BIOMATERIALS AND CONSTRUCTION

Bioderived products are being increasingly used overseas. A recent BRANZ study looked at the opportunities for using biomaterials in construction.

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Conversion of biomass into useful materials, such as polymers (plastics) and composite reinforcements, is finding increasing favour because of the perceived economic and environmental benefits. Conventional polymer materials are derived from fossil fuels, so growing polymer feedstock materials, which consume CO_2 by photosynthesis, appears to offer potential advantages.

Overseas, bioderived products are becoming readily available, with growth areas in medical devices and electronics. The use of these materials is also on the increase in New Zealand, particularly in packaging. Their potential for use in construction has not been investigated to any great extent, so BRANZ recently completed a study, funded by the Building Research levy, examining the potential, performance and availability of biomaterials in New Zealand.

Construction big user of polymer products

Approximately 43,000 tonnes of conventional polymer feedstock was converted into products for use in construction in 2006, according to figures from Plastics NZ.

PVC materials are the major polymeric material used directly by the New Zealand construction industry. Unplasticised PVC (uPVC) materials find applications in potable and wastewater piping, spouting, ducting, cladding, windows and trims. Plasticiser additives modify the material properties for applications such as cable sheathing, flooring, seals and gaskets.

High density polyethylene usage is significantly less than that of PVC. It is used in wastewater piping, building wrap, damp proof membrane, ducting and trims.

High volumes of expanded polystyrene are used for insulation. Although it has poor resistance to solar radiation exposure, it is hidden, so is fit for purpose.

Low density polyethylene consumption is almost entirely used as damp proof membrane below concrete slabs. Some substitution for high density polyethylene products is also believed to play a role in increased consumption.

Other types of polymeric materials, such as polycarbonates, polyesters (predominantly polyethylene terephthalate, PET) and polymethylmethacrylate (PMMA, acrylic) are also used in construction but account for only about 0.2% of total annual polymer usage in New Zealand.

Durability a concern

Plastic waste from construction is mainly leftover material from the building process and material recovered during demolition. Overall, plastic construction waste amounts to less than 4% of the total plastic sent to landfills each year and only about 0.2% of the total waste stream in New Zealand.

Plastic waste statistics have driven the packaging sector to be an early adopter of biomaterials, which can be biodegradable, but for the construction sector, durability is the major concern rather than waste.

Most plastic building components are required by the New Zealand Building Code to remain durable for 15 years or more. This is because they are used in applications that are difficult to repair or in areas that are difficult to access. Choosing to use bioderived materials will always be a balance of durability versus biodegradability.

Although it is possible that bioderived materials give benefits of reduced emissions during manufacture and reduced construction waste, the adoption of any biomaterial should be on the basis of establishing that the risk of substitution is minimal.

Uses for crops in construction

Around the world, some agricultural crops are finding new uses in construction. Recent developments include:

- natural fibres for reinforcing concrete and polymer composites
- hemp, flax and wool used in insulation materials
- straw-bale houses
- hemp-shive concretions with a lime binder used for wall construction
- linseed oil in natural paints and resins.

These developments are mainly limited to applications within the weathertight interior of buildings. Generally, bioderived materials are expected to struggle to deliver the properties required for use in exposed areas. Resistance to moisture and assurance of long-term durability will be important considerations when deciding whether or not to use bioderived materials.

Biodegradable packaging

The BRANZ study found that biopolymers and composites do have some potential for New Zealand's building industry, but their application is likely to be restricted because of their biodegradability. Hence, the use of natural fibres will probably be limited to products using synthetic resin (derived from oil) as the matrix. Likewise, the use of bioderived polymers will be limited to applications within the weathertight envelope of buildings.

Consequently, the most accessible benefit to the construction industry from bioderived materials is expected to be the adoption of biodegradable packaging materials. Such use will reduce the amount of construction-related waste persisting in the environment.

The full study report (SR192) can be downloaded from www.branz.co.nz.