

## Two enzymes to biodegrade polyethylene

CSIC has developed a method for biodegrading polyolefin-derived polymers using two enzymes Demetra and Ceres. The invention falls within the field of biotechnology, in particular within plastics, preferably polyolefin-derived plastics, more preferably polyethylene (PE), enzyme degradation by biological means.

Industrial partners from the waste management industry are being sought to collaborate through a patent licence agreement.

### *An offer for Patent Licensing*

#### Demetra and Ceres could be the solution to the plastic pollution

PE accounts for 30% of synthetic plastic production, largely contributing to plastic waste pollution on the planet to-date. Together with polypropylene, polystyrene and polyvinylchloride, PE is one of the most resistant polymers. Given the hundreds of million tons of plastic waste accumulating and the still escalating pace of plastic production, re-utilization of plastic residues is a necessary path to alleviate the gravity of the plastic pollution problem, and at the same time to render available a huge potential reservoir of carbon. To-date, only mechanical recycling is being applied at a large scale and the low quality of the secondary products, severely restrict the potential of this solution to the problem of plastic waste accumulation. Chemical recycling, is an alternative procedure. Several chemical technologies have been applied at a lab scale, although the high energetic cost still impede the scaling up of these tech. tools.

Our technology based on degradation by biological means could be the solution to these problems. Although the synthetic nature of the plastic in general, together with the hydrophobicity and inaccessibility features, make plastic a difficult target for animal, fungal or microbial-derived enzymatic activities so far, this is not the case for Celera and Demetra that degrade untreated PE.



Plastic pollution problem

#### Main innovations and advantages

- Several bacterial and fungal strains have been identified as capable of carrying on a certain extent of PE degradation. However, in most of the cases such degradation requires an aggressive pre-treatment of PE (heating, UV light, etc.) that accelerates the incorporation of oxygen into the polymer, being the abiotic oxidation the real bottleneck of the reaction. Celera and Demetra perform this oxygenation by themselves without any pretreatment, saving energy and simplifying the process.
- In the past decade a few microorganisms have been described as capable of acting on untreated PE17-23, although they require a significantly longer incubation time compared to experimental conditions with pre-oxidized PE.
- Reported enzymes capable of acting on polyolefin-derived plastics require a pre-treatment of the plastic material.

#### Patent Status

Two European patent applications filed

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