# Ridding the sea and land from toxic plastics fragments

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Plastic products made of PVC, Polystyrene and other prominent plastics are flooding the market. They are a growing threat to the environment, as they are found in the sea or dumped in land fills. But in a few years, there may be ways of tackling this worrying trend. BioClean, an EU-sponsored research project, due to be completed in 2015, is sparing no effort to find ways of reducing the impact of non-biodegradable plastics in the environment.

In 2012, the worldwide plastics production was 288 million tons. More than 95% was due to polymeric materials, plastics, obtained from fossil resources. Europe alone contributed for about 20% of the global production. Currently, the chemicals are disposed of through land filling, incinerating and recycling. The trouble is that plastic waste in landfills often undergoes photo oxidation, a type of oxidation due to direct solar radiation, and degradation. As a result, small fragments and particles, which can absorb toxins and toxic chemicals, are released in the environment. These particles may eventually be ingested by marine animals, thus entering the food chain.

In this context, the project strategy aims at gaining a deeper scientific understanding of biodegradation of such materials in natural environments and waste disposing facilities. It also explores the feasibility of biotechnological solutions for an effective and sustainable disposal of plastic waste. Specifically, the project is focused on four kinds of plastics: PVC, Polystyrene, Polypropylene and Polyethylene.

Progress is already in sight. "So far, we have identified more than 15 bacterial cultures along with some terrestrial fungi—about ten strains—that are able to degrade at least one of the four target chemicals," says Fabio Fava, professor of industrial and environmental biotechnology at the University of Bologna, Italy. "This means that we have a number of new microbes capable of degrading fossil based plastics," Fava, who is also the project coordinator, tells CommNet. However, he adds: "the biodegradation observed is often slow and limited."

To make the plastic more amenable to biodegradation the researchers have used a range of pre-treatments such as UV and gamma rays as well as ozone irradiation. "This has resulted in encouraging results, says Fava. The project researchers are now integrating the pre-treatment processes with the biodegradation to see how one can make the plastics less

harmful to the environment. Ultimately, the aim is to develop a combination of physical, chemical and biotechnological processes for the biodegradation and detoxification of plastic waste in existing landfills. The project may also promote biodegradation of plastic fragments and particles generated in waste composting, importantly, plastics that is found in marine habitats.

This work has so far been very well received among scientists working with biodegradation of plastics. "As far as I can judge, the consortium is engaged in very important tests that can play a decisive role in making plastic products less harmful to the environment," says Ms Minna Hakkarainen leader at KTH, the Royal Institute of Technology in Stockholm, Sweden, conducting a research project on designing biodegradable plastics.

Meanwhile, environmental organisations welcome the focus of this work in preventing harmful plastics entering the sea. "All efforts that can be made to prevent and mitigate the current impact of plastics in marine ecosystems should be welcomed," says Stephan Lutter, international marine policy expert at WWF Germany in Hamburg, concluding: "However, it's clearly a difficult work, and it will take quite some time until progress can be made."

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