

Cellulose fibres hybrid chemical modification approach employed in polymer composite applications

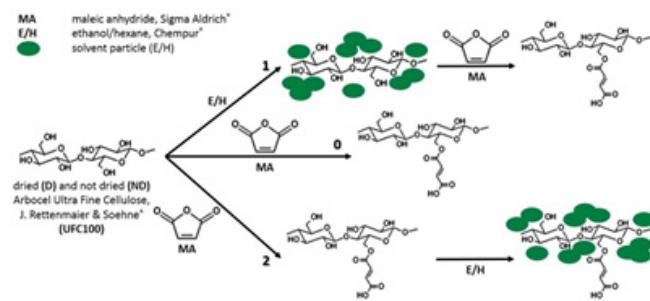
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Abstract

Following research study highlights the importance of an indispensable process in cellulose fibres (Arbocel UFC100 - Ultra Fine Cellulose) modification, which may easily change the biopolymer properties - drying. Study provides a broad range of information considering the drying process consequences on the chemical treatment of the cellulose and properties of cellulose-filled polymer composites based on an ethylene-norbornene copolymer (TOPAS Elastomer E-140). This research underlines the importance of UFC100 moisture content reduction, considering polymer composites applications, with the employment of techniques different than thermal treating. Therefore, a new hybrid chemical modification approach is introduced (Fig.). It consists of two steps: solvent exchange (with ethanol either hexane) and chemical treatment (maleic anhydride - MA).



Hybrid chemical modification of cellulose fibres: Path 0 – regular surface modification with MA, Path 1 – solvent exchanges before the surface modification with MA, Path 2 – solvent exchange after the surface modification with MA

What should be emphasized, in case of all carried out UFC100 treatments a decrease in moisture content was evidenced. Nevertheless, it may be claimed that ethanol employment highly contributes to the lowering of water absorption ability of cellulose (up to 1.65%). Moreover, regarding composite specimen mechanical properties, the highest performance improvement was

noticed in case of TOPAS + UFC100/ND/MA/1/E sample. Here, not dried cellulose has been modified with MA after a solvent exchange with ethanol. What is more, in case of that sample, also an improvement in storage modulus has been detected. Both Payne effect and filler efficiency factor indicate a possibility of a filler reinforcing nature. In performed research new filler hybrid modification approach, being undoubtedly a scientific novelty is introduced. Moreover, valuable data considering composite properties filled with cellulose fibres of various moisture content has been provided (thermal, mechanical, structure).



Biography

Stefan Cichosz is a master student at Lodz University of Technology, Poland. Till now, he is a first author of 5 and co-author of 2 publications. His works has been cited about 10 times. During the short scientific career, he has been awarded many times, e.g. a scholarship from the Minister of Science and Higher Education in Poland, the prize for the best bachelor thesis realized at the Faculty of Chemistry in the academic year 2017/2018, the prize of the Lodz University of Technology Rector for the youngest first author of a scientific article published in 2018, the title of Student of the Year 2017/2018 of the Faculty of Chemistry. He is also a manager of two scientific projects financed with The Best of The Best 3.0 and Diamond Grant 2019 programs (Ministry of Science and Higher Education in Poland). At the beginning of the following academic year, he is going to start his PhD studies.

Participation in the conference enabled with the financial support of Ministry of Science and Higher Education, Poland (decision no.: DIR.ZPZSW.640.241.2019/1/W/116) – program promoting student internationalization - The Best of the Bests 4.0, implemented under the Operational Program Knowledge Education Development co-financed by the European Social Fund (POWR.03.03.00-00-P019/18).