

Bast Fibre Reinforcement – Analysing bast fibres for their use in lightweight engineering and construction

Objective

In order to increase stability in the plant stem, bast fibres in the bark area stabilise the stem. In contrast to the rigid wood, these fibres are very flexible allowing slender-stemmed, tall plants to move in the wind without breaking.

Over the last 5,000 years, and probably even before that, bast fibres from plants have been of great importance as a basis for clothing, cordage and building materials. Until now, complex and multi-stage processes have been necessary, in order to extract bast fibres from the stalk without adhering impurities. A new process extracts the bast bark from hemp by peeling. The resulting characteristic values are very promising in comparison with the continuous rovings made from flax available on the market. The material could be used as reinforcement in lightweight engineering and construction.

Approach and results

In the course of the project, materials made of hemp and flax from Central Europe as well as ramie and kenaf from Indonesia were analysed for their composite properties and the characteristic values were compared with each other. For material testing purposes, glue-on tensile samples were produced from natural fibre-epoxy resin mixtures.

With the help of glue-on samples, which were produced under defined conditions with regard to geometry, temperature management, moisture content, fibre weight and resin quantity as comparative samples, characteristic values such as tensile modulus, breaking strength and elongation could be determined. The bast fibre materials in use differed in the type of plant, e.g. hemp, flax, ramie and kenaf, the type of pre-treatment, e.g. roasting, fibrillation or bundling, and the type of resin being used. The evaluation of the characteristic values resulted in 35 to 39 GPa modulus of elasticity in the tensile test. This opens up a high potential for tensile-strength, indigenous bast fibres made from flax and hemp, which can be used in the fibre composite industry.



Production of fibre composite samples with bast fibre reinforcement

However, the test results also showed that the measured values fluctuate considerably. The practical application of the fibres was tested using the pultrusion process. Therefore, challenges such as providing a continuous fibre sliver and achieving a high fibre content in the pultrudate had to be overcome.

Acknowledgement

We would like to thank the Federal Ministry for Economic Affairs and Climate Protection for funding the research project *Bast Fibre Reinforcement* (Reg. No. 49VF200068) within the funding programme “FuE-Förderung gemeinnütziger externer Industrieforschungseinrichtungen – Innovationskompetenz (INNO-KOM) – Vorlaufforschung (VF)”.

The final report on this project is available on request from april 2024.

Contact: Dipl.-Ing. Heike Metschies
Dipl.-Ing. Elke Thiele

Phone: +49 371 5274-213
Phone: +49 371 5274-243

Email: heike.metschies@stfi.de
Email: elke.thiele@stfi.de

14/08/2023

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Supported by:



on the basis of a decision by the German Bundestag

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