Assessment of Life Cycle Studies on Hemp Fibre Composites

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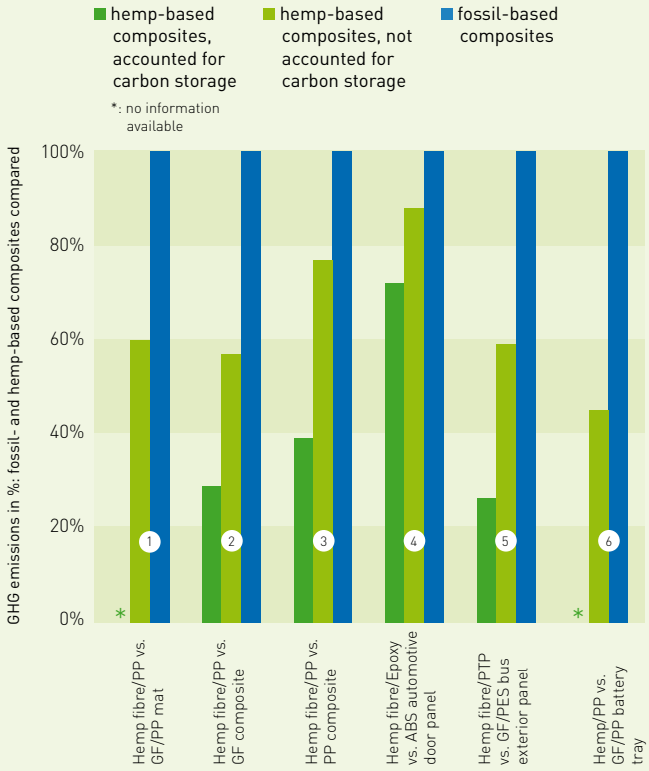

Figure 1: GHG emissions expressed in percent for the production of fossil-based and hemp-based composites for a number of studies – where available showing the effects of biogenic carbon storage

(PTP: Polymer material made of Triglycerides and Polycarbon acid anhydrides, PES: Polyester)

Hemp fibres are very suitable replacements for a variety of fossil-based materials. In this study, hemp-based reinforced plastics are compared to non-renewable materials like acrylonitrile butadiene styrene (ABS) and glass fibre reinforced polypropylene (PP-GF) regarding their environmental impacts on climate change and primary energy use.

The analysed products are compared based on their functionality. The assessment encompasses the extraction of raw materials, where applicable the cultivation of crops, the processing of materials and transports.

Hemp fibre reinforced plastics are materials that are composed of a polymer and hemp fibres from which the composite receives its stability. Hemp fibre reinforced plastics are mainly used in the automobile industry for interior, but also exterior, applications, and also for the production of furniture or other consumer products. The material shows favourable mechanical properties such as rigidity and strength in combination with low density. The material, moreover, does not splinter and leaves no sharp edges (which is an important characteristic especially in the case of automobile accidents). The majority of the currently produced applications are manufactured using thermoplastics and thermoset compression moulding for which the natural fibre fleece and the polymer material are heated and pressed. A wide range of natural fibre automobile interior applications are produced in this way, including door panels and car boot trims, rear shelf and roof liner panels, dashboards, pillar trims, seat shells, under-bodies and other parts. Another, currently less common, processing technique is injection moulding which is expected to quickly gain market shares in the near future.

Six of the LCA studies included in the analysis of hemp fibre reinforced plastics are depicted in the chart. All of the hemp fibre reinforced plastics examined show energy and greenhouse gas (GHG) savings in comparison with their fossil-based counterparts. The chart shows the considerable savings that are achieved when the functionally-equal hemp-based composites are used instead of fossil-based composites. Because internationally no agreement has yet been made on whether or not to include the storage of biogenic carbon in product-based life cycle assessment, both methods have been included in this study.

Therefore without accounting for biogenic carbon storage, GHG savings range between 12 and 55%. When biogenic carbon storage is taken into account savings between 28 and 74% can be reached.

Even larger savings can be reached: Because of the higher density of glass fibres for example, a weight reduction of the application can be achieved when hemp fibres are used. This can result in considerable GHG and energy savings during use." Also, hemp fibre reinforced plastics contain to a smaller or larger extent fossil-based resources. In order to decrease the use of fossil energy and mitigate GHG emissions, inputs of fossil-based materials should be reduced as much as possible or replaced by bio-based plastics. At the current time those fully bio-based composites are only used in the Japanese automotive industry.

Result: Hemp fibre reinforced plastics show considerable energy and greenhouse gas (GHG) savings in comparison with their fossil-based counterparts.

The full study 'Hemp Fibres for Green Products – An assessment of life cycle studies on hemp fibre applications' will be available at www.eiha.org by March 2011.

www.nova-institut.de

The study was financed by:
www.eiha.org
www.drbronner.com
www.hempflax.com
www.bafa-gmbh.de

Sources of information for the graph:

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