

A special bond

Amid growing concerns surrounding the health and environmental impacts of resorcinol and formaldehyde latex-based adhesives, two recently announced projects could see a new standard set in tire cord dipping technology

by Rachel Evans

For decades, resorcinol formaldehyde latex (RFL) dip has been used as an adhesive in tires to bond the textiles in the reinforcement layers to the surrounding rubber. In recent years, however, resorcinol and formaldehyde (RF) have been under close supervision by legislative bodies, due to the health and environmental concerns associated with the handling of these chemicals. It is expected that reclassification in some parts of the world could lead to tighter limits on usage, or even a ban.

Although some suppliers have developed eco-friendly alternatives, RFL dipping remains the dominant system worldwide. Offering a step change in the quest for a sustainable solution, Michelin has launched a new, high-performance RF-free resin adhesive designed for bonding textiles.

Commercialized under its newly established brand, ResiCare, the product is the fruit of nine years' R&D and the deposit of more than 35 patents. Michelin's industrial director, Olivier Furnon, explains, "You might be surprised by the length of time it took to develop; this is because we had to be sure that it can be used in all types of tires and with different textiles – nylon, aramid and hybrid cord, for example."

In the new ResiCare formulation, resorcinol and formaldehyde have been replaced by phloroglucinol and terephthaldehyde.

During the development, other molecules chemically similar to RF, which do not have any associated health or environmental concerns, were also investigated. "We disregarded solutions requiring an increased use of isocyanate," adds

Furnon, "because we do not consider this molecule to be a valuable avenue of research."

As phloroglucinol and terephthaldehyde come in powder form, whereas resorcinol and formaldehyde are liquid, a new processing method to produce the resin, which forms the basis of the glue, had to be developed. "This process is costly, so the glue is currently quite expensive, but through some fine-tuning we will be able to reduce the price in future," says Furnon.

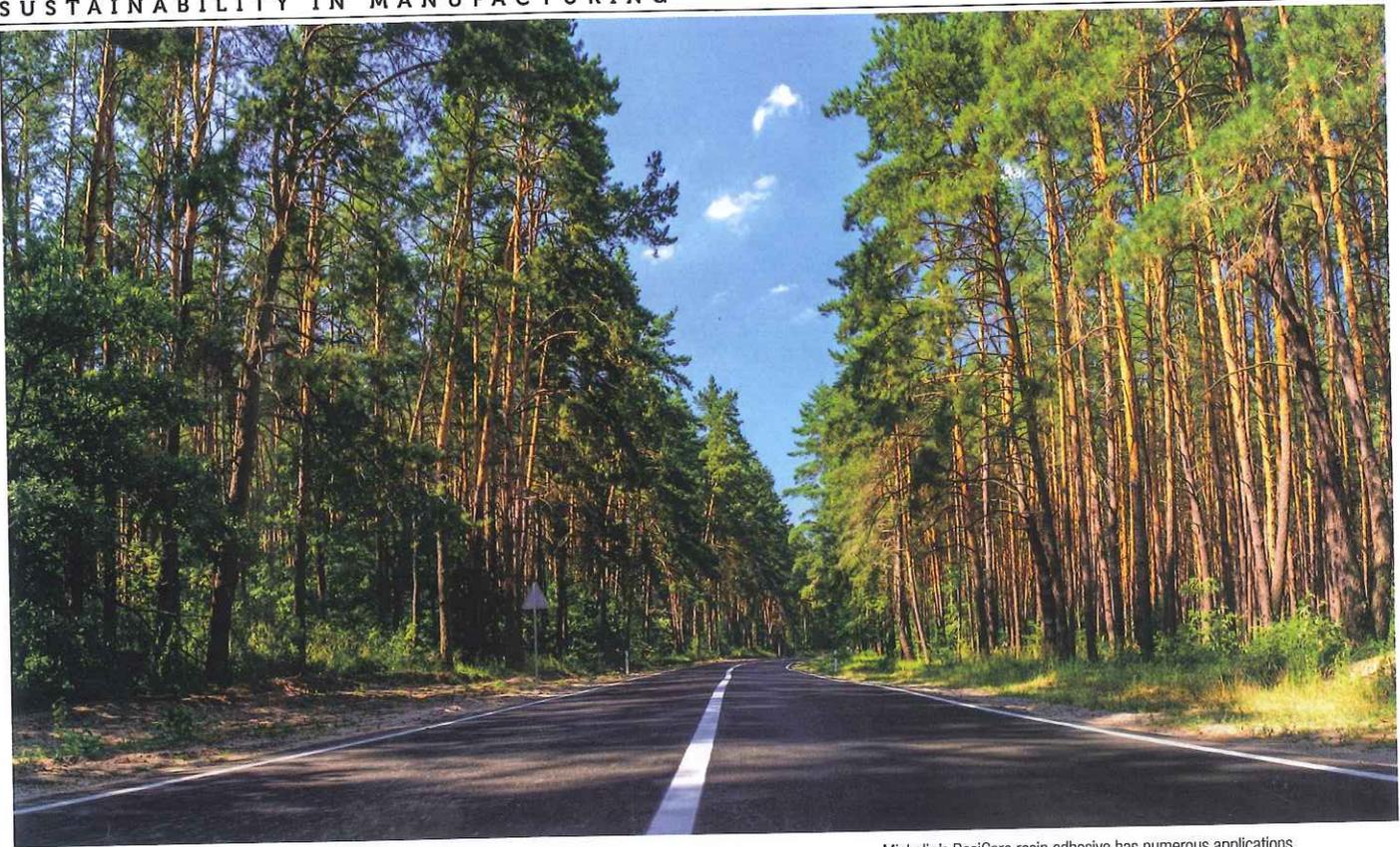
To test its adhesive performance, the product was analyzed in the lab, applied on different types of fiber, using peel tests. This included rayon and aramid, which according to Furnon, performed satisfactorily. It was also evaluated on polyester, nylon and aramid/nylon hybrid fabric, in passenger car and light truck tires. The results of these tests met the expectations.

Furnon notes, "The bonding strength of the fabric to the rubber depends on the type of rubber compound. Although the results of the initial tests met our expectations, variations in performance are always possible."

The new resin adhesive has been deployed at Michelin's semi-finished textile plants and the first tires to contain the glue – the Alpin and Energy Saver models – will be manufactured by the end of 2018.

"The next step is to find a suitable bio-source for our raw materials because the phloroglucinol currently comes from a petroleum-sourced supply. We know how to produce it from a bio-source, but unfortunately this method isn't suitable for mass production," adds Furnon.

ResiCare can either provide the resin or the process to produce it.



Michelin's ResiCare resin adhesive has numerous applications beyond tire manufacturing, such as in timber processing