Is There a place for natural fibres in the emerging bioeconomy?

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The drivers towards a more sustainable economy are familiar, but worth reiterating. The global population is growing and all the new inhabitants will want to be clothed, kept warm and fed. Currently, we are dependent on finite petrochemicals, which are not only going to become more expensive, but are also associated with the release of greenhouse gases. One solution is to increase our use of renewable fuels and materials. Natural fibre producers will have to recognise the part they can play in this emerging bioeconomy. We may well be running out of oil, but it doesn't follow that natural fibres can replace synthetics – bio-based synthetics also have a role to play.

The Value Proposition of Renewables

The renewable carbon in renewable fibres provides a means to manage carbon in a sustainable manner. Petrochemicals were once living organisms and the carbon they contain is the product of ancient photosynthesis. Petrochemicals are formed over a geological timescale, so their large-scale use for fuels and materials means they are finite on a human time scale. The GHG released by the use of fossil fuels also contributes to climate change. However, by using renewable fibres, and thus renewable carbon, we can manage carbon in a more sustainable way and reduce the net gain of GHGs in the atmosphere.

Natural Fibres Do Have Unique Properties...

As well as being renewable, natural fibres have many properties that are unavailable through synthetic fibres, or cannot be achieved without prohibitive expense. The automotive industry has prized natural fibres for their strength and weight-saving properties for many decades. Construction also has many applications for natural fibres such as structural walls made with hemp and lime, insulation made from sheep's wool, and flexible composite membranes.

... But It's Functionality That Counts

However, when performance counts for so much the sustainability of natural fibres in not enough. The unique properties of natural fibres may not translate well into a functional product. Furthermore, synthetic fibres can be manufactured on a large scale (which means energy efficiency) and generally give a consistent product. It is difficult from a technical and sustainable perspective to scale-up the production of some natural fibres. It is now possible to use biological material as a feedstock for producing bulk chemicals that can then be turned into fibres. If we can make polyester that's identical to a petrochemical-derived fibre, but is simply made from biomass, then need we be concerned that this is not a 'natural' fibre?

Take polylactic acid (PLA) as an example. PLA is made from corn, so it is a renewable-carbon-based polymer. It's most familiar guise is in packaging, but it can also be extruded into fibres that can be used in everything from jumpers to geotextiles. For example, Ingeo™, a PLA fibre from NatureWorks is used in 320 nonwoven and textile products.

Using 1000 tons of Ingeo instead of polypropylene could save the equivalent of 4418 barrels of oil. A new, second generation of PLA is also on the way, that will have even greater functionality. PLA is not a 'natural' fibre, but it has the environmental benefits of renewable carbon and it can be made in high volumes. It also illustrates the opportunities for the fibre industry in general to create blends of natural, renewable and synthetic fibres to give a consistent product or particular functionality.

Biocomposites

Natural fibres and resins can be combined to make to make biocomposite materials. However, the continuing reliance on petrochemical-derived resins is a considerable environmental drawback. One major goal is to make suitable composites containing only renewable materials, i.e. both fibres and resins derived from biomass. Several of these 100% renewable biocomposites are now available, for example PolyFlax, which has fibres and resin derived from sugarcane. Demands for new high-tech materials in the automotive and aerospace industries could provide an increasingly large market for biocomposites that use natural fibres and biobased resins and polymers.

The Future

In the future there will be a place for natural fibres and bio-based synthetic fibres – one need not be a threat to the other. But producers of both types of material will have to consider both the markets for their products and the full life cycle environmental impact of their products. Intuitive feelings about the environmental value of natural products are not sufficient to warrant a place in the emerging bioeconomy. At a time when consumers grow ever more suspicious about greenwashing, it is important to demonstrate that a natural fibre is truly a sustainable alternative, and to demonstrate that material functionality will not be compromised by using bio-based materials.