Editorial corner – a personal view

A second life for polymers ... needs more research

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While scientists and engineers tend to focus on the role of polymers as problem solvers, parts of society appear to consider polymers more as a problem. Polymer scientists therefore need to consider the discussed issues in their daily research, like the various end-of-life options for polymer articles. But before going into details let's look what happens to the about 300 mio tons of polymers produced every year right now.

In Europe (EU27+CH+NO), out of 25 mio tons of polymer waste 25% are recycled mechanically and 36.5% used as an energy source (in combustion, steel and cement production mostly). 38.4% or 9.6 mio t still goes to landfills, varying between 1% (CH), 50% (IT) and 70% (UK), while peaking at 87% for Malta (acc. PlasticsEurope). In North America, the recycled fraction is 9% (USA) resp. 16% (Canada), with about 60% going to landfills. China, a hotspot of plastic waste treatment, manages 22%, out of more than 600 mio tons, half of this being imported. Only India manages to re-process more than half at a rate of 60%.

A consequence of this bad resource management together with poorly maintained landfills is the increasing ocean pollution by plastic waste, as the recorded quantities can hardly be caused just by beachside littering (250 kt globally, see DOI: [10.1371/journal.pone.0111913](https://doi.org/10.1371/journal.pone.0111913)). One may dispute the claimed consequences, but trying to combat this kind of marine pollution by fishing particles from the sea is doomed to failure if the influx is not reduced. That means better waste management and higher cost – and good recycling may partly pay for it.

The role models are there: Global paper production is based 50% on recycling, glass production 75% in

Europe and 70% in the US. In all cases, these figures were not just reached by politics or public pressure, but also by ingenuity and research. The fact that polymer recycling is not growing rapidly is at least partly due to a lack of research efforts in the field which is obviously not considered 'sexy' enough by the scientific community. Progress happens, nevertheless, largely driven by industrial research. The highly relevant issue of purification, for example, is largely handled in such developments (e.g. http://www.ereima.at/en/general_corema/), and the involvement of small companies demonstrates economic opportunities.

Academic research on recycling, however, is often rather repetitive and unrealistic in scope, even if ~950 papers on the subject were published in 2014 (acc. SciFinder). An example is the use of tyre regrind for toughening thermoplastics – this works well if done correctly, but the simple issue of the necessarily horrid sulphur smell of such compounds which will prevent application of such compounds in more than 90% of the cases is never addressed.

Polymer scientists need to take a fresh look at recycling, dealing with issues like compatibilisation, purification, emission reduction and long-term stability from a 'fundamental perspective'.

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