Light-weight solutions with wood based biocomposites

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Bio-based material solutions, including biocomposites, are gaining more and more interest due to increasing environmental awareness, new government legislations, tightening CO_2 regulations and volatile crude oil prices. Within biocomposites, wood and cellulose fibres are often utilised with advantages of sustainability, reinforcement capability, low cost, easy availability, and non-abrasiveness. However, solid wood fibre composites have challenges in drilling and nailing together with relatively high density. At the same time, the use of light-weight thermoplastic materials provide remarkable savings in energy and cost, having numerous applications and high volume markets, but being typically based on crude oil derived polymers. By exploitation of cellulose fibre reinforcement and light-weight structures, various new applications for biocomposites can be achieved.

Extrusion foaming of wood fibre reinforced thermoplastic composites can create new business opportunities by combining the advantages of thermoplastic foams and wood fibres. However, to create desired foam structures, new knowledge of the behaviour of biocomposites in extrusion foaming process should be gained. Our work has focused on revealing the general foamability, cell structure and variables affecting the foaming behaviour of composites with wood fibre reinforcement. The research has also focused on extrusion foaming of cellulose fibre reinforced lignin based material, from which closed-cell, low density foam was obtained by optimisation of process conditions.

In addition to extrusion foaming of biocomposites, wood based fibres can provide also other methods for creation of light-weight biocomposite solutions. Light-weight, high-performance sandwich structures were developed by utilisation of thermoformable cellulose fibre based films in bio-based honeycomb structures. Also, porous wood fibre webs produced by foam-laid forming technology were combined with extrusion foamed polylactic acid structures to create an interior wall multilayer structure, targeting towards light weight product with excellent mechanical, thermal insulation and sound absorption and insulation properties.