

A professor promotes apparel that can purify the air we breathe.

Catalyst for cleaner air

Professor Tony Ryan, dean of science at the University of Sheffield, insists on looking at the world through the eyes of a chemist. This has enabled him to develop a new form of cycling apparel that purifies city air as wearers pedal around town.

He is an expert in polymer chemistry, saying that he came to polymers very early in life by virtue of seeing the 'nylon rope trick' in a science lesson in school. In this widespread bit of scientific and educational fun, pupils take two liquids, one oil-based and the other water-based, and add a different chemical to each. When those chemicals combine, they produce a polymer at the interface where the oil floats on top of the water. Now he says he sees polymers everywhere he looks: clothes made of polysaccharides, shoes with soles of polyurethane.

One recent project was with clothing designer Helen Storey, professor of fashion and science at the London College of Fashion, to design dresses that dissolve in water, aimed at reducing waste in the clothing supply chain. Professor Storey has explained that this is a metaphor for a planet whose resources are disappearing in front of our eyes.

An interesting development from this professorial collaboration was a second project to develop "catalytic clothing". Professor Ryan's knowledge of polymer chemistry has led to treatment of fabrics that means clothes can take nitric oxide and volatile organic compounds out

Professor Ryan's catalytic clothing idea means cyclists' clothing can swallow up nitric oxide and other toxic substances as they ride around the city.
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of the air. "A catalyst is something that takes part in a reaction but isn't changed by the reaction," he explains. "It stays there and can be used again and again. In this case, a chemical solution in the clothing absorbs pollution in the atmosphere, does something to it and sends it back as something more benign. I have a pair of jeans that are coated with these catalyst particles. When the jeans see light they react with oxygen in the air to make bleach. That bleach reacts with whatever is around, but mostly it reacts with nitric oxide, a greenhouse gas that's a particular problem in cities. There are safety limits for nitric oxide and in Sheffield we exceed that limit on average in the course of a year."

It's a gas that represents a challenge to human health, particularly for children and older people; it can cause asthma, for example. The situation in Sheffield sounds bad because the professor says it would require everyone in the city (more than half a million people) to wear clothes coated with his solution throughout the year to take nitric oxide levels back below the safety limit.

Community laundry

He wants to set up a kind of laundry to which the citizens of Sheffield can bring their clothes to have them catalysed. For keen cyclists like Professor Ryan, the possibility opens up for catalyst-coated clothing that people can wear when moving round the city quickly, sucking up pollution as they go. "It's a community thing," he says, "and as soon as I can treat the clothing of the guys I go cycling with on a Saturday morning, that's exactly what we'll do."

The catalyst particles convert the nitric oxide into nitrates, which are water-soluble and, therefore, much easier to dispose of. But Tony Ryan is quick to say there is no new science in this. Nano titanium, which is the catalyst he uses, is well known, for example, in its use for sunscreen products.

Glittering prizes

Towards the end of May 2012, the Catalytic Clothing project jointly won an award in the sustainability category (along with a project called Cool Earth set up by fashion designer Vivienne Westwood) at a prestigious Innovation & Design Awards competition that business publishing company Condé Nast Traveller organises each year.

Successes such as this can only help raise the profile of the idea, but this will also bring extra responsibilities. Professor Ryan feels it is imperative for the science community to work harder at explaining nanotechnology to the general public because there are still people who, after watching Star Trek and other fictional depictions of it, are afraid of it, imagining that grey goo is going to replicate itself and take over the world. There are concerns also that the nanoparticles involved might cause some new disease we haven't yet heard of. He thinks scientists should communicate better about the realities behind nanotechnology to address these fears and feels it might even help to come up with a new name that would help the public think of nanoparticles in a positive light.

"Chemistry can contribute to every part of life," he says, "in health, in food, in energy. And it's only when you look at things through the eyes of a chemist that you can see the path to that. So we will see new medicines, new crops and new ways of capturing the sun's light. Those are the things that I like to work on and like to see other people working on."



Professor Tony Ryan and Professor Helen Storey worked together on a dissolving dresses project before moving on to catalytic clothing. *Gavin Duthie/University of Sheffield*

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