Sorting plastic waste: A magnetic game

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More than one third of the total plastic production in Europe—about 14 million tonnes per year—are polyolefins, also known as polyalkenes. This is a family of polymers used for the manufacture of a variety of products, mainly bottles for water and soft drinks, and food packaging. The problem with polyolefins is that the material is not biodegradable, and can only be recycled into new plastics product when the waste is available in pure form.

Up to now, sorting the plastic waste into different types has been a complicated and expensive process, requiring several steps. Now, researchers of a European project, W2Plastics, including project partner Peter Rem, and his colleagues have developed a method to separate in one step the different types of plastic by their specific weight, or density. Rem is a researcher in resources and recycling at the Technical University of Delft in the Netherlands.

The technique, called magnetic density sorting, consists of passing the plastic waste through a tank with a suspension of 5-nanometre iron oxide nanoparticles, placed on top of a magnet. By attracting the iron oxide particles, the magnet artificially increases the density of the liquid. The density is the highest at the bottom of the container, and gradually decreases with its height. When the plastic, mixed in the iron oxide suspension, flows through the tank, it segregates into different layers that match the densities of the different types of plastic flakes. The sorting process consists in recuperating the flakes at different heights.

"In one step the process eliminates contaminants, such as wood or foam, and we get separate streams for polypropene, polyethylene, PET, and polystyrene, and the cost is low, below 100 euros per tonne," Rem tells youris.com. The precision is quite surprising, he believes, as the process separates plastics differing in density of less than 0.1%. Project partner Redox Recycling Technology in the Netherlands is now operating a prototype magnetic separator processing 200 kg of plastic waste per hour, reports Rem He claims that the recycling industry is quite interested. Not only for the recycling of plastics, but also for the recuperation of metals from shredded electronics. For example a European project RECYVAL NANO researching a process for the recovery of indium, yttrium and neodymium metals from flat panels displays, is interested in the technique.

Other experts are also testing this type of approach. Aernout Kruiswijk, CEO at recycling company Van Vliet Utrecht in the Netherlands reports that his company has just completed an experimental magnetic density sorter for heavy polymers with a capacity of processing 400 kg of plastic waste per hour. We have tested it and the result was disappointing, we will decide whether the system is economically viable or not," he says.

But there are various reasons why the availability of such a new recycling technology, does not guarantee it will be widely adopted. Unlike the steel industry, the primary manufacturers of polymers are not involved in the recycling of their products and view recycling as conflicting with their own interest, according to Rem. As a consequence, technical

information about these polymers is for the most part lacking. "The polymer manufacturers also engineer the polymers in such a way that they can't be recycled easily," says Rem.

What is more, the large variety of types of plastic that are geared to specific applications and production processes has long been an obstacle to recycling. "A polymer that has to be extruded is entirely different from a polymer used for blow-moulding bottles," notes Rem. It is very difficult to separate these different types of plastic from waste so that they can be recycled easily into a new product" adds Rem.

Some wonder whether the cost of the recycling technology is justifiable for polyolefines. "Polyolefines are not toxic, why would we recycle them?" questions Jean-Marc Saiter, a researcher in dense matter and materials at the University of Rouen, France. "The recycling process itself is not 'green,' and recycling uses energy and transport, making it expensive," he tells youris.com. But he agrees that the magnetic separation technique is worth developing, especially for other, unforeseen applications in the future. "What is expensive today can be economic tomorrow," he adds.

More information: www.w2plastics.eu/

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