Glycomics and Lipidopics

Extended Abstract

Effect of Ionic Liquids on Dissolution and Identification of Wood Polysaccharides

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Abstract

To study the polysaccharide composition of wood, we previously developed a new method suitable to analyses a large number of samples needing low amounts of biomass. The method relies on wood dissolution in ionic liquids; the resulting solutions are then immuno-labelled with monoclonal Antibodies (mAbs) against plant cell wall polysaccharides epitopes. In the present work, we synthesized and tested several imidazolium and 1,8-diazabicyclo [5.4.0] undec-7-ene (DBU) based ILs for their ability to solubilized Douglas-fir wood. The couple times-temperatures has been tested for its ability to produce dissolution of wood in IL. Polysaccharide solubilization has been then analyzed thanks to ELISA technique with a set of mAbs against hemicellulose, pectin and cell wall protein. We deduced that a wood treatment at 80°C with the 1-ethyl-3-methylimidazolium bromide allows a good polysaccharides release, especially for mannans and xylans tightly bound to cellulose and lignin, with preserving the structure and that even for pectin's. The development of potentially "green" technologies based on renewable feedstock's is one of the main challenges for mankind in the next decades and centuries underlining the social and economic importance of research conducted in this area. Wood is one of the most versatile biological raw materials that is available today in large, renewable reserves around the world. Wood products have countless important industrial applications, such as in design, furniture and construction. These applications have a bright future ahead. At the same time, chemical and mechanical wood processing provides the basis for a growing range of globally significant fiber-based tissue, paper and packaging applications and solutions. At the sharp end, advances in the use of the individual chemicals and polymers that make up wood are creating the foundation for future biorefineries and helping change the shape of society for the better. The human use of wood reaches back thousands of years. The nowadays escalating global population and limited natural resources, however, call for new ways of improving the efficiency of our use of this vital natural resource. This opens up significant opportunities for products based on renewable, non-food materials ('non-food bio-products'). In addition, the fading fossil resources with the simultaneously increasing demand for global energy and arising environmental concerns generate a strong need for new technologies based on renewable and inexhaustible resources. Thus in the face of the current oilprices and the sustainability challenges, the bio-economy concept is the fast winning ground. The question arises, can we increase the share of "consumer products" using renewable raw materials, like wood, instead of the non-renewable resources, like oil? The forest-based industry sees this opportunity and believes that the industry will play a decisive role in the development towards a bio-economy. With this goal in sight, diversifying the product output of the primary wood. The Author(s). Licensee InTech. This chapter is distributed under the terms of the Creative Commons Attribution License ,which permits unrestricted use, distribution, and eproduction in any medium, provided the original work is properly cited.refining process – pulping – is a rational strategic starting point. The pulp mills of today are being redefined as the biorefineries of tomorrow. Fossil fuel resources are limited so alternative renewable resources are needed to fill the gap that inevitably will be created once the fossil resource supplies start to dwindle. Biomass has the potential to fill this gap. To utilize this renewable resource in the production of fuel and chemicals, the so called "biorefineries" specialized in fractionation and making use of all components of the biomass are needed. The development of potentially "green" technologies based on renewable feedstocks is one of the main challenges for mankind in the coming years underlining the social and economic importance of research conducted in this area. On this regard, biomass is expected to have the potential to fill the gap of the dwindling fossil fuel resources. Replacement of fossil fuels withnew sustainable resources is becoming crucial due to the depleting petroleum reserves, increasing global energy demand, and arising environmental concerns. In particular, ligno-cellulosic biomass can be an alternative to fossil resources as a sustainable and environmen- tally-friendly feedstock for producing chemicals and fuels. However, today, only a small portion of the world's annual production of biomass is utilized by mankind, while the rest is allowed to decay naturally. With the inevitable depletion of petroleum-based resources, there has been an increasing worldwide interest in renewable resources such as biomass. One reason for

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the current approaches being taken to utilize biomass is the difficulty in processing lignocellulosic materials and the energy needed for separation of their components. The three major compo- nents of biomass (cellulose, lignin, and hemicellulose) are covalently bonded together, which makes dissolution and further separation of these components difficult. This has been recognized as the grand challenge for biomass utilization [4]. Ionic liquids (ILs) are relatively new family of solvents for dissolution of cellulose and could aid in this task. The use of ILs for cellulose dissolution stems from the unique properties of these solvents to interact with the strong hydrogen bonds of polysaccharides. The scientific discovery of the dissolution of cellulose in ILs is being translated into new processing technologies, cellulose functionalization methods and new cellulose materials including blends, composites, fibers and ion gels. These materials can replace current analogs to overcome the environmental issues associated with petroleum-based products. Although there are many ILs available that can dissolve cellulose, the processing difficulties such as fractionation need to be overcome to support large-scale use. The dissolution and functional modification of cellulose in ionic liquids based on previous researches have been reviewed and summarized by reference [5].However, due to the chemical versatility of both cellulose and ILs new developments leading to the next generation of cellulosic materials are expected in the near future [6].Dissolution of cellulose in ILs allows the comprehensive utilization of cellulose by combining two major “green” chemistry principles; using environmentally-preferable solvents and bio- renewable feed-stocks. However, the utilization of cellulose or cellulosic materials has not been developed entirely because of its poor solubility in common organic solvents. But the cellulose dissolved in ILs can be regenerated with anti-solvents such as water, ethanol and acetone. Ionic Liquids - Current State of the Art 420 Ionic liquids are organic compounds that contain at least one ionic bond. ILs consist of organic cations and organic or inorganic anions. ILs are salts with melting points below 100 oC, which possess many advantageous properties. Moreover, ILs are non-volatile, non-toxic, nonflam- mable and thermally and chemically stable. Due to their larger molecular radii, ILs exhibit only weak cohesion compared with common salt.

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