

A large, clear plastic bottle is shown floating in the ocean. The bottle is partially submerged, with its neck and cap above the water line and the main body below. The water is a deep blue, and the sky is a lighter blue with a bright sun visible in the upper left corner, creating a lens flare effect. The bottle has some scratches and appears to be a standard PET bottle.

New Solution to Solve Marine Pollution

**“Urban Rig” from Japan has
successfully turned wastes into
renewable energy**

Water is the source of life, and the ocean gathered by water is of great significance to humanity. The ocean provides society with critical natural resources such as pharmaceutical materials, food and energy. According to United Nations predictions, by 2040, marine garbage will reach more than 4,000 tons, of which plastic products have the greatest impact on the marine environment. Therefore, how to change human activities to ensure the diversity of marine species and the long-term maintenance of its ecological environment is a top priority, which is what the 14th Sustainable Development Goal (SDG) hopes to achieve.

In 2020, Urban Rig Company in Osaka, Japan, successfully converted marine garbage into light diesel oil and charcoal without producing harmful gases. In the following three years, Urban Rig (a device with the same name as the company) made a huge contribution to the treatment of marine debris in Zhejiang, China. Urban Rig's waste disposal volume and profits generated from energy production demonstrate its potential to achieve the first goal of SDG14, "significantly reduce marine pollution of all kinds".



Largest size Urban Rig. The efficiency of garbage disposal is 5 times that of portable. The picture comes from Urban Rig's YouTube channel.

The stalemate facing plastics

Standard waste disposal methods are unsuitable for marine debris because it combines seawater and plastic products. Landfilling plastics take up much land, and long degradation times will seriously affect the sustainable use of land. Burning plastic produces toxic gases such as carbon dioxide and dioxins. Plastics soaked in seawater will also release chlorine during incineration, damaging the heating equipment. Although many manufacturers have chosen degradable plastics to speed up the decomposition of plastics in nature, the decomposition results of this material are not complete. Most plastic products on the market today that is labelled as "100% recyclable" are made from traditional plastic mixed with biodegradable masterbatch. The degradable plastic made through this method can be decomposed into fine particles under the action of light and heat conditions and microbial enzymes. However, the degraded particles will still retain plastic molecules. These molecules will come into the natural cycle and eventually enter the human body through the food chain. According to a 2022 article by *The Guardian*, Laura Sadofsky and her team at Hull York Medical School in the UK discovered microplastics deep in human lungs for the first time. Although the impact of plastics on health has become evident, completely replacing traditional plastics with degradable masterbatch is still challenging to implement because it would double the manufacturing cost of plastic products.



A picture of Urban Rig working on a truck, from the Urban Rig official website.

Non-hazardous, portable and durable

Urban Rig's device shows the possibility of cleanly disposing of marine debris without impacting the cost of making plastic products. The key technology of this device is superheated steam. Superheated steam further heats water vapour to reduce the oxygen content in the steam. In a heated environment lacking oxygen, plastic will not react with oxygen. Thus, Urban Rig prevents the harmful gas dioxin from being generated during the garbage disposal. In an interview with Japan's Public Relations Office, Urban Rig representative Ito Tomoaki explained how Urban Rig's device heat-treats marine debris while preventing chlorine from corroding pipes. "When waste enters the device, the first step is pyrolysis. During this process, seawater will vaporise before plastic, so setting up a catalytic converter for chlorine can effectively prevent device damage", he says.

Ensuring the durability of Urban Rig is the basis for clean disposal of marine debris. Its crucial contribution to the sustainable development of the marine environment is to convert plastic into energy. It can recover oil and charcoal from marine debris for reuse. Ito explains the subsequent recycling steps for the device. "The second step of the Urban Rig is to condense and pressurise the gases produced by the pyrolysis process in the first step to extract the oil in the plastic. This step leaves solids that are difficult to vaporise, such as charcoal and metal. They can be reused through manual screening," he says.

According to data provided by Urban Rig, the device can recover 10,000 litres of light diesel and 50 cubic meters of charcoal from 200 cubic meters of marine debris containing 10% plastic. The energy extracted from waste can also supply part of the device's operation, reducing the garbage recycling cost. In addition, unlike traditional garbage recycling stations, Urban Rig has a compact design, making its deployment more convenient. The device weighs only 10 tons. With its small size, the finished product can be transported by truck to the coastline or directly put into use on ships, reducing the cost of installation and garbage transportation.

"We hope Urban Rig can show society a low-cost way to recycle marine debris, then people will understand that protecting the ocean does not necessarily require reducing human activities"
- Ito Tomoaki



Staff at Ocean Cloud Warehouse are collecting garbage. The picture comes from China National Radio News reporter Shang Tianyu.

Pilot project achieved significant results

The performance of Urban Rig in recycling marine debris in Zhejiang, China, illustrates the positive contribution this technology may make in protecting aquatic resources in the future. Fishermen in Zhejiang Province can use a mobile application to declare marine debris salvaged while fishing and receive subsidies based on the weight of the waste. The waste will then be transported to the Urban Rig, near the coastline, for processing. The light diesel recovered by Urban Rig will be directly used as operating fuel for the equipment.

At the same time, the remaining charcoal and metals will be transported to the Ocean Cloud Warehouse 200 kilometres away. AI will sort different materials in the warehouse and send them to different conveyor belts for separate processing. The final output materials will be manually inspected for quality and sold to various factories. Xianwei Fu, the person in charge of Ocean Cloud Warehouse, explained in an interview with Xinhua News Agency how this series of measures ensure the sustainable development of marine resources.

“We use emerging technologies to turn the garbage collected by fishermen into industrial raw materials and “feedback” them with the profits generated from garbage recycling. This proactively increases people’s enthusiasm for recycling waste and allows us to clean the ocean while utilising marine resources”

Limitations of the new technology

Urban Rig has yet to be put into large-scale use today because the processing speed still needs to be improved, with an upper limit of only 5 tons per day. According to data from the *Bulletin on the Status of China’s Marine Ecology and Environment*, nearly 15,000 tons of marine garbage were produced in 2022 alone. This means that the current speed of Urban Rig’s processing of marine garbage makes it difficult to fulfil the needs at the national level. Xianwu Tang, author of environmental literature *The Vicissitudes of Homeland*, expressed his views on the future of protecting marine resources to promote sustainable development.

“Urban Rig shows the government a new perspective on how humans can maintain marine resources for sustainable development. Controlling marine debris should not just be the effort of the masses. The government needs to take the initiative to promote new technologies so that we can ultimately protect the marine environment”
- Xianwu Tang

With further research and development of technology and the government’s promotion of the garbage recycling model created by Urban Rig, it will have the potential to significantly reduce pollution caused by marine debris and achieve the first goal of SDG14.



Plastic waste from the ocean washes up on the beaches of Qingbang Island. Picture taken by Sina Hong Kong.