Plants: a source of ‘green’ plastics?

Most plastics are derived from fossil fuels, but new research suggests that soon it may be possible to ‘grow’ plastics. With around 100 million tonnes of plastics used each year worldwide, finding a renewable and biodegradable source of plastics could help reduce both carbon emissions and landfill waste.

Plants have been used to produce plastics for some time, with plastics made from plant starches and soy protein. However, scientists have recently genetically modified a plant, Arabidopsis thaliana, so that it produces an organic ‘plastic’ that is similar to polypropylene, a common form of plastic.

The scientists introduced three new proteins into the plant which work with two proteins which are normally present. Together these proteins make a material called polyhydroxybutyrate-co-polyhydroxyvalerate (PHBV). PHBV is a flexible, moldable plastic and can be used to produce a wide range of consumer products, from plastic shopping bags to bottles and containers.

The researchers believe the most useful site for PHBV synthesis in the plant is the chloroplast (a group of cells in the leaves) as it can expand to accommodate the plastic as it accumulates. This means greater quantities of plant-based plastics can be produced more easily and cheaply. Also, if production of PHBV can be restricted to certain parts of the plant, such as the leaves, it may allow plants to be developed which can be used for both food and plastic products, such as soy beans or maize – a so called ‘double crop’.

Since most currently available plastics are made from fossil fuels, they also contribute significantly to greenhouse gas emissions. An estimated 4 per cent of the world's annual oil production is used as a feedstock for plastics production and an additional 3-4 per cent is consumed during manufacture. Plant-based plastics could, therefore, contribute to strategies to reduce carbon emissions.

With further development, plant-based plastics could be produced as valuable by-products in food crops or from non-food crops grown on marginal land, the researchers argue. Genetic modification is regulated by Community legislation, and any such genetically modified plant would need to be thoroughly assessed for safety to humans and the environment before it is granted authorisation for cultivation.


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