



Polyurethane-eating fungi discovered in Amazonian rainforest

Researchers have identified plant fungi in the Ecuadorian rainforest that can digest plastic. The discovery hints that there may be a wide range of effective waste-consuming microbes in existence, according to the study, which found that several different fungi, including one called *Pestalotiopsis microspora*, can break down the widely used plastic, polyurethane.

Polyurethane is an important plastic in the building industry and is used in foam insulation. In 2011, Europe, the Middle East and Africa produced over five million tonnes of polyurethane and levels of polyurethane waste are expected to rise.¹ The market for polyurethane is being driven partly by its use in more sustainable buildings – better insulation reduces energy consumption and carbon dioxide emissions, and contributes towards the EU meeting its emissions targets. Polyurethane is also used in the foam seats of cars, trucks and other vehicles.² The End-of-Life Vehicles Directive (ELV-2000/53/EC) controls how waste from vehicles is managed.

The European Diisocyanate & Polyol Producers Association (ISOPA) is the trade association for producers of the main chemicals used in making polyurethanes and works with legislators to guide best practice in waste management of polyurethanes. A number of studies have already demonstrated polyurethane degradation by other microbes. The microbes 'feed' on the plastic, using it as a source of carbon to fuel internal processes. In most previous studies it was found that, unless microbes supplemented their plastic diets with other sources of carbon, they took a long time to digest the plastic.

In the new study, the researchers identify various plant fungi that can use polyurethane as a sole carbon source. They demonstrate this for two populations of *Pestalotiopsis microspora* and several others from the same genus, although they note that the ability to degrade polyurethane is not universal across all *Pestalotiopsis* species. All the fungi tested were collected from woody plants in the Yasuni National Forest within the Ecuadorian Amazonian rainforest and grown on polyurethane in the laboratory.

Altogether, they tested 59 plant fungi and identified 18 with a level of polyurethane-degrading activity worthy of further investigation. Four of the six most active plastic digesters were from the genus *Pestalotiopsis* and all six degraded the plastic faster than *Aspergillus niger*, the only other microbe so far known to be capable of using polyurethane as a sole source of carbon.

Based on molecular investigations, the researchers concluded that *P. microspora* fungi were able to break down the plastic using a specific enzyme they called polyurethanase. Interestingly, when they isolated this enzyme, they found that it could degrade polyurethane on its own, independently of the fungi.

The findings suggest that the wider family of plant fungi, known as endophytes, may provide a rich source of biodiversity for potential use in bioremediation of plastic waste. There are estimated to be over 300,000 species of land-dwelling endophytes, of which the researchers sampled only a very small fraction.

1. UTECH. (2012). Global Experts to Detail Polyurethanes Market Trends & Innovations at UTECH Europe 2012. UTECH Europe, 11th April. [Online]. Available: www.utecheurope.eu/page.cfm/Action=Press/libID=1/listID=1/libEntryID=48 [Accessed: 10th July 2012].
2. ISOPA. (2012). Position Paper: ISOPA's Position on Polyurethanes and the EU End-of-Life Vehicles Directive. ISOPA. [Online]. Available: <http://www.isopa.org/isopa/uploads/Documents/documents/elv33.pdf> [Accessed: 10th July 2012].

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