

Innovative fire- and water resistant cellulose-based material



National Center for Research and Development, III edition of EEA and Norway grants;
The Program 'Applied Research' in the frame of Norway Grants 2014-2021 / POLNOR 2019 (NOR POLNOR/CellMat4ever/0063/2019-00)

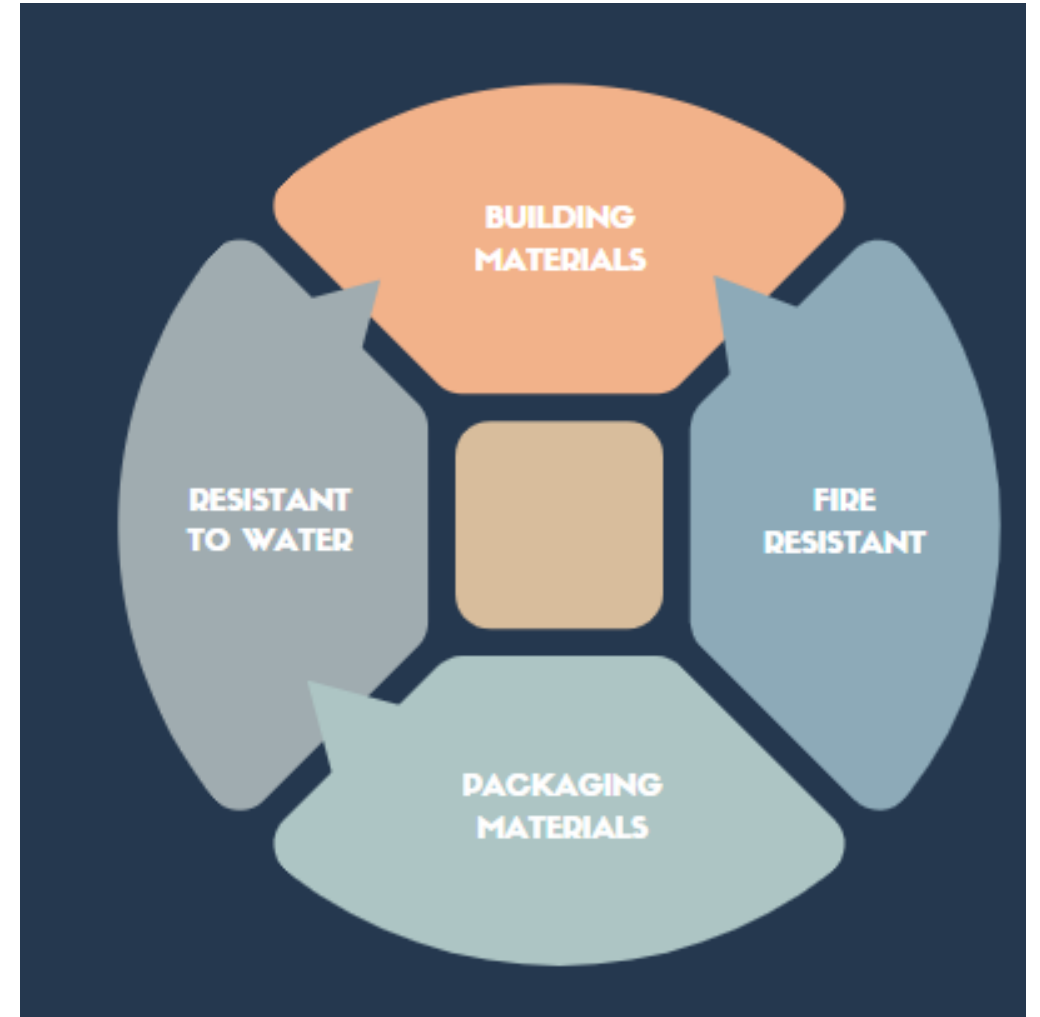
PARTNERZY:

Genesis

1. Thematic areas
 1. Food and natural resources,
 2. Energy, transport and climate,
2. Expected results are:
 1. Enhanced cooperation between the Polish and Norwegian partners;
 2. Technology transfer, sharing experiences and best practices (S2B),
 3. **Development of new products and technologies,**

Aim

Innovative fire- and water resistant cellulose-based material



Results

1. Hydrophobization of cellulose through silanized starch
2. Panel cellulose composite with increased fire resistance
3. Preparation of biopolymer-based coatings and films for use on cellulose substrates
4. Hydrophobization of corrugated board through silanized starch

cellmat.up.poznan.pl/en/



Review

Expandable Graphite as Cellulosic Materials—A

Bartłomiej Mazela ¹, Anyelkis Batista and

Faculty of Wood Technology, Poznan University

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Article

Influence of Chemical Pre-Treatments and Ultrasonication on the Dimensions and Appearance of Cellulose Fibers

...ńska ² and Mikołaj Zieliński ¹



Review

Cellulose and Its Nano-Derived Fire-Resistant Surface: A Re

Mehrnoosh Tavakoli ^{1,2}, Ali Ghasemian ¹, Moh and Bartłomiej Mazela ^{2,*}

Article

Influence of Nanocellulose Structure on Paper Reinforcement

Waldemar Perdoch ¹, Zhuoran Cao ¹, Patryk Florczak ², Roksana Markiewicz ², Marcin Jarek ², Konrad Olejnik ³ and Bartłomiej Mazela ^{1,*}



Article

Strength and Moisture-Related Properties of Filter Paper Coated with Nanocellulose

...is Jones ^{2,3}



Waste Management
Volume 160, 1 April 2023, Pages 165-172



High hydrophobic silanized naner: Material characterization and its l through brown rot fungu

European Journal of Wood and Wood Products (2023) 81:1581–1590
<https://doi.org/10.1007/s00107-023-01976-x>

ORIGINAL ARTICLE

Sorption properties of paper treated with silane-modified starch

Jerzy Majka ¹, Waldemar Perdoch ¹, Łukasz Czajkowski ¹, Bartłomiej Mazela ¹, Wiesław Olek ¹

Received: 4 January 2023 / Accepted: 28 July 2023 / Published online: 10 August 2023
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Hydrophobization of cellulose through silanized starch

Waldemar Perdoch¹, Bartłomiej Mazela², Andreas Treu³, Tomasz Nowak⁴

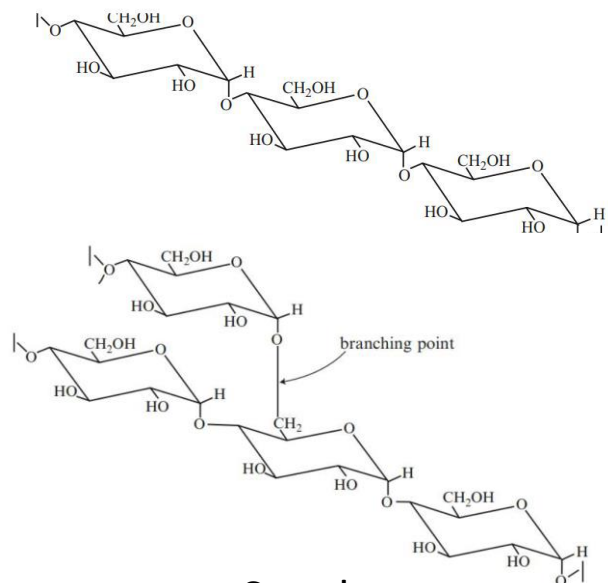
Poznań University of Life Sciences, Poznań
Norwegian Institute of Bioeconomy Research, Norway,
Poskładani.pl, Poland,

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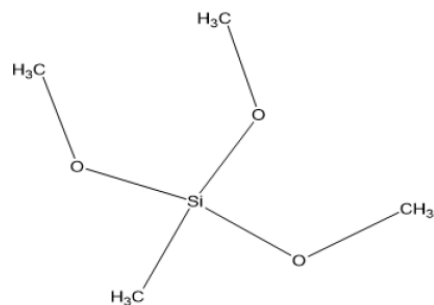
Output



Aim



Starch



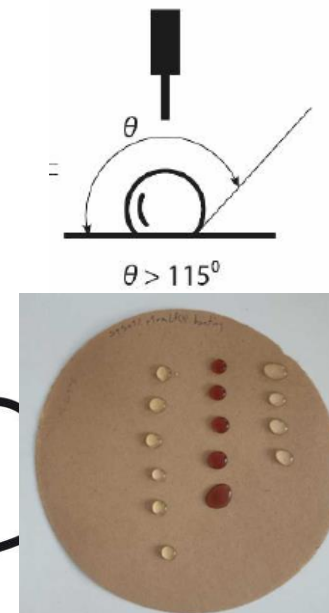
MTMS

Methyltrimethoxysilane CAS 1185-55-3

H₂O
70°C
pH>8,5

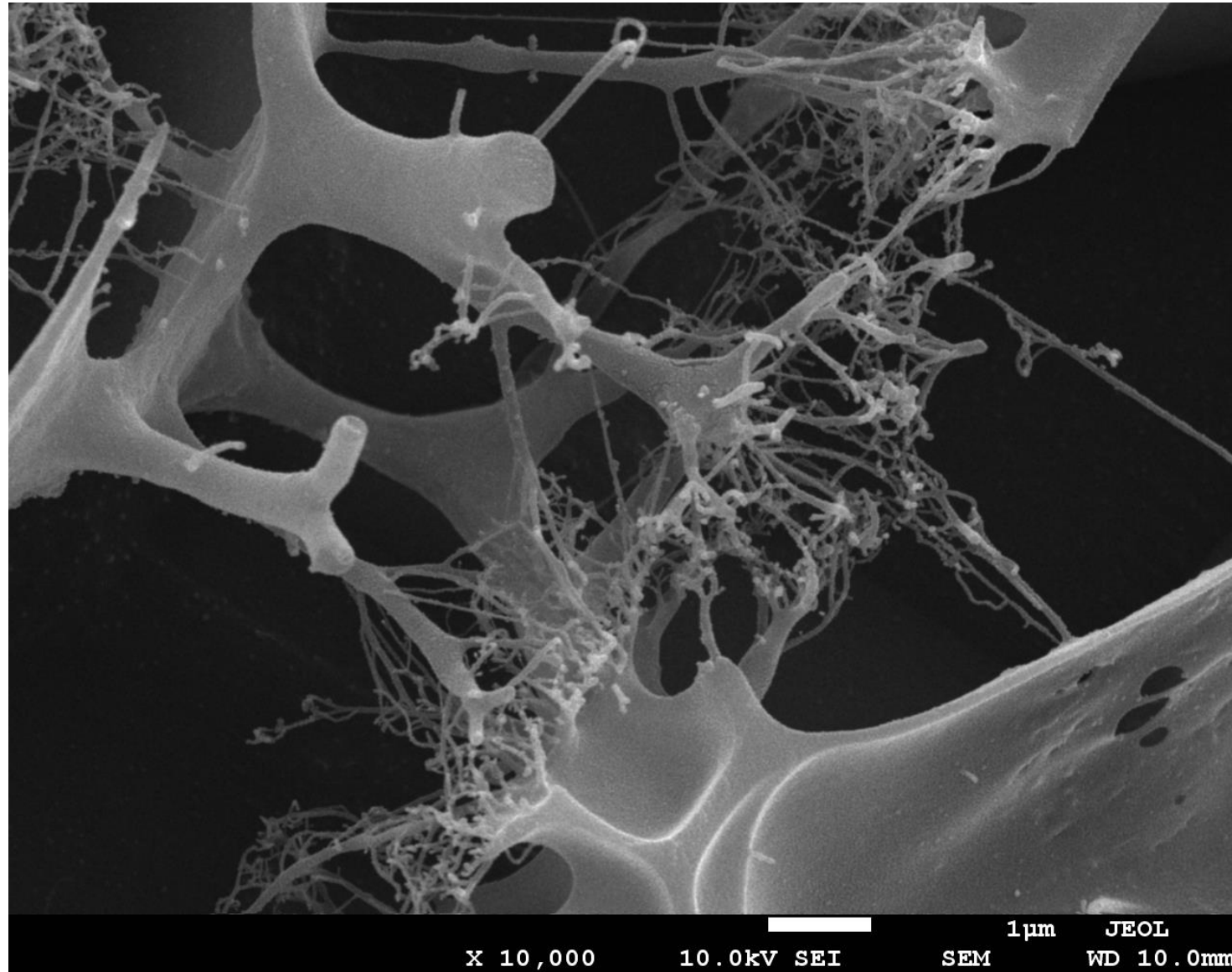


**Cellulose
fibres**



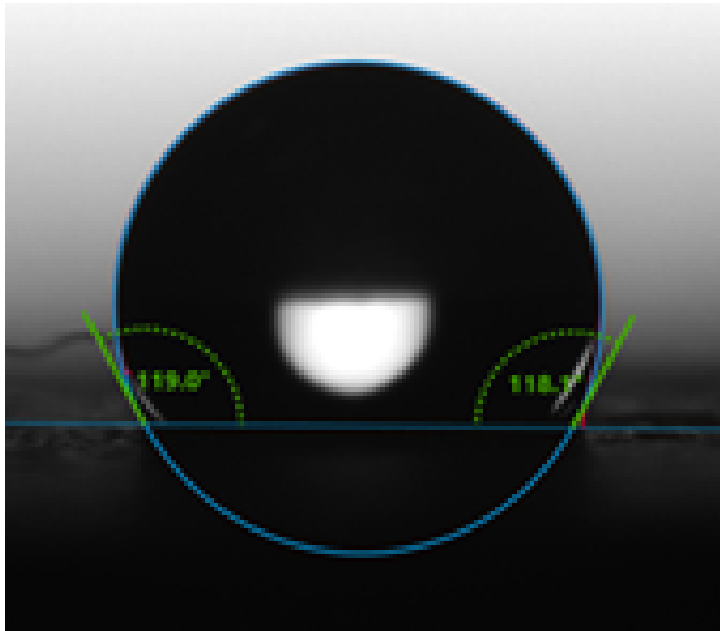
In the study, model papers were produced and hydrophobized in bulk and on the surface through polysaccharides modified with methyltrimetoxysilane (MTMS).

Effect of starch modification – cryo-SEM-EDX

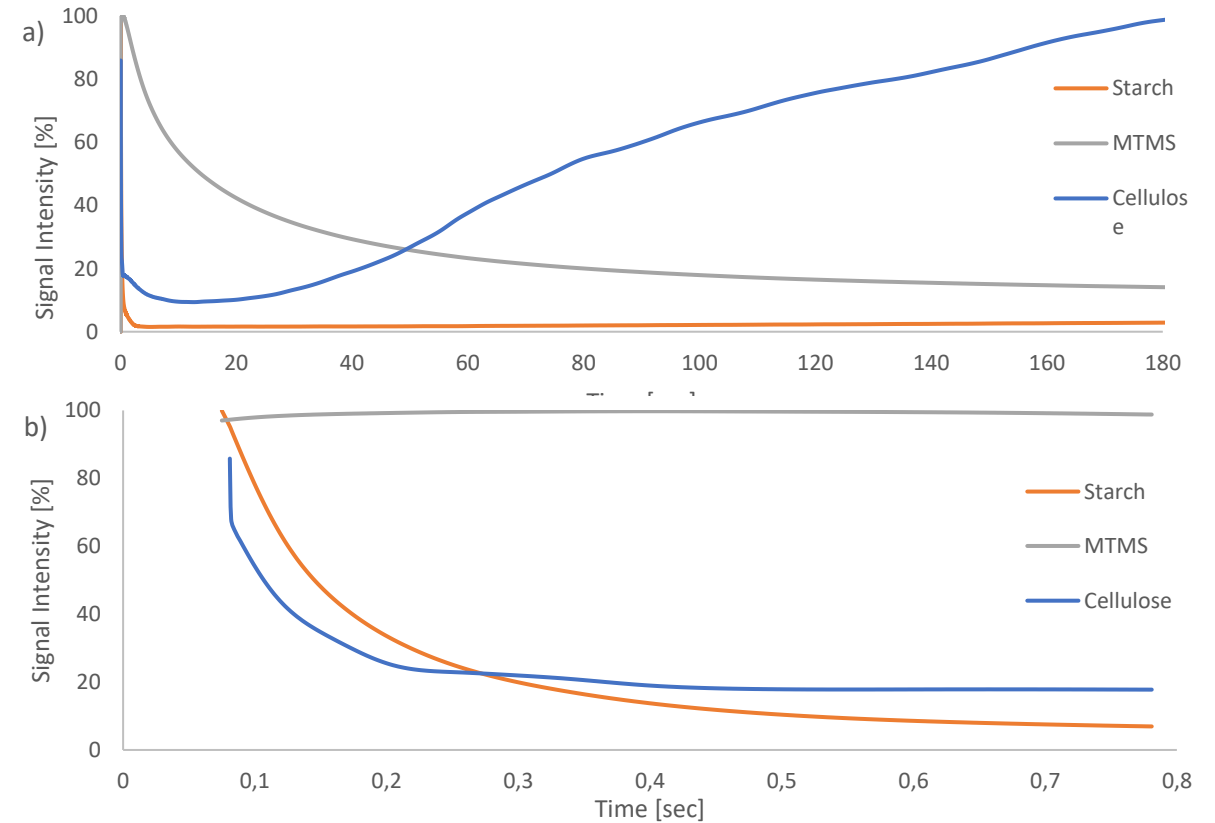


Nowak, T., Mazela, B., Olejnik, K., Peplińska, B., & Perdoch, W. (2022). Starch-silane structure and its influence on the hydrophobic properties of paper. *Molecules*, 27(10), 3136.

Surface treatment

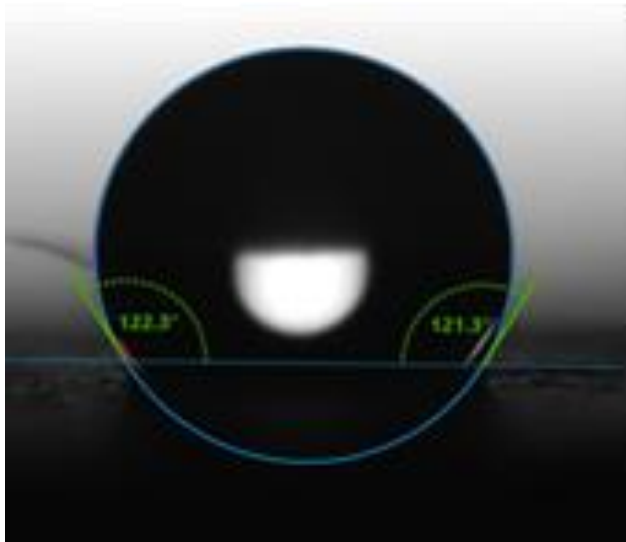


Water contact angle

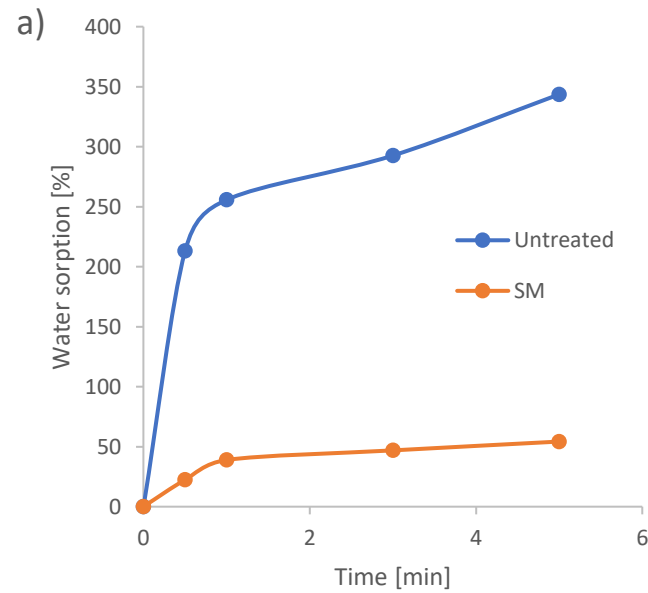


PDA - penetration Dynamic Analysis

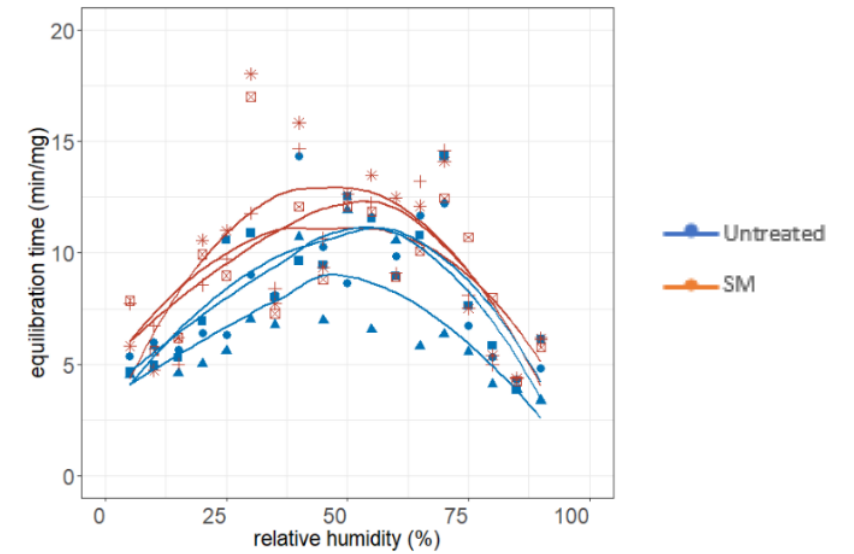
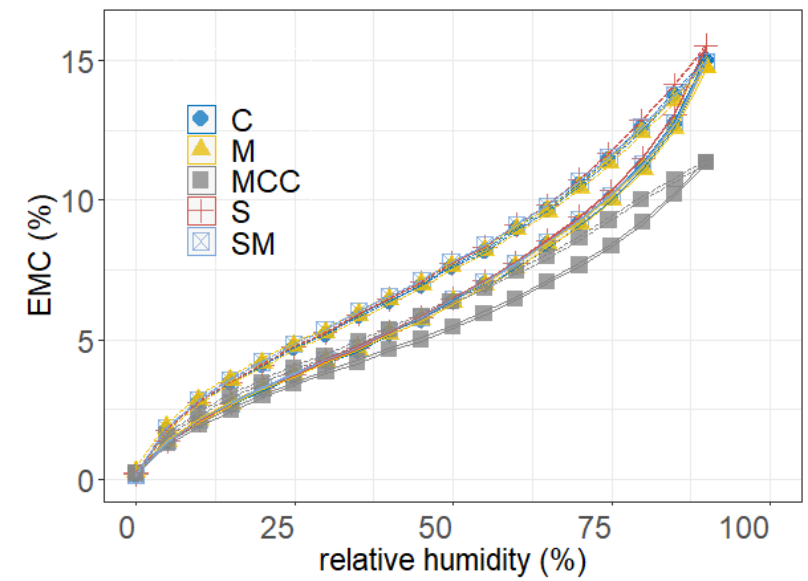
Bulk treatment



Water contact angle

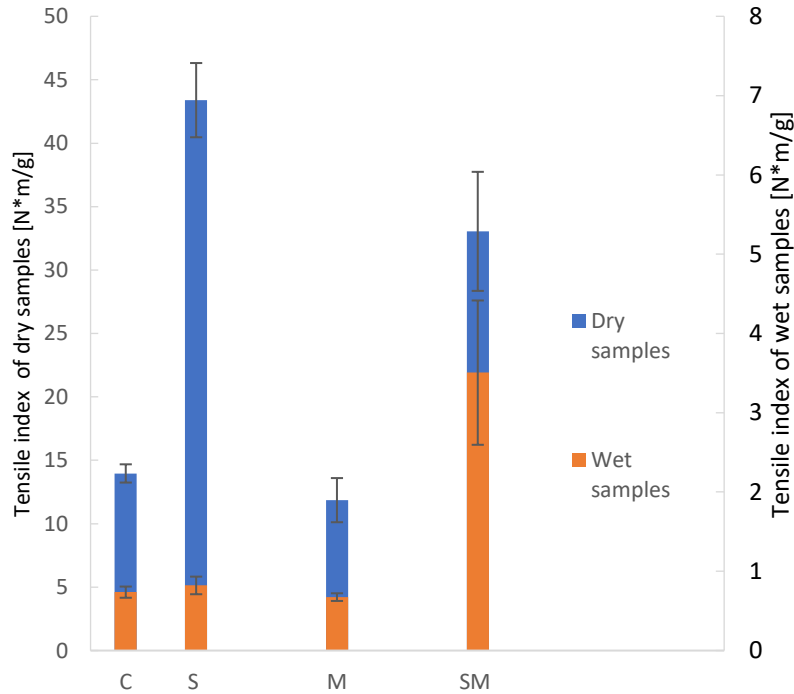


Water uptake



DVS

Bulk treatment





Tensile index



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High hydrophobic silanized paper: Material characterization and its biodegradation through brown rot fungus

Waldemar Perdoch ^a  , Bartłomiej Mazela ^a, Mehrnoosh Tavakoli ^{a b}, Andreas Treu ^c

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<https://doi.org/10.1016/j.wasman.2023.02.007> 

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Conclusions

1. Paper material based on cellulose modified with starch silylated through MTMS was highly hydrophobic
2. PDA and WCA analysis confirmed the high barrier properties of the examined material against water.
3. Biodegradation of the material is available after leaching
4. Dynamic vapor sorption of the treated papers was not altered, however, the equilibration time was prolonged.
5. Cellulose with MTMS-modified starch highlighted their high potential as a hydrophobic agent in the paper and packaging industry.

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Acknowledgements.

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