



Thematic section: Research into New Technologies.

Subsection: Biotechnology.

Full Paper

The Reference Object Identifier – ROI-jbc-C/21-2-4-10

The Digital Object Identifier – DOI: 10.37952/ROI-jbc-C/21-2-4-10

Received 21 November 2021; Accepted 24 November 2021

Development of the concept of a bioethanol plant based on the biopalping technology platform

Andrey G. Dontsov

*Biochemistry and Biotechnology Laboratory. Biology Institute of Komi Scientific Center
of Ural Department of the Russian Academy of Sciences. Kommunisticheskaya St., 28.
Syktyvkar, 167982. Komi Republic. Russia. Phone: +7 (908) 328-89-85.*

E-mail: dontsov@ib.komisc.ru

Keywords: bioethanol, wood pretreatment, steam explosion, biopulping.

Abstract

Modern methods for the production of motor bioethanol are focused mainly on the processing of agricultural waste, while the production of "cellulosic" bioethanol from wood remains an unsolved problem. The technologies for processing wheat straw implemented on an industrial scale are based on the use of a steam explosion for the pretreatment of raw materials. A high-temperature effect on wood under conditions of a steam explosion can lead to partial condensation of residual lignin and the formation of products of its pyrolysis, which will complicate the subsequent conversion of cellulose into fermentable sugars. For this reason, the use of a steam explosion for pretreatment of wood can lead to an increase in the consumption of enzyme preparations, an increase in the cost of the target product and a decrease in its competitiveness in comparison with bioethanol obtained from straw. Probably, biopalping technology will be more preferable for wood pretreatment, which does not require complex equipment and harsh processing conditions. This article compares the key technological and technical and economic characteristics of the existing steam explosion technology and the promising biopalping technology. Based on tests of a prototype preparation for biopalping of aspen wood, the possibility of a significant reduction in the duration of solid-phase fermentation of aspen wood in comparison with known biodelignifiers has been shown. In contrast to the steam explosion technology, after biopalping of aspen wood pulp, a higher efficiency of its conversion into fermentable sugars is achieved with a lower (not less than 30%) consumption of enzymes. The proposed concept (brief regulation) of bioethanol production, based on biopalping technology, demonstrates one of the possible options for the technical implementation of the process when obtaining "cellulosic" bioethanol from wood raw materials.

For citation: Andrey G. Dontsov. Development of the concept of a bioethanol plant based on the biopalping technology platform. *Butlerov Communications C.* **2021**. Vol.2. No.4. Id.10. DOI: 10.37952/ROI-jbc-C/21-2-4-10

References

- [1] Improved pretreatment of biomass: *Pat. 2551320, Russian Federation: IPC C12P 19/02, C12P 19/04*. M. Garbero, P. Ottonello, M. Cotti Comettini, S. Ferrero, P. Torre, F. Kerki, A. Bonanni; Beta Renewables S.p.A. No. 2011143865/10; application 03/31/2010. publ. 05/20/2015. Bul. No.14. (Russian)
- [2] M. Nishida et al. Multi-scale instrumental analyses for structural changes in steam-treated bamboo using a combination of several solid-state NMR methods. *Industrial Crops and Products*. **2017**. Vol.103. P.89-98.
- [3] T. Liitiä, S. Rovio, R. Talja, T. Tamminen, J. Rencoret, A. Gutiérrez, del J.C. Río, A. Sutka, R. Tupciauskas, M. Andzs, J. Gravitis. Effect of steam explosion on fibre lignin structure for selfbinding fiber boards. *Proceedings: The 13th European Workshop on Lignocellulosics and Pulp. Seville, Spain*. June 24-27, **2014**. P.515-518.
- [4] L.V. Garibova. Fundamentals of mycology: Morphology and taxonomy of fungi and mushroom-like organisms: textbook. Allowance. *Moscow: Partnership of Scientific Publications KMK*. **2005**. 224p. (Russian)
- [5] A.V. Bolobova, A.A. Askadsky, V.I. Kondratenko, M.L. Rabinovich. Theoretical bases of woody composites biotechnology. Ferments, models, processes. *Moscow: Science Publicity*. **2002**. Vol.2. P.343. (Russian)
- [6] I.G. Semenkov. Phytopathology. Wood-destroying fungi, rot and pathological colors of wood (identification tables): a tutorial. *Moscow: GOWPOMGUL*. **2008**. 72p. (Russian)
- [7] W.R. Strohl. Antimicrobials. Microbial Diversity and Bioprospecting. American Society of Microbiology ed. A.T. Bull. *Washington DC*. **2004**. P.336-355.
- [8] A.G. Dontsov, and I.E. Sharapova. Use of biopulping for pretreatment of wood in bioethanol production. Part 2. Effect of biopulping on reactivity of wood substrates during fermentative hydrolysis. *Butlerov Communications*. **2018**. Vol.56. No.11. P.146-152. DOI: 10.37952/ROI-jbc-01/18-56-11-146 (Russian)
- [9] N. Nelson. A photometric adaptation of the Somogyi method for the determination of glucose. *J. Biol. Chem.* **1944**. Vol.163. P.375-380.
- [10] M. Somogyi. A new reagent for the determination of sugars. *J. Biol. Chem.* **1945**. Vol.160. P.61-68.
- [11] M. Shafiei et al. Techno-economical study of biogas production improved by steam explosion pretreatment. *Bioresource Technology*. **2013**. Vol.148. P.53-60.
- [12] A. Hasanly, M.K. Talkhonchek, M.K. Alavijeh. Techno-economic assessment of bioethanol production from wheat straw: a case study of Iran. *Clean Technologies and Environmental Policy*. **2018**. Vol.20. No.2. P.357-377.
- [13] F. Zimbardi, E. Ricci, G. Braccio. Technoeconomic study on steam explosion application in biomass processing. *Applied Biochemistry and Biotechnology*. **2002**. Vol.98. No.1. P.89-99.
- [14] Andrey G. Dontsov. Development of the concept of a bioethanol plant based on the biopalping technology platform. *Butlerov Communications*. **2021**. Vol.68. No.12. P.95-102. DOI: 10.37952/ROI-jbc-01/21-68-12-95 (Russian)