This thesis presents work that was done within the Swedish Centre for Resource Recovery (SCRR). Research and education performed within SCRR identifies new and improved methods to convert residuals into value-added products. SCRR covers technical, environmental and social aspects of sustainable resource recovery.


Natural fibres such as kenaf, hemp, and flax, also known as bast fibres, offer several benefits such as low density, low cost, carbon dioxide neutrality, sustainability and renewability. In Europe, their composites are used by many car manufacturers, mostly in interior semi-structural applications. At present, the dominant reinforcement fibres in the automobile composite parts are glass fibres because of their good mechanical and processing properties. Yet, their use is criticised in the industry because of high ecological standards in the new applications. The specific mechanical properties of bast fibres are comparable and at times better than glass fibres. In structural applications, their use is however limited because of poor mechanical strength, varying fibre characteristics (because of climate, cultivation, soil), and low thermal strength, which does not allow processing at higher temperatures. Thus, they cannot fully meet the structural strength and durability demands of automobile parts as the glass fibres do. This research work aims to improve the mechanical properties of bast fibre reinforced polymer composites by hybridisation with high performance basalt fibres. Basalt fibres are natural inorganic fibres with mechanical and thermal properties higher than bast fibres and comparable to the common glass fibres (E-glass).

Composites were manufactured by established processing methods such as carding, resin impregnation and compression moulding. They were analysed for their mechanical, thermal, and morphological properties. The material characterisation showed significant improvement in the mechanical performance of the bast fibre reinforced polymer composites by the addition of basalt fibres. It was found that selecting basalt fibres with appropriate sizing could significantly influence the fibre matrix bonding and is a deciding factor in defining the optimal mechanical performance of the composite. Apart from material characterization, the composites were processed to demonstrator parts according to the industrial specifications, to study their processability for the implementation of the material in practical applications.

The study highlights the potential of basalt fibres to improve the mechanical performance of bast fibre reinforced composites by hybridisation while stressing the importance of fibre matrix interaction to define the composite's performance. The newly developed hybrid bast/basalt composites can be applied in structural, load bearing, and shock absorption applications and have exciting potential to replace, at least partially, glass fibre reinforced polymer composites.



Electronic version: http://urn.kb.se/resolve?urn=urn:nbn:se:hb:diva-24939
ISBN 978-91-89271-21-0 (printed)
ISBN 978-91-89271-22-7 (pdf)
ISSN 0280-381X, Skrifter från Högskolan i Borås, nr. 118


DOCTORAL THESIS
Resource Recovery

*Anjum Saleem*

DEVELOPMENT AND CHARACTERISATION OF BAST AND BASALT FIBRE HYBRID POLYMER COMPOSITES FOR AUTOMOTIVE APPLICATIONS

# Development and characterisation of bast and basalt fibre hybrid polymer composites for automotive applications


ANJUM SALEEM


UNIVERSITY OF BORÅS