Editorial corner – a personal view

Carbohydrate-based epoxies – good news for the environment?

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The relationship between polymers and the environment is contradictory. The use of polymers prevents deforestation but contributes to the accumulation of solid wastes. Focused research on thermoplastic biopolymers promises a solution, however their programmed stabilization and recycling requires more efforts. General way for the management of thermosetting polymer wastes (such as recycling) is not available thus various approaches are considered. Their replacement with thermoplastics, depolymerization or use as filler are technically and/or economically limited thus their waste is mostly disposed by combustion. Nature shows the biodegradation of lignocellulosic ‘natural thermosets’ as an alternative solution. The research of biodegradable epoxy resins based on epoxidized soybean oil has a long history, however, the achievable thermal resistance is not comparable with the commercial ones. Although the carbohydrates are the building blocks of the most abundant natural polymers sugar-based alternatives of thermosetting polymers are not widely used. Major reason can be their water uptake being much higher than that of monomers derived from petrochemical feedstock. However, hydrophilicity can be suppressed by blocking the free OH functions. One of the most promising sugar-derivatives as starting material for polymerization is the group of dianhydrohexitols, such as diglycidyl ether of isosorbide (1,4:3,6-dianhydro-D-sorbitol), which can maintain the mechanical properties at elevated temperature, when incor-

porated into thermosets. However, its drawbacks are the relatively high cost and the limited number of epoxy groups. The higher functionality level of sorbitol glycidyl ether provides larger chemical variability but limited thermomechanical performance. Syntheses of further carbohydrate derivatives are needed to provide affordable and thermal resistant crosslinked polymers of controlled biodegradability. These monomers can originate from various industrial plants or even from agricultural byproducts. More expensive carbohydrate monomers such as modified chitosans can be considered as comonomers to be grafted onto the backbones and adjusting this way the final properties to the requirements. Fully biodegradable composites can be formed by combination of these resins with natural fiber reinforcements.

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