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# CELISE 1<sup>st</sup> Symposium

## Selected issues of lignocellulosic biomass valorization and functionalization

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25<sup>th</sup> July, 2023





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# Index

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- Birch bark post-processing residues as particleboard binder
- Replacing hardener by functionalized suberinic acid residues  
*(both completed under ForestValue 2021 project acronym „BarkBuild”)*
- Textile waste valorization in high density fiberboards



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# Birch bark post-processing residues as particleboard binder

- About 5 kg paste-like **acidic** residues after Suberinic Acid (SA) extraction
- Low SA content, dry mass content ca. 25%







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# Birch bark post-processing residues as particleboard binder

Single layer 10 mm thick PB, 700 kg/m<sup>3</sup>  
nominal density

3 different particles size:

- fine (as for industrial PB **face** layers)
- medium (as for industrial PB **core** layers)
- coarse (as for industrial OSB)

Resination\*: 10% and 20%

Wood raw material for particles production:  
mainly *Pinus sylvestris* L.

No hydrophobic agent added



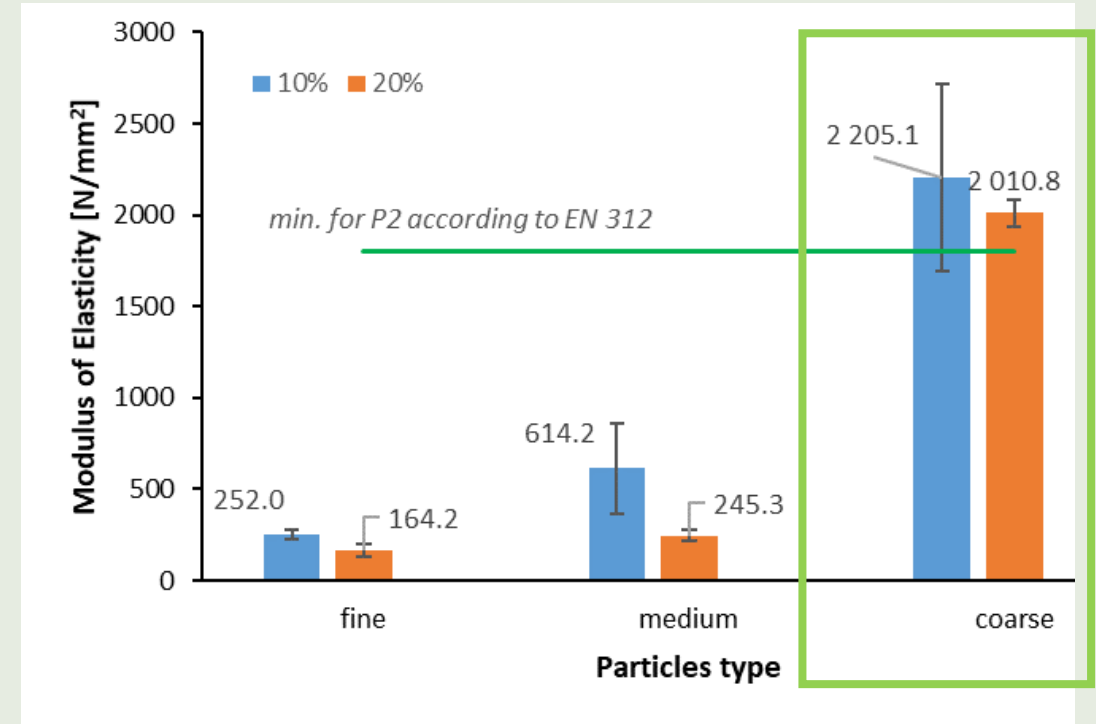
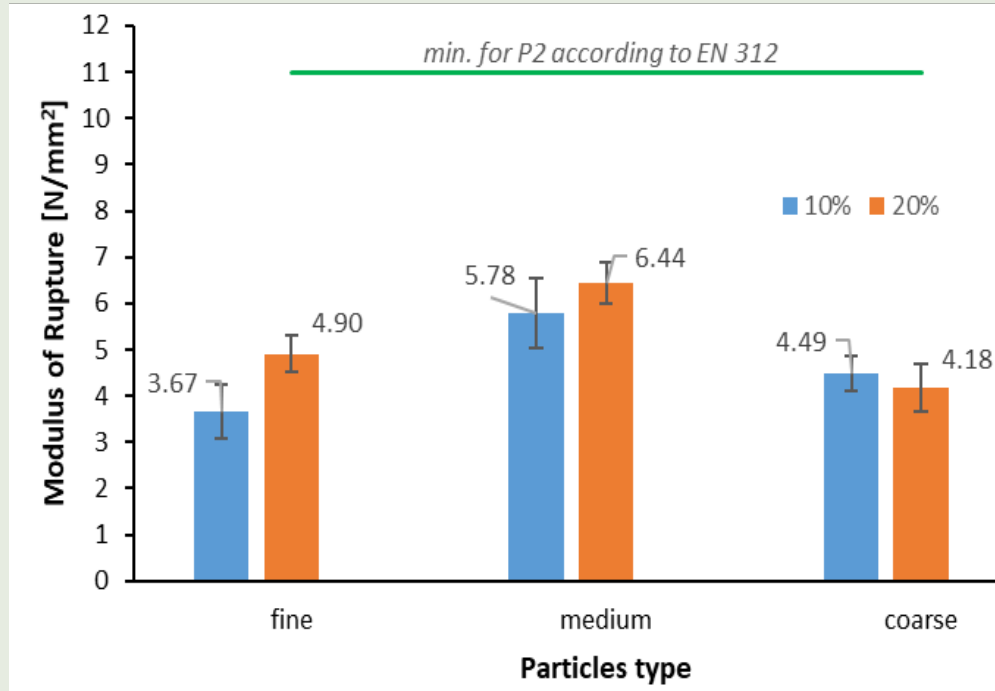


# Birch bark post-processing residues as particleboard binder

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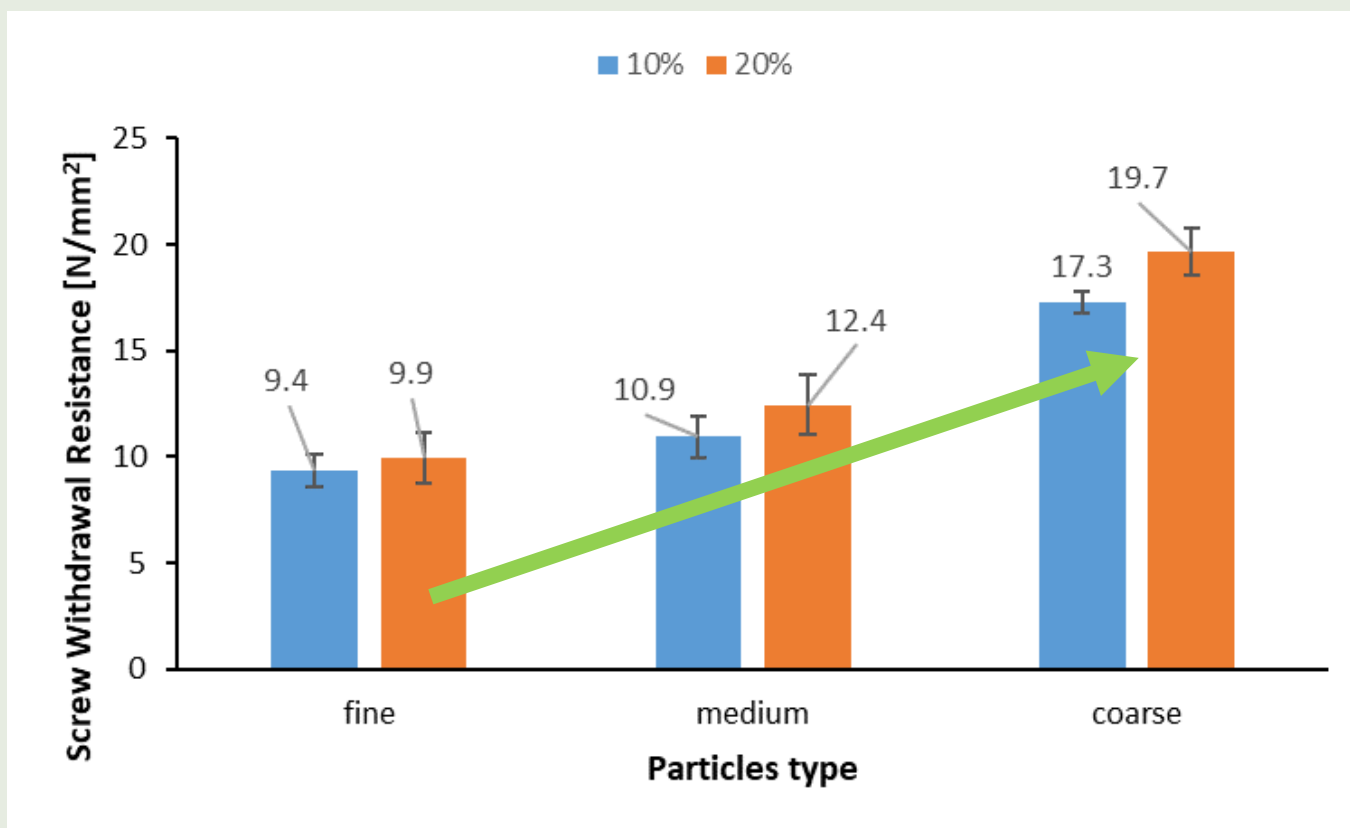


## MOR and MOE





## Screw Withdrawal Resistance



PB - a



PB - c



PB - b



PB - d

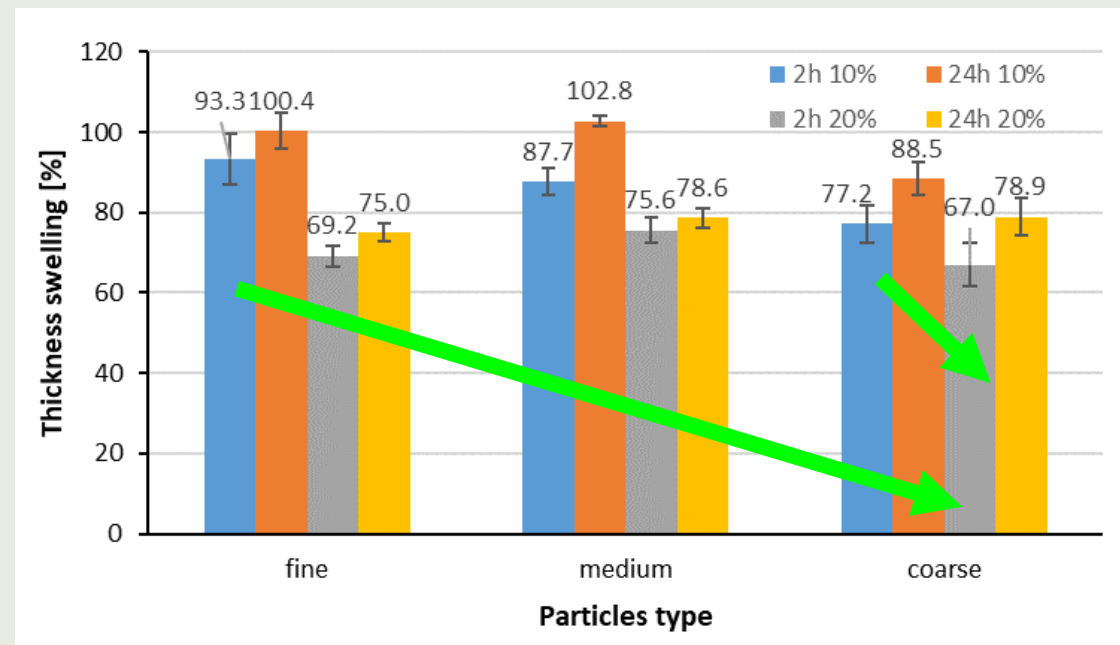
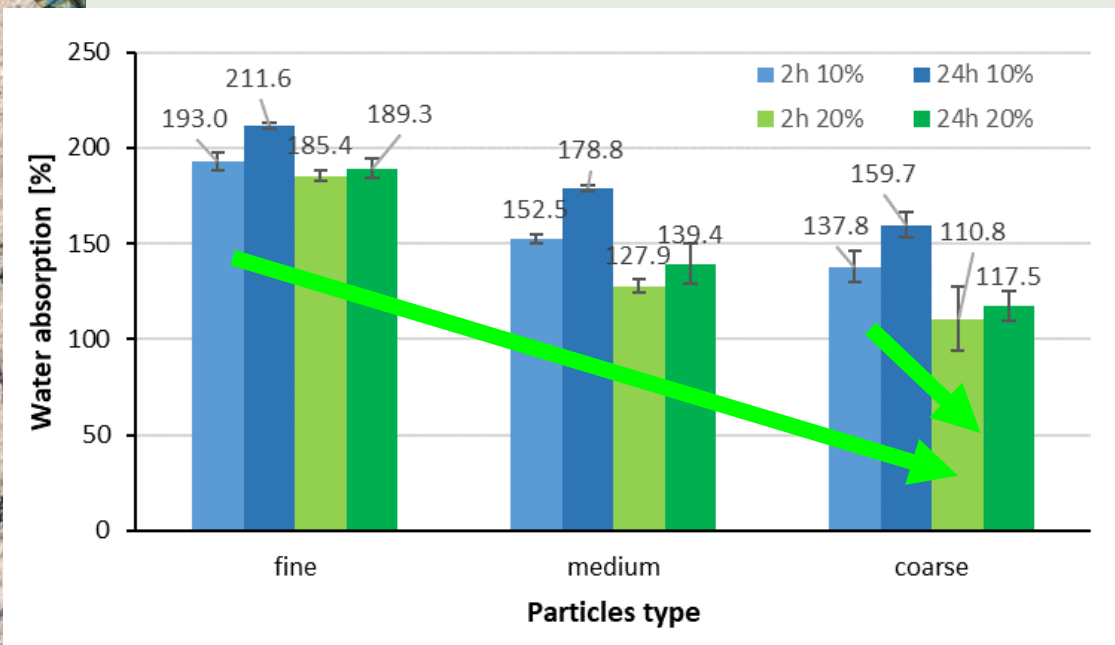




# Birch bark post-processing residues as particleboard binder

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## WA and TS





# Birch bark post-processing residues as particleboard binder

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## Conclusions

The highest **MOR** values were obtained by medium-particle samples and 20% resination.

The higher the particle size and less resination, the higher **MOE** values.

**IB** increased by increasing of resination.

The higher particle size and resination - the higher **SWR**.

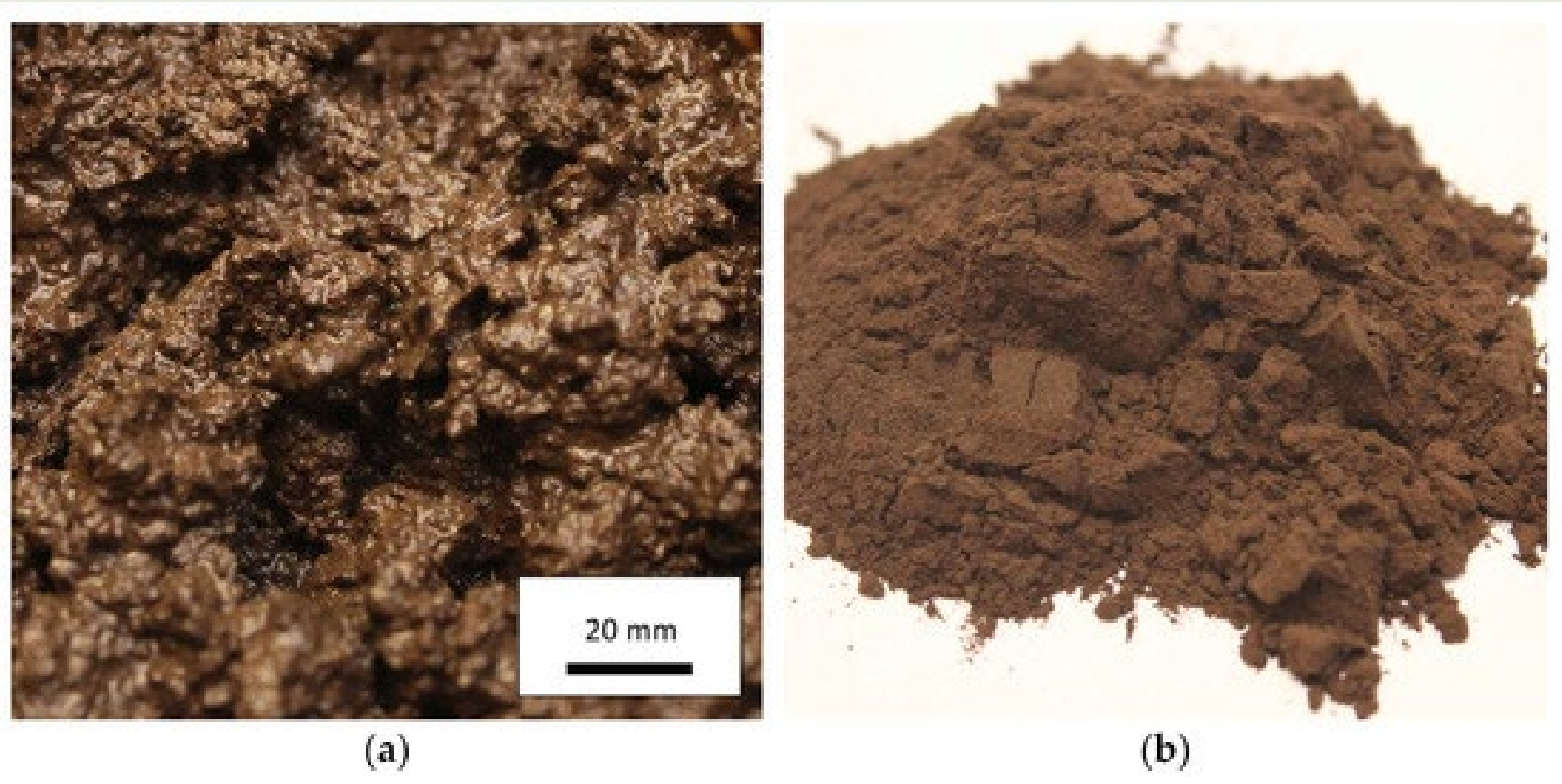
**TS** and **WA** positively decreases with higher resination.





# Replacing hardener by functionalized suberinic acid residues

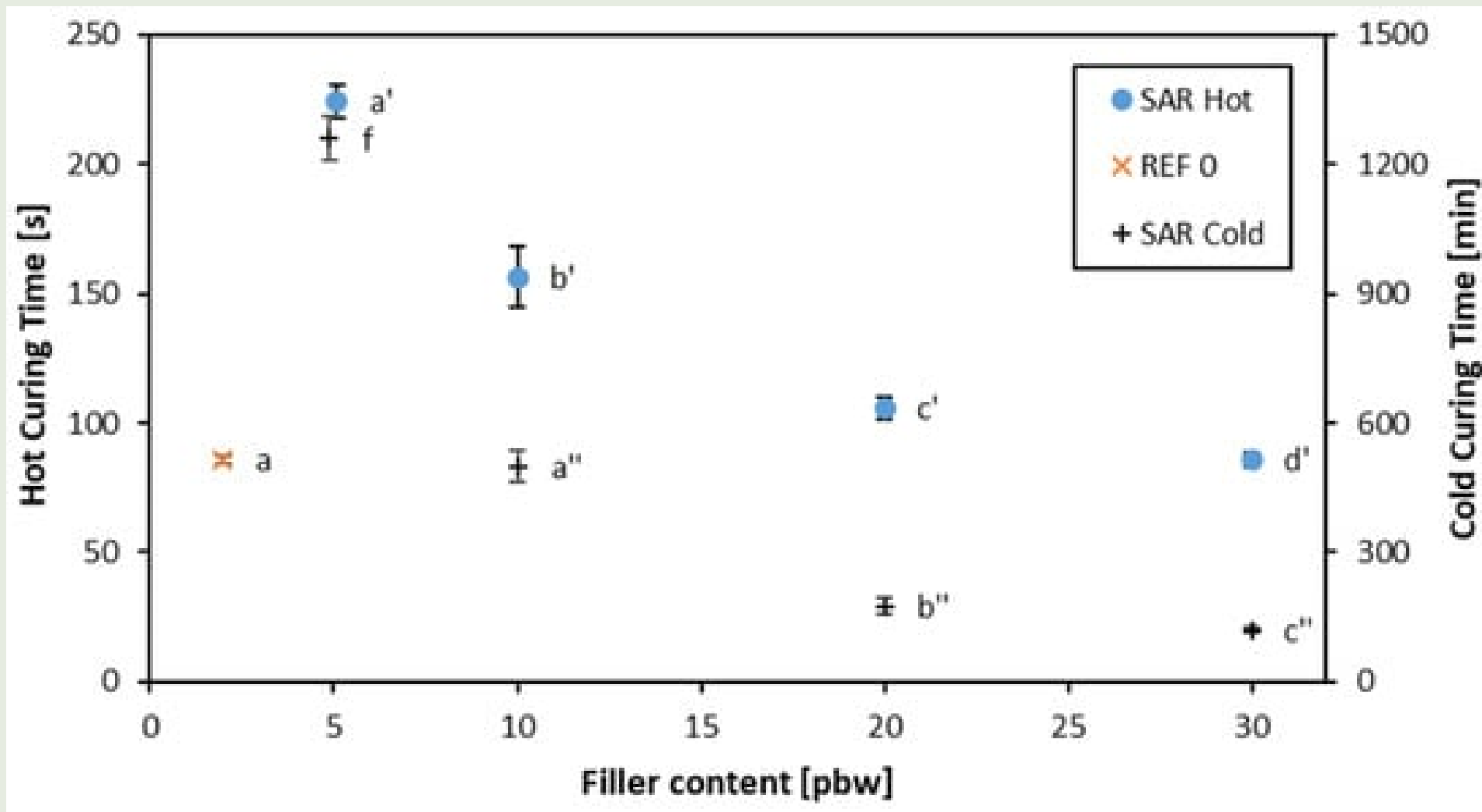
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# Replacing hardener by functionalized suberic acid residues

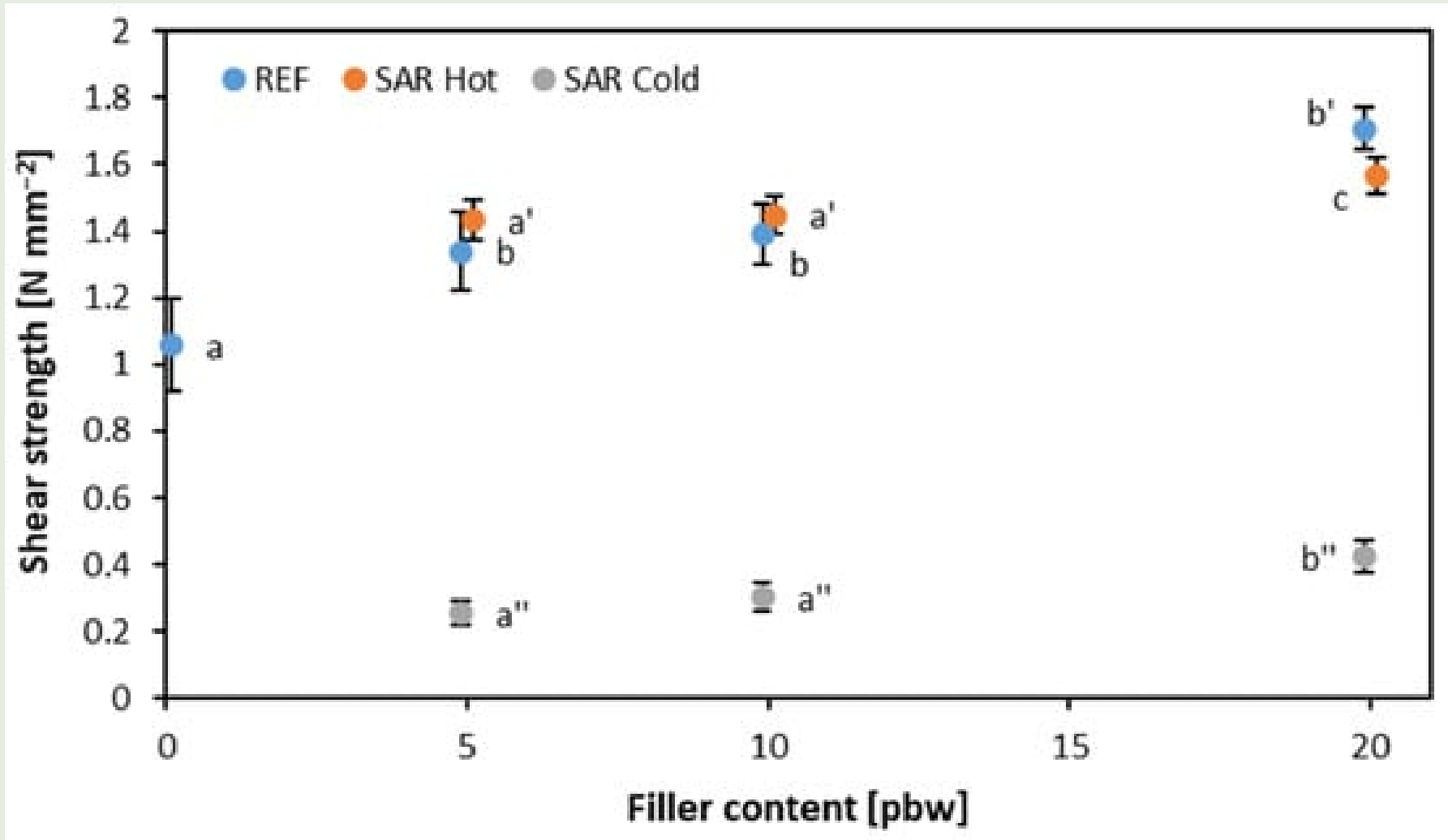
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# Replacing hardener by functionalized suberic acid residues

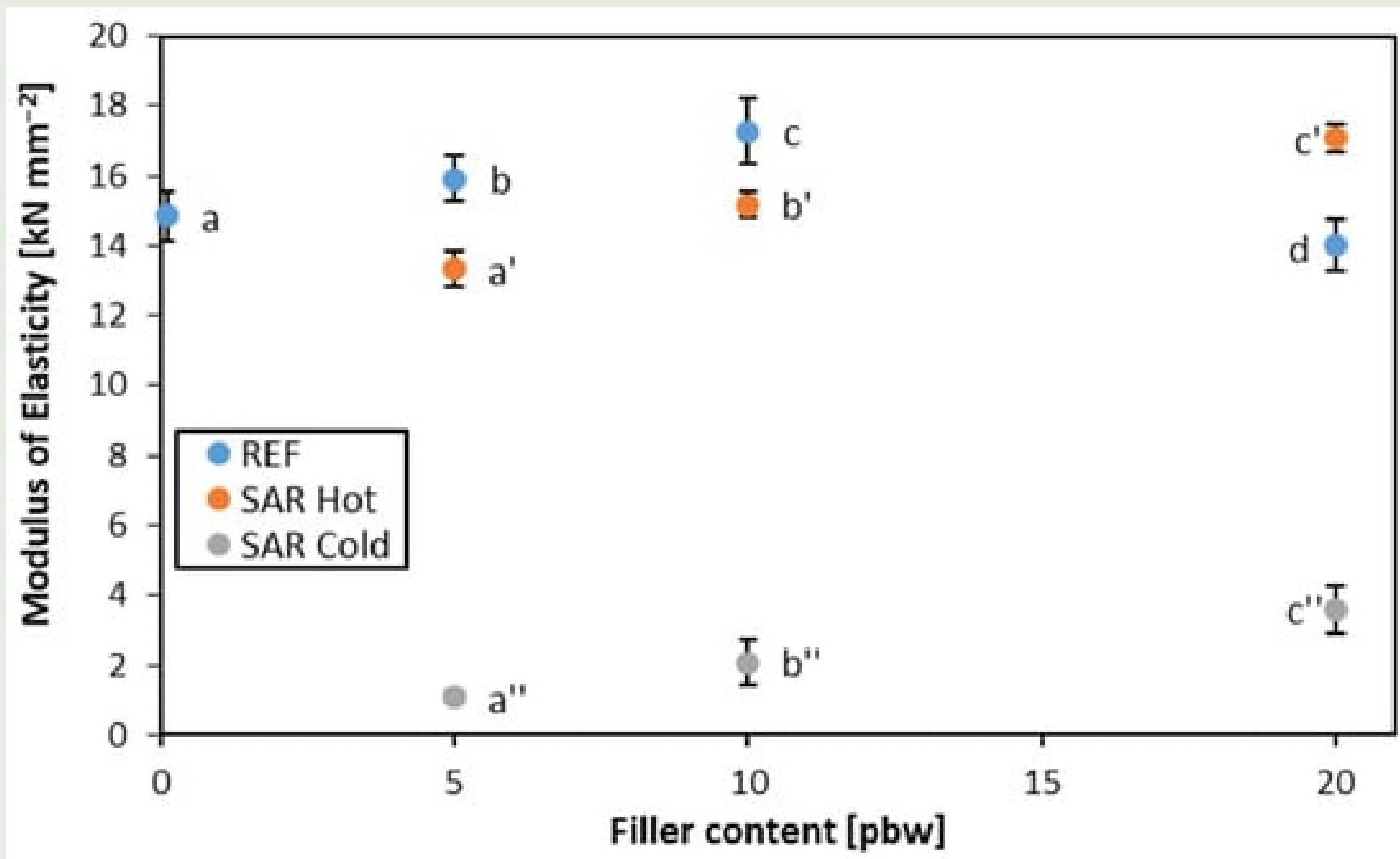
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# Replacing hardener by functionalized suberic acid residues

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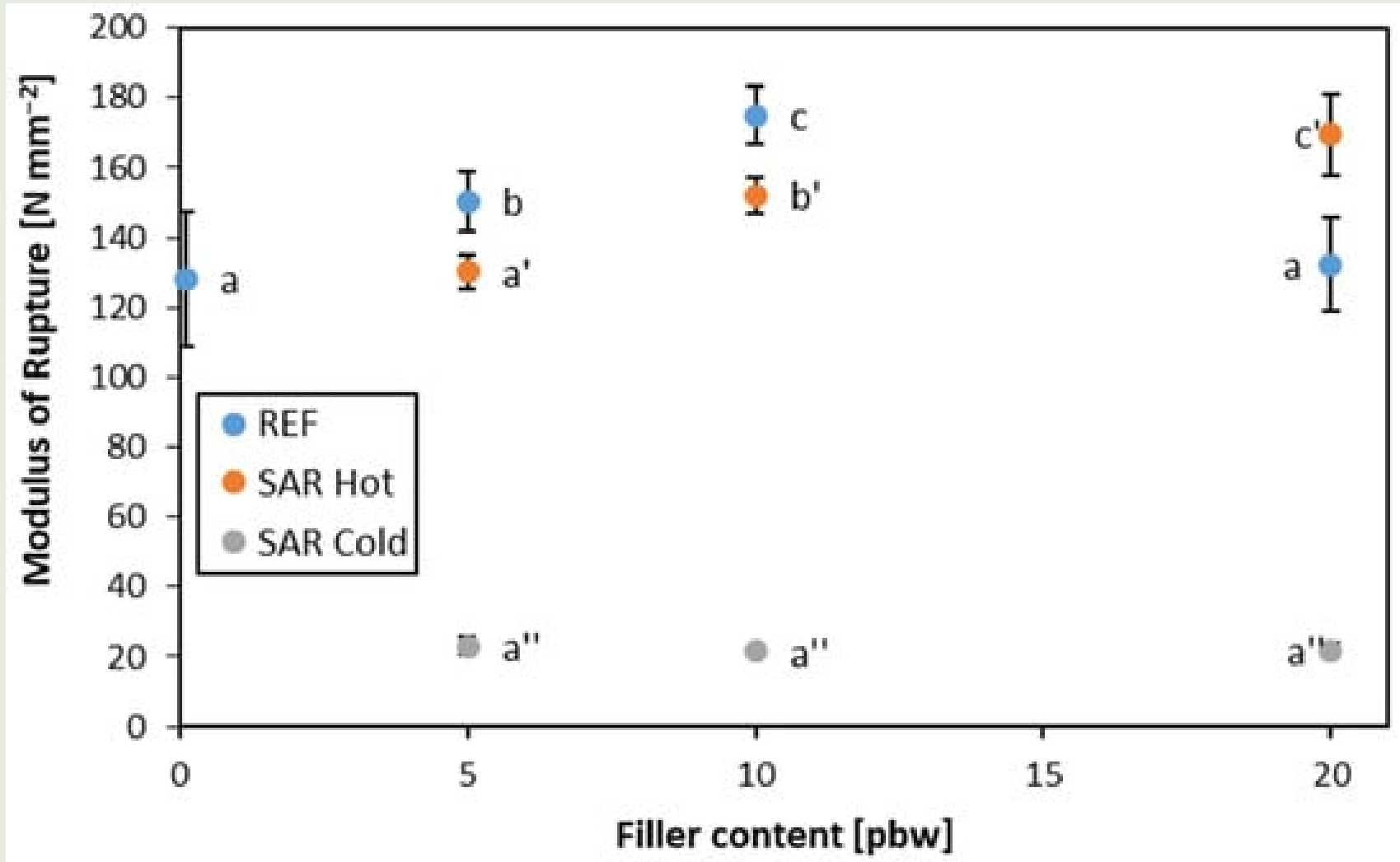






# Replacing hardener by functionalized suberinic acid residues

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# Replacing hardener by functionalized suberinic acid residues

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REF 10



SAR 10



SAR 10 C



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## Replacing hardener by functionalized suberinic acid residues

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The shear strength of the plywood samples **increases with the SAR rise** for both cold- and hot-pressed panels. The positive effect of veneer impregnation limiter by resin has been identified for SAR acting as a filler. Additionally, a higher density of SAR-containing bonding lines has been reached for hot-pressed panels. In the case of bending strength, and modulus of elasticity, the **increase in both parameters has been found** when increasing the SAR filler content within the above-mentioned range.

The results confirmed the ability to use the SAR as an upcycled component of the bonding mixture for plywood production.





# Textile waste valorization in high density fiberboards

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# Textile waste valorization in high density fiberboards

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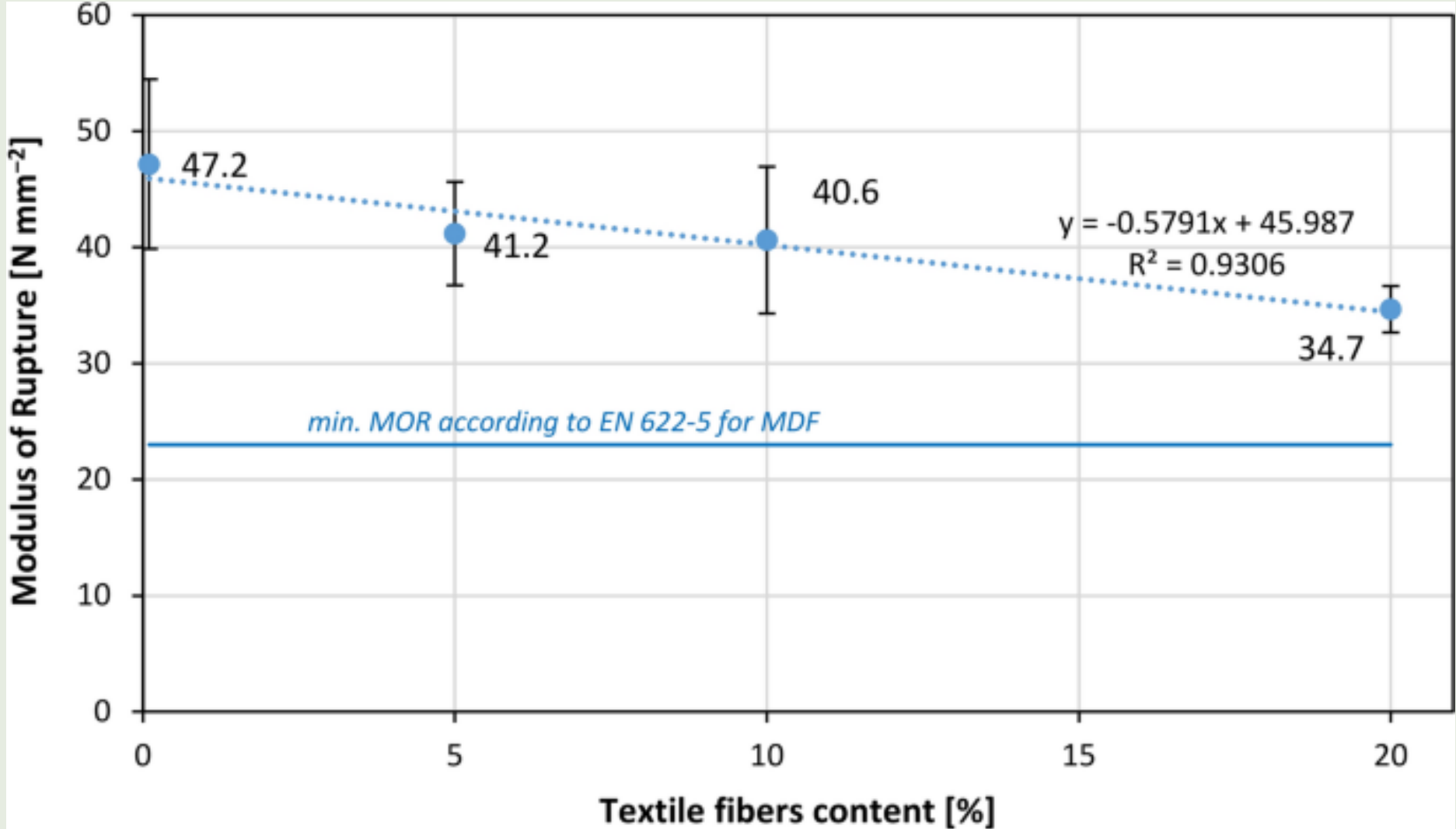
The following variants of the panels were produced: **reference panels and panels with various textile fibers content (5, 10 and 20% w/w) added at the production stage.**





# Textile waste valorization in high density fiberboards

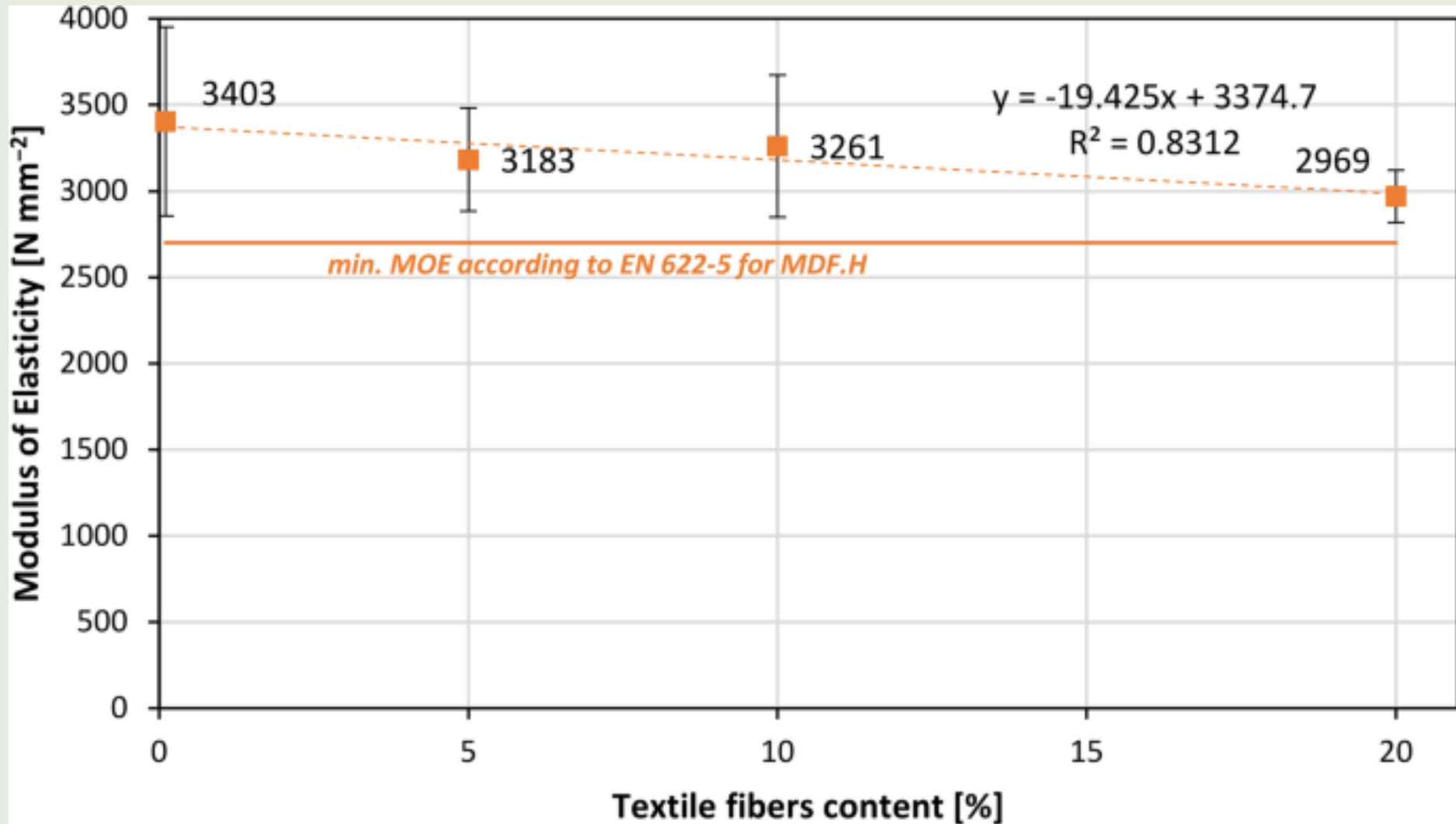
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# Textile waste valorization in high density fiberboards

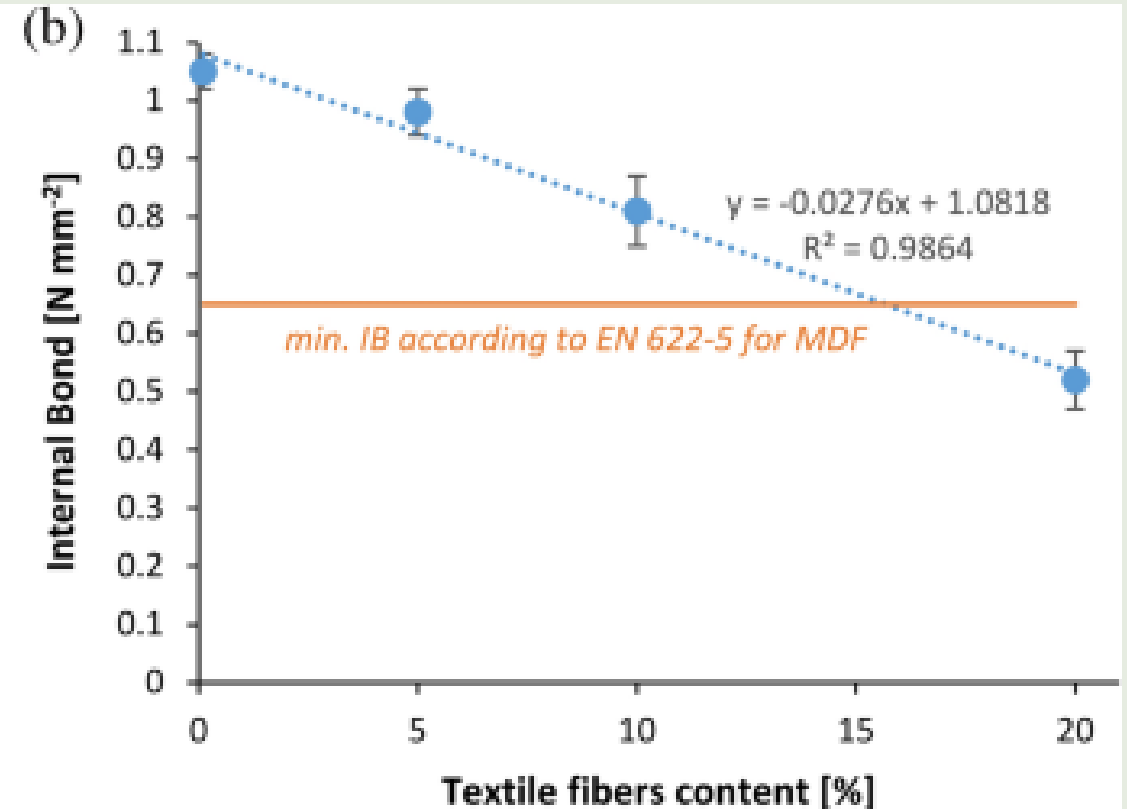
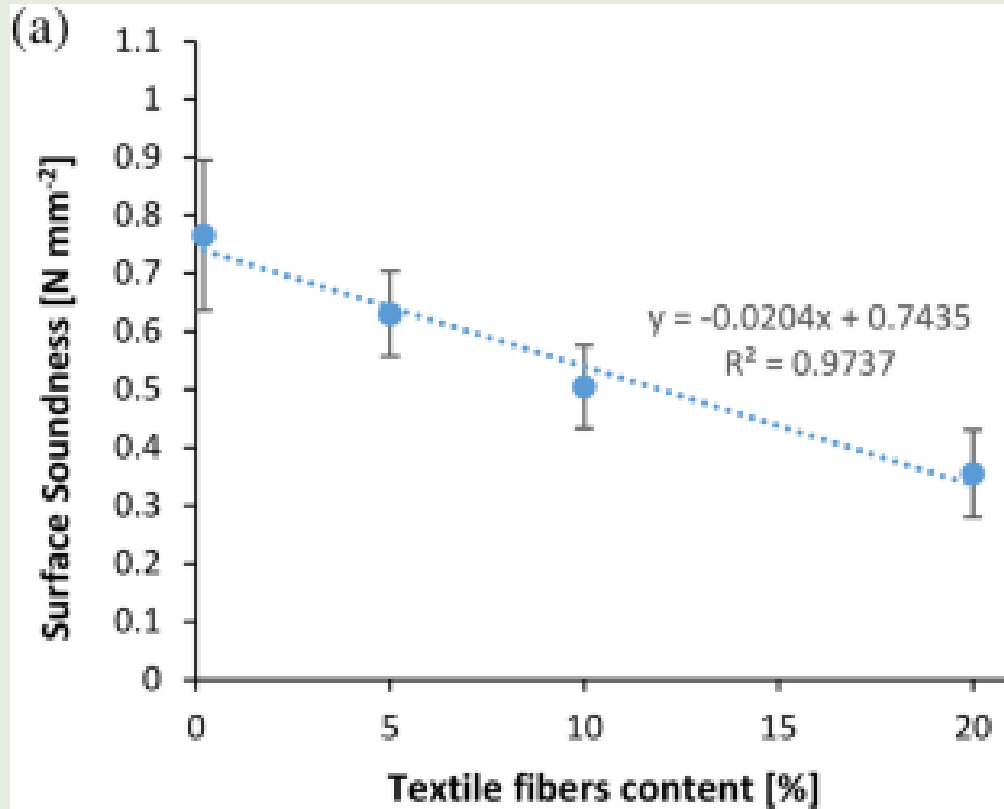
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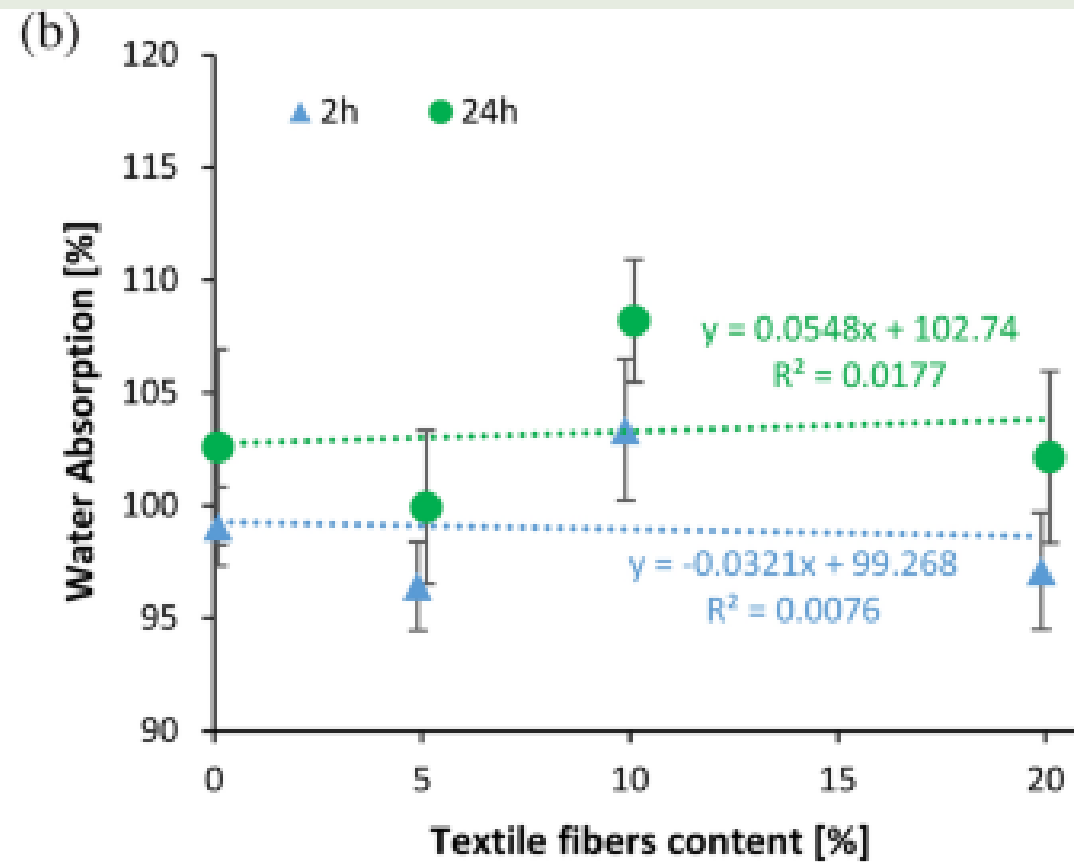
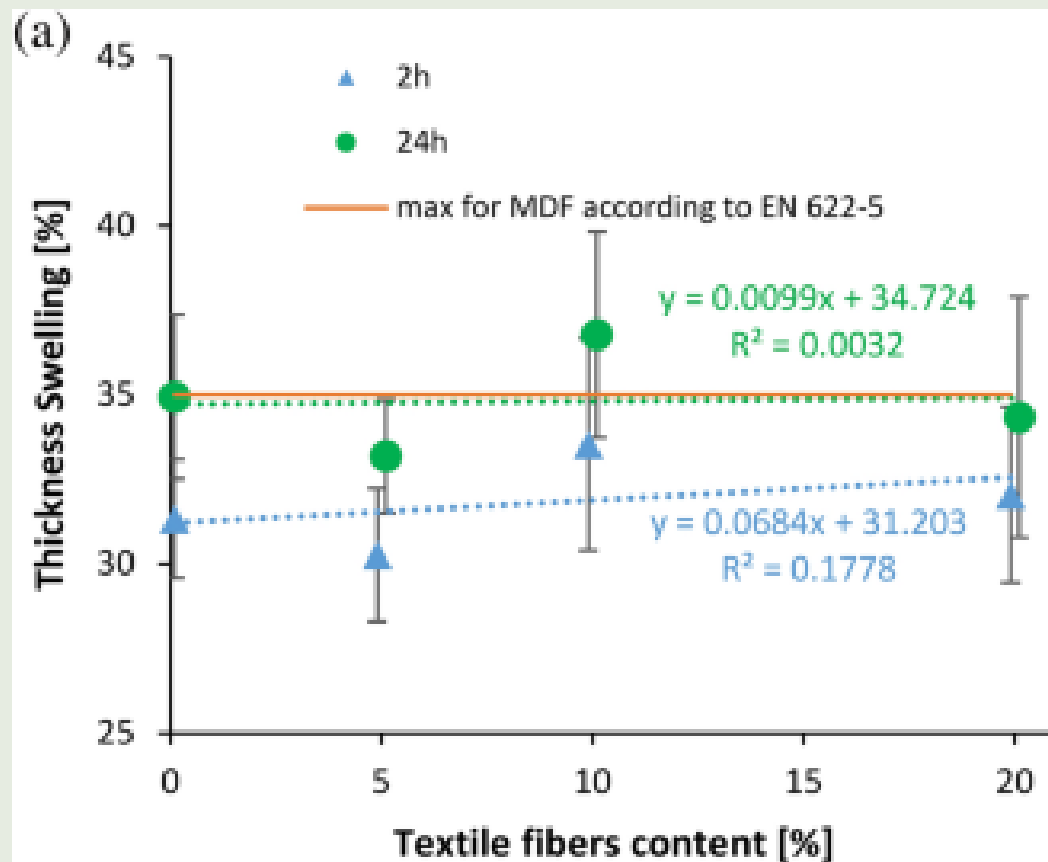






# Textile waste valorization in high density fiberboards

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## Textile waste valorization in high density fiberboards

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The increasing content of textile fibers in HDF panels **has no strong and significant influence** on the physical properties including density profile, thickness swelling after immersion in water, and water absorption, even if neither hydrophobic agent nor water-resistant resin was applied. **The highest impact is on mechanical properties, in particular internal bonding and screw withdrawal resistance.** Even the lowest values of modulus of elasticity and modulus of rupture, achieved here with 20% by weight of upholstery textile fibers, meet the requirements of European standards.

With a not excessively high fiber content from textile waste, taking into account the subsequent use of the HDF produced, **it is possible to utilize the recovered upholstery textile fibers as an addition to wood fibers when producing the MDF-type panels.**



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# Textile waste valorization in high density fiberboards

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## Thank you for your attention!

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and functionalization**

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