Cigarette butts are widely discarded on beaches and end up in the sea

IN SEARCH OF GREENER SEAS

The results of the 2019 IET Global Challenge have been announced, with two inspiring projects winning the accolades.

By **Tim Fryer**

WERE Samuel Taylor Coleridge able to update his 'Rime of the Ancient Mariner', he might have changed its most famous line to: "Water, water everywhere, nor any drop without plastic contamination." For in the 185 years since he wrote the poem, the challenge is no longer how to survive the seas, but is how the seas are to survive, given the rubbish we put in them. Apart from climate change itself, it is arguably the most pressing and high-profile environmental issue facing the world at the moment. It is timely, therefore, that the 2019 IET Global Challenge focused on this issue.

Young engineers (aged 18-35 years old) were charged with finding solutions to two specific tasks. Firstly, the Greenpeace Challenge looked for ways to reduce plastic waste by addressing the use of superfluous packaging of supermarket products. Secondly, The Green Seas Challenge invited an innovative solution for clearing cigarette butts from beaches.

The winning teams came from Malaysia and the UK respectively and will receive their awards at this year's IET Innovation Awards on 13 November in London.

Plastic food packaging is a major source of marine pollution

GREENSEAS CHALLENGE

WINNER: BAYWATCHERS

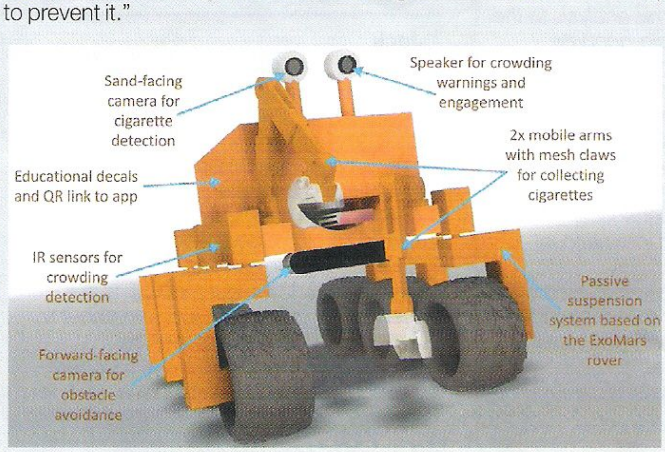
Cigarette butts have become a huge problem. Around 4.5 trillion of them are thrown away as litter every year and, as they are not readily biodegradable, often find their way into the oceans. Used filters contain toxic chemicals, which can leach into the water and it only takes one discarded cigarette butt per litre of water to kill a fish. Popular beaches are a particular problem, which is why the GreenSeas Challenge was to develop a robot for cleaning the beaches of cigarette butts specifically.

The winning team was called Baywatchers and was made up of engineers on the UK Atomic Energy Authority graduate scheme. Their solution, which they named KRABB-E, uses a claw mechanism, similar to an excavator. A viewing system would detect a cigarette butt and activate the arm to move to its location and collect it. The claw material would be mesh, allowing the claws to pick up only large material with the cigarette butt, reducing the demands on the sorting system.

The team conducted trials on every aspect of the machine's construction and operation. They concluded that the best method for filtering out cigarette butts was to use a specifically developed collection and sorting system based on weight and size, rather than shape and density. The coarse-meshed (~3 mm) claw is used to collect the cigarette from the beach, picking up only large objects along with the butt, while sand slips through. It then deposits the material onto a conveyor belt. A calibrated low-power vacuum is used to collect the cigarette butt from the conveyor belt. Larger objects will pass through back onto the beach.

This robust, solar-powered machine measures about half a metre in every dimension and can be left to its own devices for extended periods of time. It also is designed to publicise the work it is doing to the beachgoers it will be working around. Both on KRABB-E itself and on its static solar power charging point, there is information designed to educate the public.

"It is something memorable for those who encounter it," claims the team. "More tech-savvy than any of the existing competitors on the market, the KRABB-E system is an eye-catching design that was chosen to educate the public and raise awareness of the impact of pollution on our ecosystem. In the short term, KRABB-E will be successful in reducing litter. But in the long term, KRABB-E could help to prevent it."



GREENPEACE CHALLENGE

WINNER: NANO MALAYSIA

In its bid to protect the oceans, NanoMalaysia has come up with a solution that draws its inspiration from a natural product taken from the sea itself – carrageenan, which is derived from red algae sometimes known as Irish moss or sea moss.

The facts are stark. According to the Royal Statistical Society, eight million tonnes of plastic waste enter the world's oceans every year, with approximately 80 per cent of it coming from single-use plastics. The primary source of such plastics is from packaging groceries.

NanoMalaysia's award-winning entry was for PICAS block – a new approach for packing dried, loose products such as pastas, beans and grains. Indonesian cooks might see the similarity with tempeh, the traditional beancake, although it is a finished, cooked product, while PICAS is a method of storage.

PICAS is an acronym for 'Packaging In Carrageenan And Starch', where dried food is bound together and sold in the form of blocks. The blocks of beans/grains are bound together using natural polymers such as starch and carrageenan.

Starch is used as the internal binder to maintain mechanical integrity of the film, while carrageenan is coated on the outside of the block to form a physical barrier, protecting the contents from contaminants. To release the beans, the consumer simply drops the block into some hot tap water. After a few minutes, the carrageenan film will be hydrolysed, turning into a soft jelly. At this point, the blocks can be rinsed with cold tap water, and the carrageenan layer can be peeled and removed easily. The hydrolysed carrageenan film also traps contaminants in its hydrogel matrix, thereby maintaining the hygiene level of the beans inside. When the starch binder is exposed to water, it dissolves, thus releasing the beans. These natural polymers can be washed away safely to the drain.

The blocks could be sold in standard weights, making shopping and cooking straightforward. The NanoMalaysia team, which was made up of students from several Malaysian universities, explained: "The simplicity and ease in consumer adaptability are our key selling points. The main aim of this solution is not to propose an alternative biodegradable packing material, but to come out with an entirely new way to sell dried food that is easier to use. Imagine reaching out for a block of beans the same way you would for an orange, or an apple, and placing it directly into your shopping basket at the market. No plastic bags needed!"

Common sources of carrageen include Manihot esculenta (a woody shrub from South America) and Chondrus crispus (Irish moss). Both are easy to cultivate using modern agricultural and aquaculture systems. Therefore, an increase in demand for carrageenan and starch will not cause much ecological stress.