

Development and Sales of Environmental Products and Technologies

Working closely together as one unit, the group companies of Cosmo Oil are applying their wealth of petroleum-related technology in the research, development and sale of environmentally-related products. These technologies and products are not limited to the petroleum industry, however, and have been introduced into many other industries as well.

Cosmo Research Institute

(from July, 2001, Research and Development Center)

From Desulfurization to Soil Remediation Technology, Applying Petroleum Technology Experience to Environmental Support

Cosmo Research Institute is involved in a wide range of research and development in petroleum technology. One part of that development is active work on technology related to the environment, with the results being applied not only by Cosmo Oil but by other companies and industries as well.

The Institute successfully applied biotechnology to the excess sludge resulting from the wastewater treatment process at oil refineries, with the resulting technology, currently under patent application, able to drastically reduce the amount of excess sludge. This technology will be put into field test in our refineries from 2001.

In research and development on soil remediation, methods for precisely measuring the amount of oil in the soil and for evaluating the possible application of bioremediation—a remediation technology using microorganisms—were successfully developed. Practical evaluation test will be made in 2001.

Much of the Institute's technology has focused for many years on research and development on the production of products with low environmental impact. With regulations on the content of sulfur in diesel fuel scheduled to reduce allowable levels from 500ppm to 50ppm, special effort is currently being placed on the development of catalysts able to meet this need. Even with this difficult demand for desulfurization materials, a highly activated catalyst has been developed, with performance evaluation in oil refineries scheduled for 2001. If the desired effects are confirmed, it is also expected that this catalyst will contribute to the reduction of infrastructure expansion and operation costs.

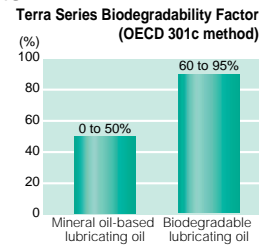
Hydrogen production technology is being applied in the development of fixed fuel cells. Fuel cells are seen as the next-generation energy source, because the exhaust they produce contains very few pollutants. A trial production unit was completed in the spring of 2001. A new

technology called ATR (Auto Thermal Reforming)*, used to promote the development of hydrogen production technology, is also being applied for the further miniaturization of fuel cells.

Cosmo Oil Lubricants Co., Ltd.

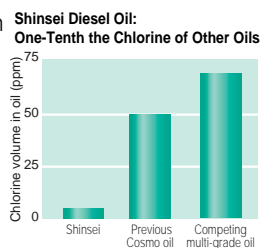
A Unique Approach to Low-Chlorine and Biodegradable Products

Cosmo Oil Lubricants bases the development and sale of its many low-environmental impact lubricating oils on its individualistic philosophy. Cosmo Terra is a series of synthetic lubri-



cating oils with a highly biodegradable structure. Because the oils are decomposed by microorganisms into carbon dioxide and water, they help to protect river, marsh, ocean, soil and other environments. It is a series with wide applications, from oils for outboard motors and chainsaws to grease for construction and agriculture, with the environmental friendliness that has resulted in their being certified as Green Mark products.

Chlorine is an effective additive for increased lubricant performance, but its potential role in dioxin production has been noted in recent years. To respond to this, Cosmo Oil Lubricants in 1999 was the first in Japan to release a chlorine-free lubricating oil. Cosmo Shinsei Synthetic Diesels. Oil for diesel cars has a level of chlorine just one-tenth that of normal oils. By combining a high viscosity-index oil base with chemically synthesized oil, it not only provides the benefits of low-chlorine oils for the environment, but also contributes to extended engine life and a greater distance between oil changes. And the Cosmo Clean series of metal processing oils provide low-chlorine benefits in metal cutting, punching, pressing and processing, solving the problems associated with chlorine in disposal and washing.



For gasoline engine cars, the newly-developed Cosmo Lio SL series of engine oils provides reduced fuel consumption, and increased heat resistance, stable oxidation, durability, cleansing and anti-wear actions. The Lio SL series has been designated as an environmental brand by the American Petroleum Institute (API).



Cosmo Lio Supreme



Experimental plant for slurry method biotechnological soil remediation

*ATR (Auto Thermal Reforming)

In the manufacture of hydrogen, oxygen is mixed with the raw materials (hydrocarbon and steam) oxidizing a portion of the raw material and providing the heat for hydrogen generation.

Cosmo Engineering Co., Ltd.

Applying Hydrocarbon Vapor Recovery and other Oil Refinery Technology to Other Industries

Cosmo Engineering, which shoulders the responsibility for the construction and maintenance of our oil refinery equipment, has also made a major contribution to environmental activities at the refineries.

The company developed the hydrocarbon vapor recovery units used during shipping at oil refineries and oil storage depots and at other times to recover gasoline and other vapors. In 1997, the recovery unit using this independently developed adsorber, the application of a property now called the Cosmo adsorption system to adsorb vapor, was first put into practical use. This unit is now being supplied not only within Cosmo Oil, but to other petroleum companies as well. For example, the same technology was put to use in a volatile organic compound (VOC) recovery device which provides a high recovery rate and space-saving size, and has been praised for its high level of safety. These factors all contribute to its wide use in the chemical, printing and pharmaceutical industries.



Hydrocarbon vapor recovery unit

Cosmo Engineering also introduced the fixed-bed adsorption unit technology for the removal and disposal of dioxin. This very successful development, installed in existing incinerators after the ash collection stage, can greatly reduce the concentration of dioxin, with removal rates of 99 percent or more. This is a great contribution to the decrease of the dioxin generated by municipal trash or industrial waste incineration facilities.



Dioxin removal unit

The process wastewater treatment technology developed for oil refineries is also finding application in the livestock industry for the control of animal waste materials. The high-efficiency active sludge unit, film-separation active sludge unit, denitrification and phosphorus removal unit can be combined for an advanced level of treatment. This has been introduced into hog farms in response to laws restricting the dumping or burial of wastes.

Cosmo Ventures, Inc.

Petroleum-Related Technology for the Development of Environmentally-Related Products

Cosmo Ventures, Inc. is involved in the development and sale of technologies based on petroleum-related technology for the reduction of

environmental impact, but which can be applied to other industries.

The Bioflora kitchen wastewater treatment system for restaurants and other locations is one such product based on Cosmo's-exclusive technology. The Bioflora 01 developed from this unit can, for example, handle the treatment of water-soluble cutting oil wastewater. By using special microorganisms, oil or organic materials in the wastewater are biodegraded into water and carbon dioxide. Unlike existing treatment facilities, no chemicals or filtration films are necessary, and almost no sludge is generated. The aim now is for market expansion, targeted at factories striving to improve their environmental conditions.

Efforts are also being made to replace flon gas with the development and creation of new cleaning agent products. Petrosafesol is an environmentally safe and gentle cleaning agent replacing specific flon or 1.1.1 trichloroethane as a detergent. It has excellent washing and drying properties, and does not require equipment for washing with water. It has gained attention as a true next-generation cleaning agent.



Bioflora 01

Cosmo Trade & Service Co., Ltd.

Surface-Strengthening and Heat Insulation Materials: Sales of Outstanding Domestic and Foreign Environmental Products

Cosmo Trade & Service is an integrated trading company; in 2001 a new Environment Development Division was established to reinforce the handling of products related to environmental protection. It is the Japanese dealer for Ashford Formula, a US-based concrete protector and strengthener. The Ashford Formula is used to strengthen floors and other areas of warehouses and other concrete buildings, helping to protect employee health and ensure product quality by suppressing concrete dust.

The company is also the importer and distributor for Super Therm, a heat insulation coating material first developed by NASA of the US. It has been shown that the product can reduce solar light by 92 percent, achieving major air conditioning savings. Sales are being developed in a variety of industries.



Example of Ashford Formula application