

Building a bio-based car

Author: Gareth Chadwick, MindsinMotion.net<gareth.chadwick@mindsinmotion.net>

Much of the recent debate around biofuels has focused - quite rightly - on well-to-wheel analysis of various biofuels, taking into account the whole lifecycle of the fuel's main ingredients. But what about a well-to-wheel analysis - or rather, 'raw material-to-road' analysis - of the vehicle itself?

How sustainable can one tonne of metal, plastic and rubber be, regardless of the fuel used to power it? The answer, of course, is not very. But Professor Mohini Sain and his team at the University of Toronto, Canada, are working hard to change that.

Professor Sain, director of the Centre for Biocomposites and Biomaterials Processing at the University of Toronto, has been researching the use of natural materials in automotive manufacturing for decades.

[P017 image 1](#)

Benefits

The idea is simple: if we can increase the use of sustainable materials in automotive manufacturing, while maintaining performance and safety, there are two huge benefits:

1. A key component of the synthetic products, such as synthetic composites and high density plastic fibres is oil. So less synthetic products means less oil.
2. Bio-synthetic products are considerably lighter when designed properly. So the more you can use in a vehicle, the lighter it is and the less fuel it needs to power the drivetrain.

"The more renewable content we can use, the less fossil fuel-based content we need, the lighter the car, the more efficient the fuel consumption," explains Professor Sain.

Pioneering

Biomaterials such as hemp and sawdust have been used in a limited way in auto manufacturing for the best part of a decade. But Prof. Sain's research moves the technology on to the next level.

His research into bioplastics has developed pioneering bio-materials from agricultural or forestry sources, which match the high performance of metals and high density conventional plastics. They could be used in applications such as car bumpers or dashboards.

The technology works by breaking down the bonds that hold clumps of fibres together. The plant material is then combined with synthetic plastics to produce a lighter, more sustainable, but just as resilient composite. Prof. Sain expects such materials to be in general use in auto manufacturing in the next two to five years.

Completely biodegradable

The next stage is to combine plant material with plastics made from soy beans or pulp and paper sludge, to create tough biocomposites that are completely biodegradable. With the use of heat and pressure, the material, which can be as strong as steel used in diverse applications, is compressed into whatever shape is required.

This second generation of biocomposites, says Prof. Sain, should be in general use within five to ten years.

Foam

The Toronto team is also working on a range of other biomaterial technologies, such as the production of bioresins from biofuel industry byproducts, starches, proteins and vegetable oil to create tough, light materials, including foam. A recent example of a soy-oil based foam application is in the Ford Mustang, which uses the foam in its seats.

Ten years

By using a combination of currently available bio-based materials, Prof. Sain says that the weight of the average car could be reduced by as much as 400 kg, or around 40 per cent. He expects to see such a reduction within the next ten years.

“Ten years ago, auto-makers were sceptical about this technology, but with oil prices reaching new highs and carbon reduction becoming a mainstream business strategy, they are actively seeking new technologies and materials,” says Prof. Sain.