to be used for reduction of VOC emissions, and the target reduction amounts. The process of determining VOC emission levels at production worksites outside Japan has only just got underway, and there are still many worksites for which data are not available. Of those worksites for which VOC emission levels have been clarified, it is noticeable that VOC emissions at worksites in the U.S. and in Spain tend to be quite high. In this regard, there is a need for response measures that would include reviewing the production methods used, and making changes to the emissions reduction technology used.

2. Initiatives to prevent water pollution

While the COD emissions load from worksites in Japan have been kept at a low level by the strict discharge regulations, the COD emission load of worksites in Southeast Asia and Germany are relatively high. It is to be hoped that Kao will respond to this situation, in ways suited to local circumstances, and that this response will include

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the transfer of the advanced COD removal technology that Kao has accumulated through its business activities in Japan.

3. Use of Tubifex worms for volume reduction of wastewater sludge

To achieve volume reduction of organic sludge that is generated during the biological wastewater treatment process, Kao is focusing on the use of Tubifex worms. In order to create a stable habitat for the Tubifex worms within the wastewater treatment tank, it is necessary to provide the proper growth environment (in terms of temperature, salinity, pH value and habitat), while keeping the organic loading at a low level. Industrial wastewater tends to contain an unsatisfactory balance of nutrients, as well as being too highly concentrated, and having low buffer capacity. If a wastewater treatment process is operated under low organic loading so as to create a suitable habitat for Tubifex worms, then nitrification may occur, causing a decrease in pH, in which case the Tubifex worms cannot survive. By circulating the nitrified sludge liquor to the front end of the wastewater treatment tank, where a low dissolved oxygen environment has been created by reducing the aeration, it is possible to induce denitrification and prevent the pH value from becoming abnormally low. To

transform existing wastewater treatment tanks so that they are capable of denitrification, an agitator needs to be installed. If aiming to use Tubifex worms in wastewater treatment tanks for volume reduction of wastewater sludge, it is recommended to replace diffuser aeration systems with underwater mechanical aerators when the aeration system is renewed.

It would seem advisable for Kao to identify, from among its various worksites, which worksites discharge wastewater that is suitable for treatment using Tubifex worms and then install this system at an actual wastewater treatment plant to clarify the attainable cost reduction. Hopefully, going forward, this treatment method can be adopted for wastewater treatment not only within Japan but also at worksites outside Japan, so as to bring about a reduction of wastewater treatment costs.

Industrial wastewater treatments often involve coagulation treatment to remove substances that inhibit treatment, and this process generates large quantities of inorganic sludge. Ideally, Kao should adopt an integrated approach to reducing the amount of inorganic sludge and organic sludge through reconsidering raw materials, manufacturing processes and wastewater lines.

Finally

Kao has made a serious effort to reduce emissions of air pollutants from its plants, and to reduce the pollution load from its wastewater plants. These efforts have produced meaningful results, and have won high praise. With global warming progressing rapidly, the 21st century will inevitably be an era in which water is of great importance, and securing stable access to water resources will be an urgent task. In Japan, which is blessed with rich water resources, there is no pressing need to reuse treated water, but for Kao, which aims to continue conducting its business activities sustainably on a global scale, the issue of water resources is one that cannot be avoided. As a leading company in the disclosure of environmental data, it is to be hoped that Kao will work actively to safeguard water resource stability in harmony with the local community, to implement production activities in a water-saving manner, and to realize the reuse of treated wastewater.