of bacteria-H₂O₂ can be used to extract mulberry fibers for producing high value textiles.

Acknowledgements

This research was financially supported by the Scientific Program of Jiangsu Province (BY2016053-13) and Nantong City (GY12016037), and Open Fund for Large-Scale Instruments of Nantong University (KFJN1740 and KFJN1729).

References

- Liu L, Cao J, Huang J, Cai Y and Yao J. Extraction of pectins with different degrees of esterification from mulberry branch bark. *Bioresource Technology* 2010; 101, 9: 3268-3273.
- Du J, He ZD, Jiang RW, Ye WC, Xu HX and But PP. Antiviral flavonoids from the root bark of Morus alba L. *Phytochemis*try 2003; 62, 8: 1235-1238.
- Li RJ, Fei JM, Cai YR, Li YF, Feng JQ and Yao JM. Cellulose whiskers extracta ed from mulberry: a novel biomass production. *Carbohydrate Polymers* 2009; 76, 1: 94-99.
- Liu L, Jiang T and Yao J. A two-step chemical process for the extraction of cellulose fiber and pectin from mulberry branch bark efficiently. *Journal of Polymers and the Environment* 2011; 19, 3: 568-573.
- Jang YS, Amna T, Hassan MS, Kim HC, Kim JH. Baik SH, Khil MS. Nanotitania/ mulberry fibers as novel textile with anti-yellowing and intrinsic antimicrobial properties. *Ceramics International* 2015; 41, 5: 6274-6280.
- Qu C and Wang S. Macro-micro structure, antibacterial activity, and physico-mechanical properties of the mulberry bast fibers. Fibers and Polymers 2011; 12, 4: 471-477.
- Qu C, Wang S, Wang K and Ma Q. Preparation and antibacterial property of the mulberry based textiles. *Fibers and Polymers* 2014; 15, 3: 498-503.
- Park TY and Lee SG. A study on coarse Hanji yarn manufacturing and properties of the Hanji fabric. Fibers and Polymers 2013; 14, 2: 311-315.
- Wu HL, Li DM, Wu CC, Yang PP and Jing XQ. Research on the structure and properties of mulberry fiber. *Journal of Donghua University* (Eng. Ed.) 2008; 25, 2: 153-158.
- Brühlmann F, Leupin M, Erismann KH and Fiechter A. Enzymatic degumming of ramie bast fibers. *Journal of Biotech*nology 2000: 76. 1: 43-50.
- Das B, Chakrabarti K, Ghosh S, Majumu dar B, Tripathi S and Chakraborty A. Efa fect of efficient pectinolytic bacterial isolates on retting and fibre quality of jute. *Industrial Crops and Products* 2012; 36, 1: 415-419.

- Zheng L, Du Y and Zhang J. Degumming of ramie fibers by alkalophilic bacteria and their polysaccharide-degrading enzymes. *Bioresource Technology* 2001; 78, 1: 89-94.
- Cao J, Zheng L and Chen S. Screening of pectinase producer from alkalophilic bacteria and study on its potential application in degumming of ramie. *Enzyme* and Microbial Technology 1992; 14, 12: 1013-1016
- 14. Kapoor M, Beg QK, Bhushan B, Singh K, Dadhich KS and Hoondal GS. AppliH cation of an alkaline and thermostable polygalacturonase from Bacillus sp. MG-cp-2 in degumming of ramie (Boehmeria nivea) and sunn hemp (Crotalaria juncea) bast fibres. *Process Biochemistry* 2001; 36, 8: 803-807.
- Jacob N, Niladevi KN, Anisha GS and Prema P. Hydrolysis of pectin: an enzymatic approach and its application in banana fiber processing. *Microbiological Research* 2008; 163, 5: 538-544.
- Kobayashi T, Higaki N, Suzumatsu A, Sawada K, Hagihara H, Kawai S and Ito S. Purification and properties of a high-molecular-weight, alkaline exopolygalacturonase from a strain of Bacillus. *Enzyme and Microbial Technology* 2001; 29, 1: 70-75.
- Bailey MJ, Biely P and Poutanen K. InB terlaboratory testing of methods for assay of xylanase activity. *Journal of Bio*technology 1992; 23, 3: 257-270.
- Miller GL, Blum R, Glennon WE and BurM ton AL. Measurement of carboxymethylcellulase activity. *Analytical Biochemis*try 1960; 1, 2: 127-132.
- Dong Z, Hou X, Sun F, Zhang L and Yang Y. Textile grade long natural cellulose fibers from bark of cotton stalks using steam explosion as a pretreatment. Cellulose 2014; 21, 5: 3851-3860.
- Yim KY, Kan CW. A Comparison Study of Fabric Objective Measurement (FOM) Using KES-FB and PhabrOmeter System on Warp Knitted Fabrics Handle—Smoothness, Stiffness and Softness. World Academy of Science, Engineering and Technology. International Journal of Chemical, Molecular, Nuclear, Materials and Metallurgical Engineering 2014; 8, 8: 789-792.
- Reddy N and Yang Y. Properties and potential applications of natural cellulose fibers from the bark of cotton stalks. *Bioresource Technology* 2009; 100, 14: 3563-3569.
- French A. Idealized powder diffraction patterns for cellulose polymorphs. Cellulose 2014; 21, 2: 885-896.
- Mora'n JI, Alvarez VA, Cyras VP, Va'zquez A. Extraction of cellulose and preparation of nanocellulose from sisal fibers. Cellulose 2008; 15, 1: 149-159.
- Jayaramudu J, Guduri BR and Rajulu AV. Characterization of new natural cellulosic fabric Grewia tilifolia. *Carbohy*drate Polymers 2010; 79, 4: 847-851.

Received 27.01.2016 Reviewed 11.05.2016

Institute of Textile Engineering and Polymer Materials



The Institute of Textile Engineering and Polymer Materials is part of the Faculty of Materials and Environmental Sciences at the University of Bielsko-Biala. The major task of the institute is to conduct research and development in the field of fibers, textiles and polymer composites with regard to manufacturing, modification, characterisation and processing.

The Institute of Textile Engineering and Polymer Materials has a variety of instrumentation necessary for research, development and testing in the textile and fibre field, with the expertise in the following scientific methods:

- FTIR (including mapping),
- Wide Angle X-Ray Scattering,
- Small Angle X-Ray Scattering,
- SEM (Scanning Electron Microscopy),
- Thermal Analysis (DSC, TGA)

Strong impact on research and development on geotextiles and geosynthetics make the Institute Institute of Textile Engineering and Polymer Materials unique among the other textile institutions in Poland.

Contact:

Institute of Textile Engineering and Polymer Materials
University of Bielsko-Biala
Willowa 2, 43-309 Bielsko-Biala,
POLAND
+48 33 8279114,
e-mail: itimp@ath.bielsko.pl
www.itimp.ath.bielsko.pl