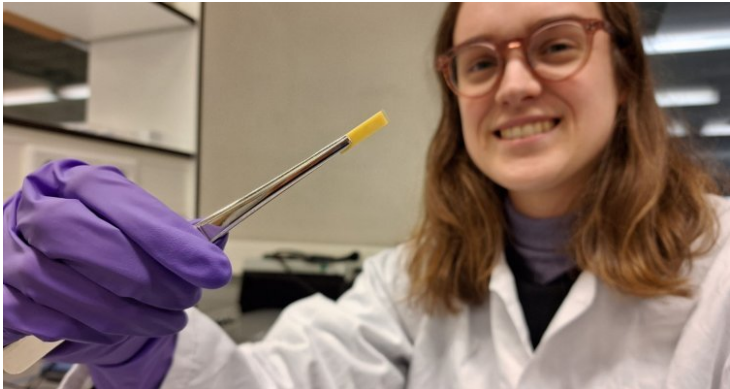


Researchers at Wageningen University creating sustainable plastic

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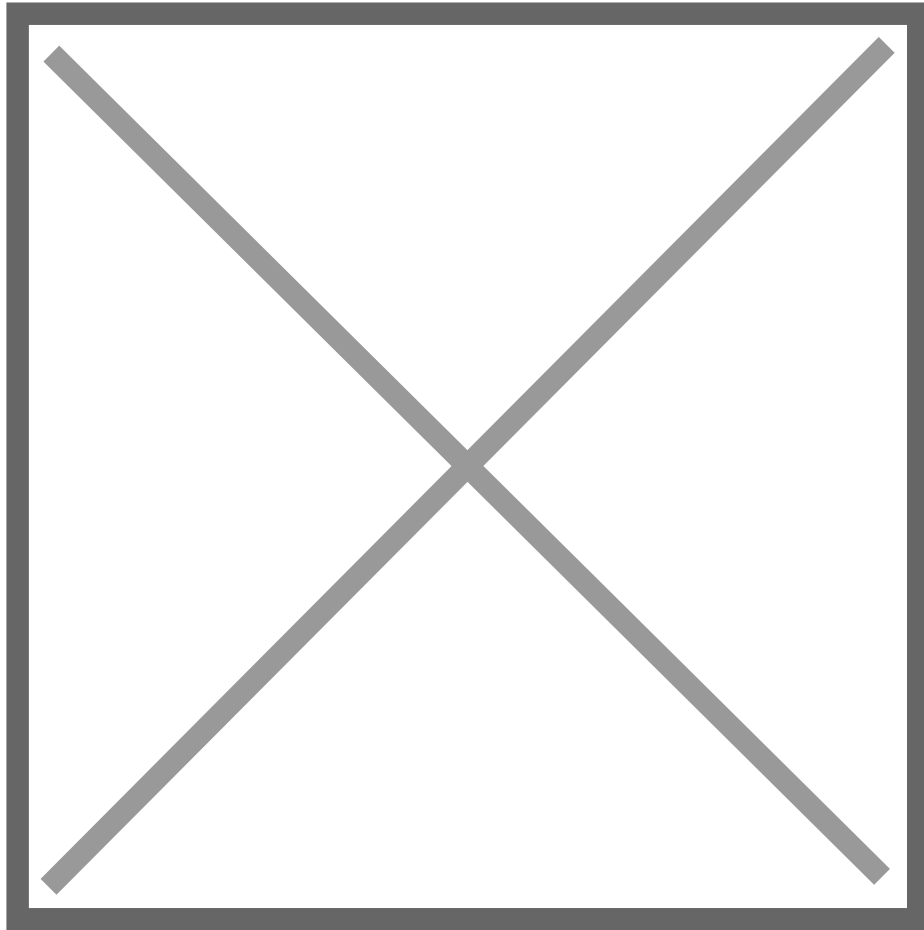
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Sustainable Plastic Processing

The plastic material is ubiquitous in our daily lives, from supermarket packaging to toys packaging. "Yet we rarely think about what happens to these materials after the shoes break or when you need new glasses," says Van Lange.

Van Lange and her colleagues have used two types of powdered components. By dissolving and combining these two solutions, and subjecting them to heat and pressure in a hot press, Van Lange transforms these substances into a rectangular piece of plastic measuring two by half a centimetre. Under normal conditions, the resulting plastic is sturdy and hard but becomes reformable when heated. But these innovative plastics are "compleximers".

"On a molecular scale, plastics consist of long chains," explains Van Lange. In traditional hard plastics, these chains are connected by chemical cross-links for strength. However, these cross-links are so robust that recycling becomes nearly impossible. Van Lange redesigned these plastics without chemical cross-links, this time utilizing adjustable physical forces.



"Half of the chains that make up our plastic are positively charged, the other half is negatively charged." When you bring them into contact with each other in the right way, they attract each other, just like two magnets. This keeps the chains together without the need for chemical cross-links. When heated, the attraction between the parts weakens, allowing the entire material to reshape. This enables the plastic to be reused or, for example, to repair a hole or other damage in the plastic with heat," Van Lange explains.

This is achieved with a kind of "molecular umbrellas" that partially shield the positive and negative charges in the plastic. "That is how we achieved the perfect attraction force and, consequently, plastic that is easily deformable when heated. Moreover, these umbrellas are water-repellent, ensuring the plastic remains robust when exposed to water. Charged material is almost always sensitive to water, so achieving this is very special," adds Van Lange.

Although the plastic is not yet ready for the market, the researchers believe it's a major milestone in sustainable plastic production and allied industries. For example, the material is not yet flexible enough, according to Van Lange: "We demonstrate that the concept works, but now we need to find a way to give it more rubber-like properties." The researcher hopes to achieve this by reducing the charge in compleximers, perhaps by adjusting the building blocks of the chains that make up the plastic. "An alternative could be to enlarge the molecular 'umbrellas,'" says Van Lange. She also considers altering the type of chains. "We currently use polystyrene, a stiff molecule," explains the PhD candidate. "If we replace it with a more flexible variant, we might already get a more bendable plastic."