

Potential use of side streams in composites

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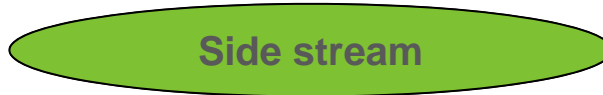
Potential use of side streams in composites



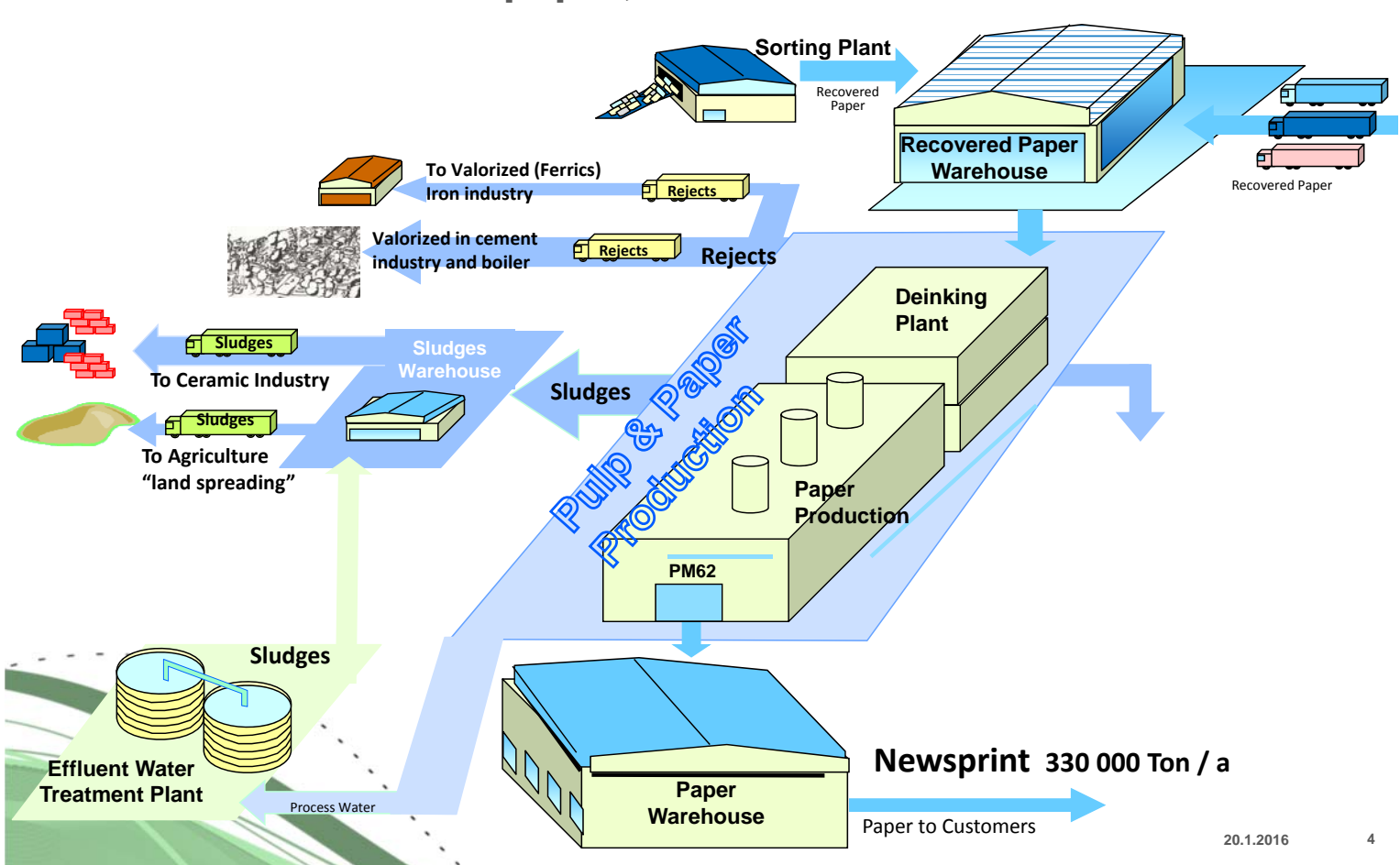
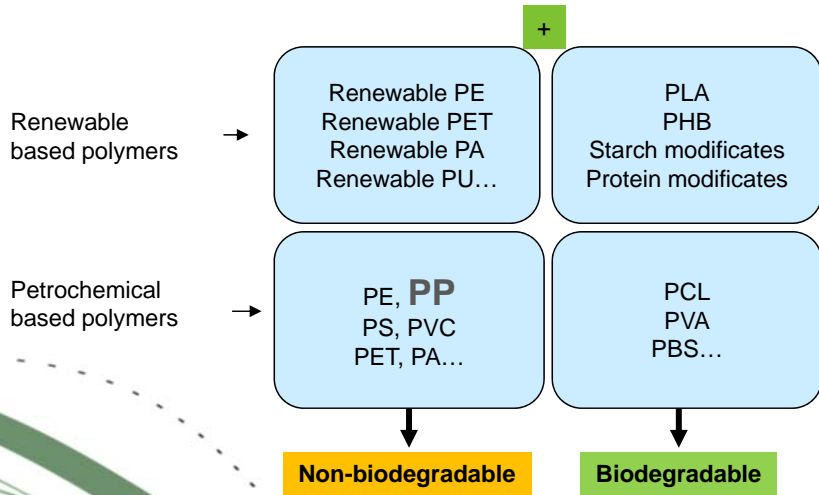
- Content
 - Biocomposites
 - Side streams from pulp&paper industry
 - Process steps from side stream to composite
 - Properties of side stream composites
 - End use possibilities
 - Conclusions

There is no universal definition or standard for biocomposites

Composites are materials made from two or more materials with different properties when combined, they produce a material with characteristics different from the individual components.



Novel composite



Side streams demonstrated in composites



Deinking pulp



Deinking sludge



Coarse fibre sludge

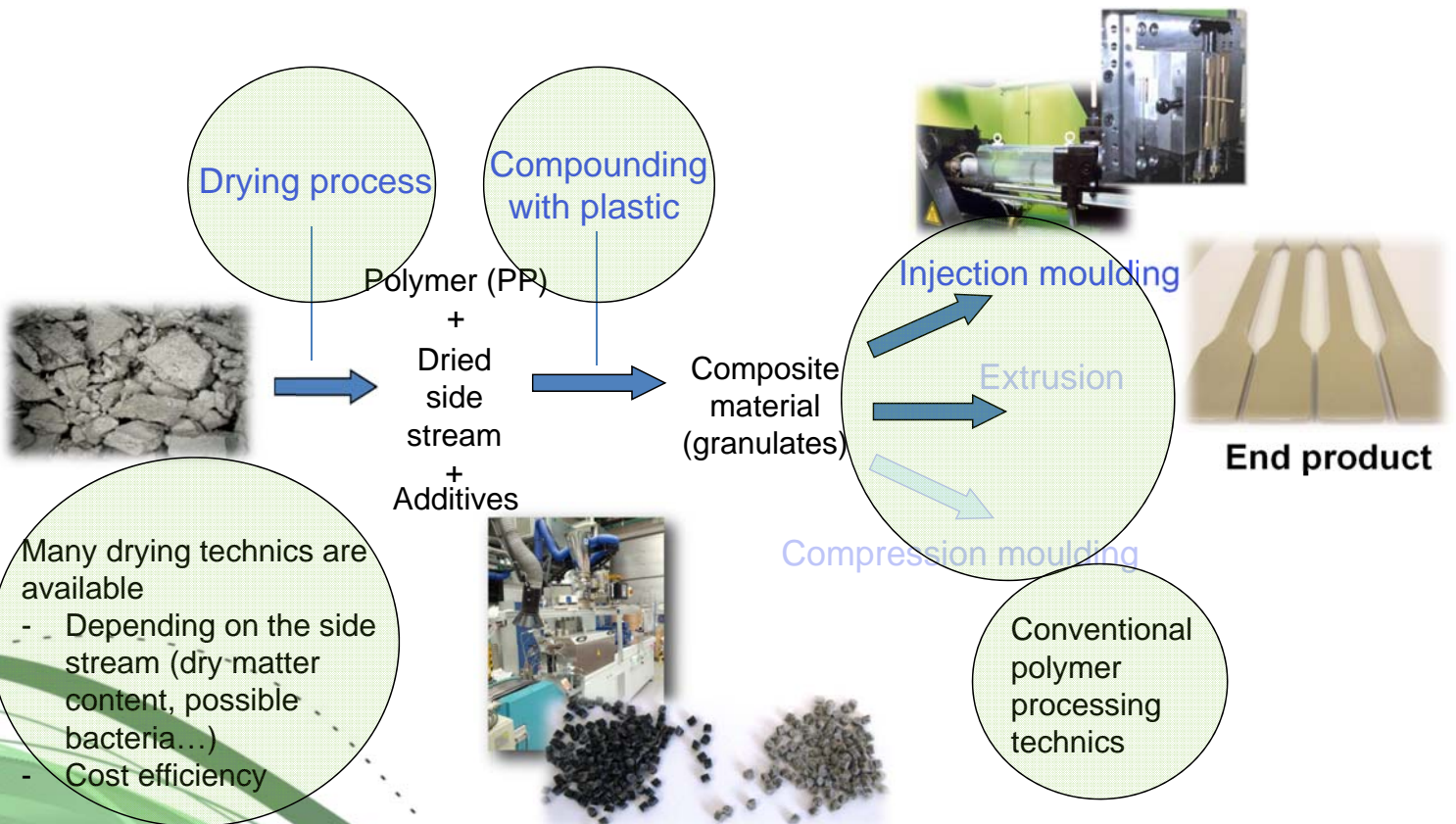


Fly ash



Total sludge

Process steps from side streams to composite

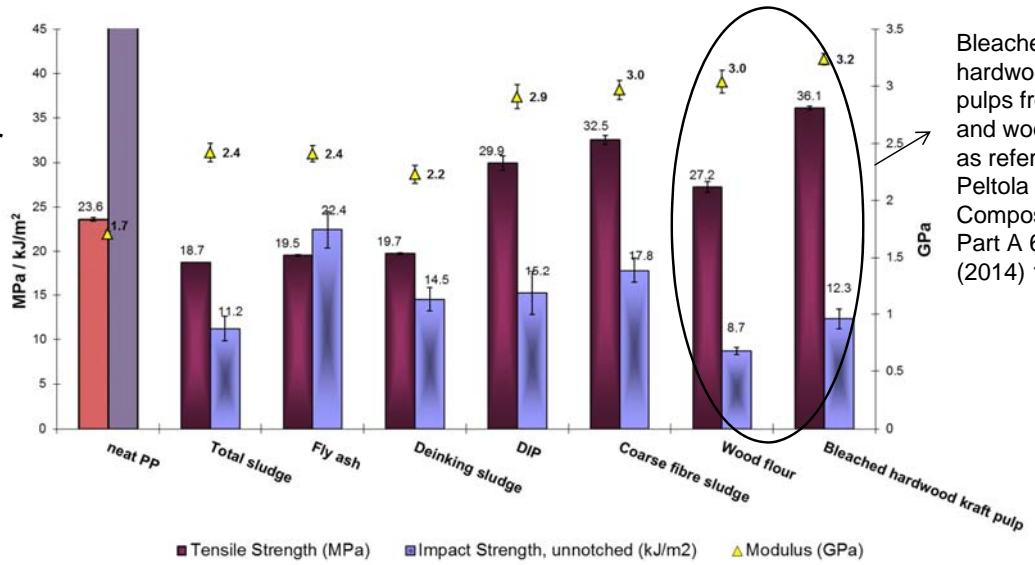


Tensile properties of side stream composites

Tensile strength is the maximum stress that a material can withstand while being pulled before failing or breaking.

Impact strength describes the toughness of the material.

Modulus describes the stiffness of the material.



Bleached hardwood kraft pulps from birch and wood flour as reference, Peltola et al. Composites: Part A 61 (2014) 13-22

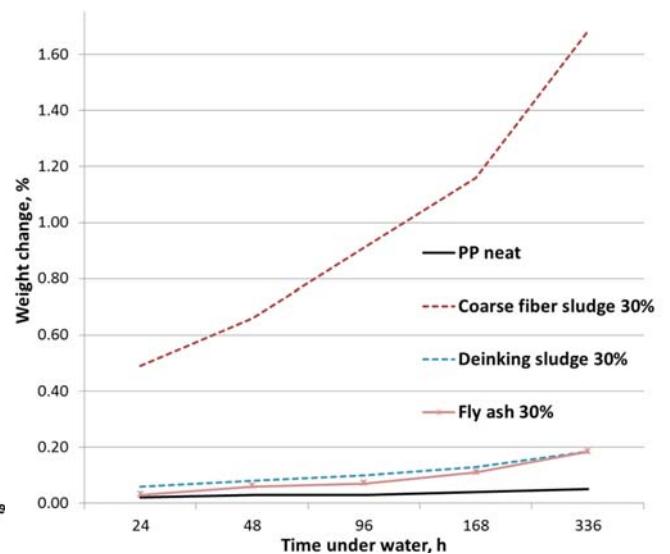
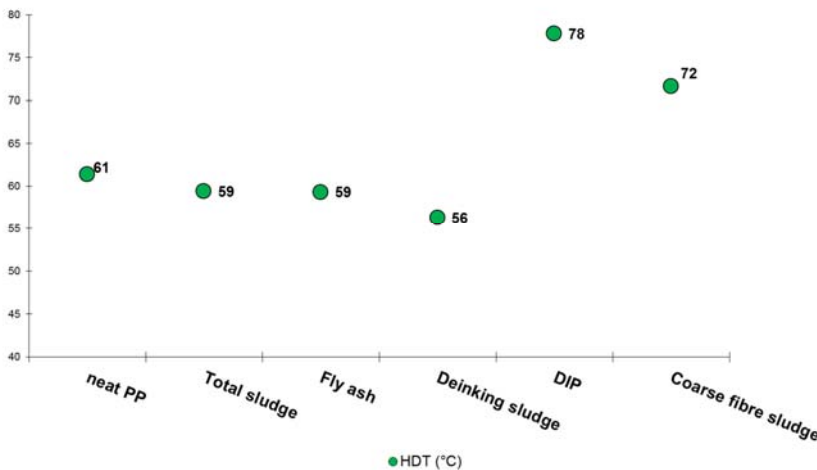
Side streams with fibres improve tensile strength and are stiffer

The best impact strength was with fly ash

Thermal stability and water uptake of the composites

The **heat deflection temperature (HDT)** is the temperature at which a polymer sample deforms under a specified load.

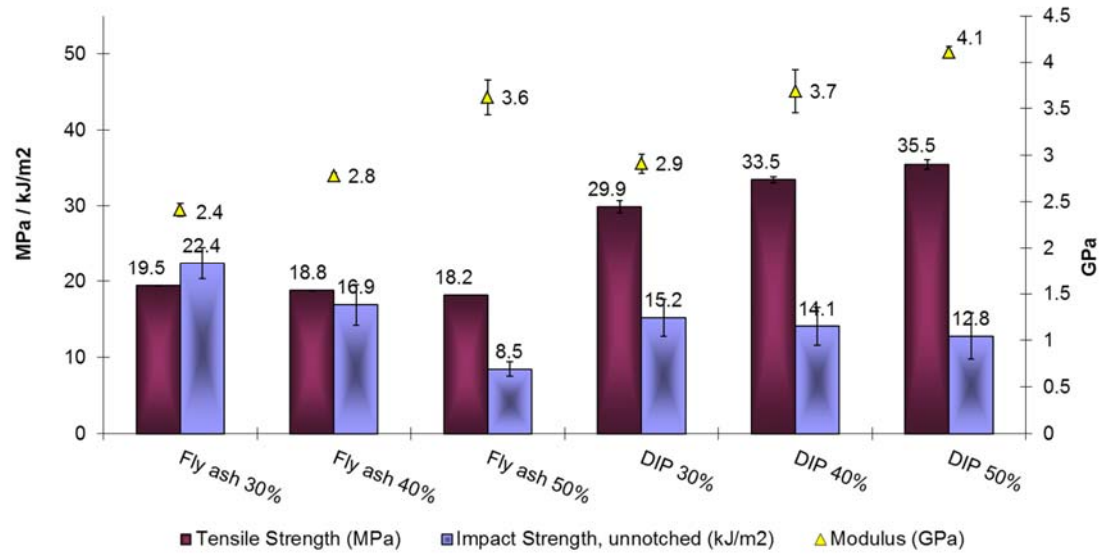
Samples were immersed in a 23 °C water bath for two weeks.



Side streams with fibres improve temperature stability but water uptake is increasing.

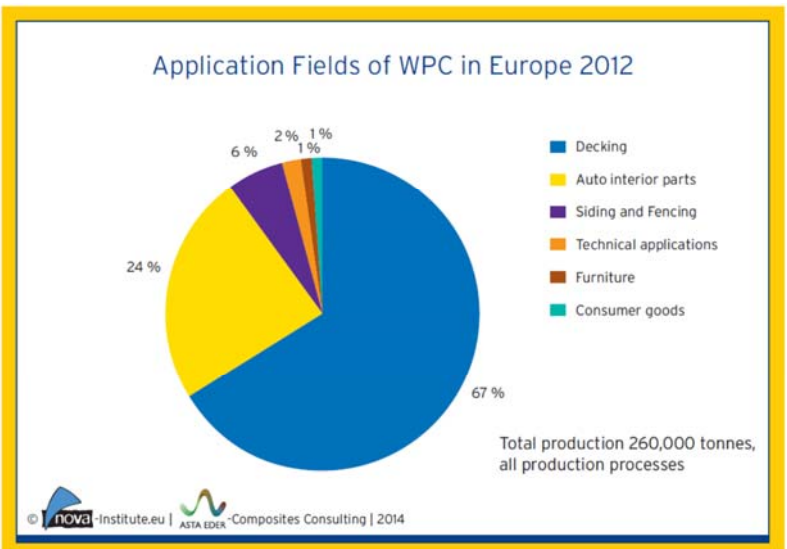
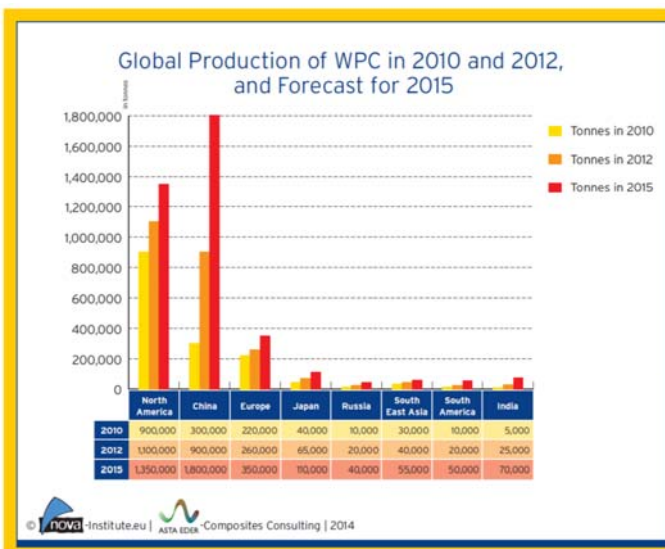
The loading of the side streams in composites

Fly ash and deinking pulp content
30, 40 and 50 wt-%



The side stream loading can be at least up to 50 wt-%
Fibrous side streams could be used as reinforcing "additive"
with other side streams

Production and applications of WPC



M. Carus, A. Eder, L. Dammer, H. Korte, L. Scholz, R. Essel, E. Breitmayer : Wood-Plastic Composites (WPC) and Natural Fibre Composites (NFC): European and Global Markets 2012 and Future Trends, nova-Institute 2014, www.bio-based.eu/markets

End use possibilities



Trex® Outdoor Furniture™



www.steenfatt.dk

Biocomposite products from pulp and paper industry

Use of side streams:

- UPM **ProFi** from UPM Kymmene
 - Waste generated in the manufacture of self-adhesive labels (mixture of paper, plastic, silicon, and ink) are used for extrusion profiles e.g. for decking
- **THRIVE™** Cellulose Fibre Reinforced Thermoplastics from WeyerHaeuser
 - Also THRIVE Recycled range available for economy pricing

Use of cellulose fibres

- UPM **Formi** from UPM Kymmene
 - Cellulose fibre reinforced plastic (PP) composite for injection moulding
- **FIBROMER®** from Mondi
 - Cellulose fibre reinforced polymer for injection moulding
- **DuraPulp** from Södra
 - Bio-composite made up of totally renewable and biodegradable components wide range of applications.

www.upmprofi.com/en/Pages/default.aspx

<http://www.weyerhaeuser.com/pdfs/businesses/cellulosefibers/THRIVE%20brochure.pdf>

www.upm.com/formi/Pages/Default.aspx

<http://www.mondigroup.com/products/desktopdefault.aspx/tabid-1911/>

www.sodra.com/en/pulp/pulp_products/Composite-material/DuraPulp/

Conclusions

- Side streams with high content of natural fibres have a reinforcing effect in PP composites. They enhance the tensile strength, stiffness and HDT.
- Side streams such as deinking sludge, total sludge and fly ash can be used as a cheap filler. They increase the stiffness of the matrix polymer.
- Fibrous side streams could be used as reinforcing "additives" with other side streams.
- The loading of the studied side streams in PP-composite can be up to 50 wt-%.
- The studied side streams are easy to process after careful drying.
- Suitable end uses for these novel composites are needed!



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Thank you!

Acknowledgement

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