The MAGnificent Seven GUNNING FOR MARINE WASTE

With tight new regulations governing the disposal of waste from ships introduced at the beginning of the year, a small scale waste gasification system developed by in Canada may just hold the answer. Having been successfully trialled by the U.S. Marines and others, the MAGS V7 system has now been launched commercially.

by Ben Messenger

The need to clean up the world's oceans is not a new one. While hard statistics are difficult to come by, back in 1997 the U.S. Academy of Sciences estimated the total input of marine litter into the world's oceans at approximately 6.4 million tonnes per year. Recent figures from the European Commission claim that the figure could be as much as 10 million tonnes. Research suggests that much of the waste entering the marine environment is from land based sources. However, a significant portion comes from shipping, be it items accidentally dropped overboard, or deliberately dumped.

In 1988 Annex V of the International Convention for the Prevention of Pollution from Ships (MARPOL) - the main international convention addressing the issue - came into force. For the first time the disposal of different types of waste generated onboard ships was regulated, with the most important feature of the Annex being the complete ban imposed on the disposal into the sea of all forms of plastics. By 2001 the agreement, which was applicable to all vessels over 400 tonnes or certified to carry 15 or more passengers, had been ratified by 100 states, covering 86% of the world's shipping by tonnage.

However, despite the efforts of MARPOL, harmful wastes continued to accumulate in the oceans. In 2001, funded by the U.S. Environmental Protection Agency (EPA), environmental charity Ocean Conservancy undertook the National Marine Debris Monitoring Program (NMDMP).

The goal of the program was to assess marine debris sources and trends in the U.S. using trained volunteers to conduct monthly surveys on designated beaches over a five-year period. According to the EPA the report indicates that approximately 49% of the items collected from beaches across the U.S. originated from land based sources, 18% from ocean based sources, and 33% from general sources (items that could have originated on land or at sea).

GETTING TOUGH

In 2006 the International Maritime Organization's Marine Environment Protection Committee (MEPC) established a group to develop the framework, method of work and timetable for

a comprehensive review of MARPOL Annex V. By Autumn 2010 the review was complete and in July 2011 the organisation adopted the amendments to Annex V by resolution MEPC.201(62), which entered into force on 1 January 2013.

Under the newly revised MARPOL convention, the disposal of almost all types of waste to the sea is prohibited, with the exemption under specific requirements of food waste, animal carcasses, cargo residues contained in wash water and environmental friendly cleaning agents. The revisions also lowered the threshold at which ships become subject to the convention to 100 tonnes or 15 passengers.

As a result of these regulations more and more ships will need to dispose of ship generated waste at suitable reception facilities ashore. However, the storage and handling of the waste can be eased if on-board treatment solutions are used to reduce the bulk and/or weight of the waste.

MAGS has recently completed a second field test

MICRO AUTO GASIFICATION SYSTEM

One small Canadian company based in Montreal believes it may just have the solution. According to Terragon Environmental Technologies, its Micro Auto Gasification System (MAGS™) is able to treat all types of waste on-board ship, with no requirement for pre-treatment.

For operation, waste contained in a regular refuse sack is manually fed into the gasifier, where it is heated with a small amount of air to enable the waste to be gasified into 'biochar' and synthetic gas (syngas), which is mainly carbon monoxide and hydrogen.

The biochar settles at the bottom of the chamber, while the syngas travels into the combustion chamber where it is ignited. The hot gases produced by the combustion are directed beneath the gasifier in a heat exchange zone where they transfer energy to the gasifier, before being instantly cooled with water. The cooled gases are then passed through the system's scrubber where pollutants are removed.

According to the company, the remaining emissions are odourless and meet the most stringent environmental regulations around the world. Additionally the system also recovers thermal energy in the form of hot water.

The system is electronically controlled to maintain a constant 650°C in the gasifier and 1100°C in the combustion chamber. While the system is capable of processing all types of waste, if a particularly moist batch of waste is treated the process may take longer to complete, and the electronic control unit may supplement the syngas in the combustion chamber with diesel to maintain temperature.

DEVELOPMENT

According to Theodora Alexakis, vice president of business development at Terragon, the development of the system began in 2005, with the idea to create an appliance that enabled a habitat to treat its own waste on-site, and to recover energy from that waste.

"At the time it was a concept, but the habitats that were most ready to receive such an appliance were Navy ships. So with support from both the Canadian and the U.S. Navies we received funding to develop the technology," she says.

With the company currently marketing the seventh iteration of MAGS, Alexakis explains that the development of the system has been a journey from a research system through proof of concept systems to automated prototypes ready for field testing.

"We develop systems to the point where we have a prototype that we can put in the field to have them tested by other people and have them validated. Once we do that we get useful feedback in terms of the operability of the system, ease of maintenance and accessibility, and make design changes based on that," explains the VP of business development.

"The first system to go into the field was V4, and then we had a couple of iterations to improve the operability and usability of the system and now we have our final design, which is a commercial system right now," she adds.

FIELD TESTS

In 2011 the Canadian Navy's Director, Maritime Ship Support (DMSS) installed Terragon's MAGS system aboard the HMCS Protecteur in Victoria, British Columbia. The installation was for demonstration and field test purposes, treating the waste generated by the ship's 240+ sailors. The project was supported by Sustainable Development Technology Canada - a foundation created by the Canadian government and which operates two funds aimed at the development and demonstration of innovative technological solutions.

The company had also previously run a demonstration with the Maersk Shipping Line, which installed a MAGS system on a cargo ship to field test its ability to conserve valuable storage space and to better manage waste disposal while at sea.

While the revisions to the MARPOL convention could clearly make technologies such as MAGS an attractive option for future ship builds, the company does not see the system being limited to the maritime market. Indeed, Terragon recently completed a second field test with the U.S. Marines in Hawaii.

"The U.S. Marines have been a champion for this technology. This is the second field test we've done with them. We had a previous version, a V5 installed at Camp Smith in Hawaii which operated successfully for about a year treating all types of waste," explains Alexakis.

"Based on the success of that project we built what we call a 'MAGS in a box' – a containerised version that the U.S. Marines tested at PTA in January in Hawaii. The containerised version is meant to be a standalone version that is transported and can be used to treat waste at forward operating bases anywhere in the world," she adds.

STEPPING UP

In the marine market Terragon has designs on more than just solid waste treatment. The company is currently developing what it calls the System for Total Environmental Protection (STEP™), which integrates MAGS technology with its Wastewater Electrochemical Treatment Technology (WETT™). The WETT system is designed to remove bulk and suspended solids, and dissolved solids, as well as to inactivate pathogens such as bacteria, viruses, moulds and spores.

According to Terragon its goal for STEP is to produce a single compact system which can simultaneously treat solid and liquid waste. All incoming solid and liquid waste is processed by the system into inert ash, gaseous fuel, sanitised inorganic material and pathogen-free clean water that can be safely discharged into most environments or recycled.

"We have a very interesting project where we're looking at the feasibility of designing a ship with this idea in mind," explains Alexakis. "What we're doing right now is a paper study but we have various participants and we are looking at three different categories of ship and what would be the impact of having such an integrated approach in terms of operational impact, environmental impact and financial impact."

The company sees the maritime market being potentially significant for its STEP technology and is investigating its applications for commercial ships, Navy ships and off-shore vessels. It also has its first demonstration project for the technology underway with the Canadian Coast Guard. However, it also sees opportunities for the technology outside of shipping - such as in enclosed habitats.

"Shipping is one market for this STEP technology, but we're also looking at various remote locations such as in the arctic," says Alexakis.

THE FUTURE

While the tightening of maritime waste regulations can surely only be a good thing for companies offering onboard waste treatment solutions, lead times on new shipping can be long. Furthermore, the willingness of ship owners to be early adopters of new technology can be low. However, with its ability to transform a wide range of waste streams into a greatly reduced residue and thermal heat, the appeal of the MAGS system extends well inland.

"Interesting markets include the military, hotels and resorts, hospitals, communities, work camps, the market is very broad for such a system," concludes Alexakis.

To build on its successful field tests, both on land and at sea, the company sees a window of opportunity for the technology to gather momentum and create a network of industry specific partners to support its commercialisation. In the longer term, if the technology finds mass appeal in the target global markets, the small Canadian company will need large commercial partners to truly achieve its vision of enabling every habitat to recover resources from its own waste.

When it comes to the success or failure of a new technology it's hard to predict the future. Many of us are still waiting for the flying cars and moon bases we were promised as children.

But in contrast to those bold predictions of the past, this technology is already with us and at demonstration level, at least, is proven. Throw in the tightening maritime waste regulations and the availability of government and military funding and support, and it starts to look as if there may just be a magnificent future for MAGS.

Ben Messenger is the managing editor of WMW magazine
e-mail: benm@pennwell.com

This article is on-line.
Please visit www.waste-management-world.com