**In an ideal world we’d have found some kind of inert, sterile, lightweight, waterproof , hard but soft, rigid but flexible, air tight but air breathable, heat resistant but heat sensitive, foldable but non -foldable, translucent but opaque material to make all our everyday items with, and maybe even to store and wrap our foods.**

**Well…its plastic isn’t it?! It’s just so bloody useful. And we all now know, just about all the qualities that make it so bloody useful are the exact same qualities that make it so bloody harmful to our environment.**

**So, what we really need is all the functionality I’ve just listed, but from a product not made out of plastic. And rest assured dear friends, those technologies are coming. In fact, some of them already exist in the marketplace today, albeit at relatively tiny scales. I looked at some of them a few months ago, and you can click up there somewhere to jump back and have a look at that video.**

**But reality tells us that even if we manage to wean ourselves off oil as a fuel for transport and heating, we will most likely still be extracting it for several decades for use in plastics, at least until the polymer alternatives reach a competitive scale on the global market.**

**So, in the meantime, that leaves us with the ever-thorny problem of dealing responsibly with the thousands of tons of this man-made indestructible menace that we all just toss into the trash every single day.**

**Recycling is patchy at best and only really delays the inevitable as the material becomes less useful each time it’s chopped up, melted down and reinvented as something else. So, a product made from a combination of virgin plastics today, might only be recyclable into a cheap polyester carpet in its second life, for example. And then eventually that carpet gets tossed into landfill or incinerated anyway. That’s because up until now, we just haven’t had sophisticated enough processes to strip out and reincarnate each individual material from an item made of different types of plastic and fibre. So, in many cases the best we can do is melt it all down and make it into generic pellets that are only useful for all the less pretty things we need, like carpets.**

**But that severe limitation may soon disappear thanks to new breakthrough technologies that can give complicated plastics and composites more than just a second life.**

**They can make them as good as new.**

**Hello and welcome to Just Have a Think**

**The world produces more than 350 million tons of plastic each year, and only about 30% of it is recycled at all. In fact, according to this research published by ScienceMag.org in 2017, nearly 80% of all the waste plastic ever produced has ended up as landfill or litter in our natural environment, including our oceans.**

**Here in Europe the European Commission adopted a plastics strategy in 2018  with a target of recycling 55% of plastic by 2030. Which is, you know, not good enough really, is it?**

**So, here’s the problem…**

**In fact…here’s the problem –**

**packaging.**

**At least it’s a big part of the problem anyway.**

**Packaging is made up of all sorts of different types of plastic, and that makes it really difficult to recycle.**

**Fresh foods like meat and cheese are packaged with lids, films and trays that are all made from different polymers that don’t blend well together during conventional recycling. And that means they need to be separated before processing. And because that’s expensive and time consuming, it generally doesn’t happen, and the recycler often just diverts it to the can’t be bothered pile.**

**According to this study called Plastic & Climate: The Hidden Costs of a Plastic Planet, in 2019 alone, the production and incineration of plastic added more than 850 million metric tons of greenhouse gases to the atmosphere—equal to the pollution from 189 new coal-fired power plants.**

**And it’s a similar problem with plastic composites that have been reinforced with some other fibres like glass or carbon from example. It’s just too much of a hassle, or in some cases just simply not possible to separate all these different constituent parts in a way that makes any of them pure and re-useable.**

**There are emerging chemical recycling technologies that rip the material to pieces, right down to the original monomer molecules that made up the original plastic polymers. That technology can eventually create high-quality plastic, but because they have to go through the process of building the polymer chains back up again, it’s currently very energy intensive, and difficult to justify economically.**

**Now though, a new technology, developed as part of an EU-backed -project called MultiCycle, looks set to totally transform our ability to get at these previously inaccessible polymers and fibres, strip them out more or less intact, and refurbish them as if they were brand new.**

**And that…would be good!**

**The process is called Creasolv, which shouldn’t be confused with creosote, especially not at any practical level, because the results would be disappointing.**

**No, Creasolv has been developed and patented by the Fraunhofer Institute in Munich in Germany, and it’s really quite simple and clever.**

**In very basic terms, it works like this.**

**You sort your plastic into the various different basic types of polymer and then you chuck your chosen polymer type into a big grinder to get it into tiny fragments. The fragments then go into a solvent-based formula containing the secret sauce that Fraunhofer have patented. I can’t tell you precisely what’s in there but, I can tell you what it does.**

**It seeks out the target polymer along with certain soluble impurities and dissolves them into the solution. And crucially, it retains the polymer chain structure of the plastic.**

**Next, any insoluble impurities are physically filtered out, leaving behind a clear solution containing just the polymer chains and the soluble impurities.**

**The insoluble impurities can themselves then be sorted and recycled if they contain valuable materials.**

**The clear solution then goes through the process of precipitation to separate out the remaining soluble impurities from the pure polymer.**

**The impurities and now all alone in solution in the Creasolv secret sauce. That solution is distilled to liberate the impurities and then the solvent can be recycled back into the process to be used again. The collected impurities can then be recycled into whatever THEY were in the first place.**

**The precipitated polymer goes through a dryer and then once it’s a solid material again it gets extruded into new granulates with very similar properties to the original virgin material.**

**So far, the team has been conducting small scale trials with multilayer packaging and composites to test the process. At the same time, they’ve been designing a large-scale pilot plant in Bavaria where trials are due to start this month.**

**The research team is also developing a system to establish the composition of plastic waste. If they can automatically identify the plastic and fibre types in any given product then they’ll be able to optimise the process based on very precise analysis of the material batches.**

**The plan is for the system to go into existing recycling plants, with some specialised facilities set up to handle large volumes of industrial waste.**

**Over in Zaragoza in Spain, The Centre for Energy Resources and Consumption, or CIRCE are coming at the same problem from a slightly different angle.**

**They’re focussing on polyamides, which are used in products like car gears and airbags, and polyurethanes which, among many other things, make the flexible foams in mattresses and carpets.**

**The research forms part of a wider initiative, also backed by the European Union, called the Polynspire Project.**

**It focusses on two technologies. The first it to add a new type of plastic called a vitrimer to recycled plastic. Vitrimers are tough and malleable and when combined with high energy irradiation in the recycling process they can significantly improve the resistance and other properties of recycled materials so they can be used in what CIRCE call “high requirement applications”**

**While the end product is not a pure reincarnated polymer like the one produced by Creasolv, the end result is effectively the same – a recycled plastic that can perform the same functions as the original virgin plastic.**

**CIRCE are also developing the use of microwaves and smart magnetic materials to reduce the amount of energy needed to generate heat for polymerisation, which is that energy intensive and expensive process I mentioned right at the start – the one that combines the stripped-down monomers back into polymers.**

**The team has completed lab testing of the technologies and are currently gearing up for the engineering phase of the project, working on the pre- treatment and purification stages of**[**recycling**](https://phys.org/tags/recycling/) **to demonstrate the concept on a semi-industrial scale.**

**The goal is to produce recycled plastics of good enough quality to replace virgin material, with a specific focus on recycled polyamides for automotive parts, where there are very stringent quality requirements, and on polyurethanes for mattress foams, where longevity and resistance to deformation are critical.**

**CIRCE say that the processes are cost effective and environmentally friendly, and both technologies could make a huge contribution towards the circular economies that our governments tell us they’re now striving for.**

**Like all such developments, what we really need to see is fully developed products hitting the marketplace that can disrupt and displace the existing options on both cost and quality.**

**But this is unquestionably a very big step in a positive direction and could prove to be a big boost to our global effort to clean up our act.**

**Let me know your thoughts in the comments section below, but that’s it for this week.**

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**And don’t forget to hit the bell icon as well so you get notified of new content.**

**As always thanks very much for watching, have a great week and remember to Just Have a Think**

**See you next week.**