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Topic:

Ligno-celluloses, Celluloses & Papers as smart materials. Paper & Board advanced materials

Paper-ID	92631
Paper title	Eco-friendly and cost-effective production of cellulosic fibers with new functionalities and applications
Presentation format	Oral presentation
Date of submission	03.03.2017 19:32 Uhr
Authors	- Lew Christopher *(lchristo@lakeheadu.ca)* (Presenter) - Md Nur Alam *(mnalam@lakehead.ca)*

Content

Due to population growth and competition for arable land, the global cotton production has reached its maximum, which provides incentives to find alternative fiber sources. About 75% of all man-made fibers is polyester, a non-renewable material derived from oil, whereas the share of cellulosics, a renewable and biodegradable material, is only 9%. Viscose rayon, the main commercial product made from regenerated cellulose, is currently produced at an annual rate of 3.7 million metric tonnes and valued at over 10 billion dollars per year. Viscose fiber yarns however are currently produced by xanthation of dissolving pulps using carbon disulfide (CS_2), a highly toxic chemical banned in North America and Europe. Other disadvantages related to the use of CS_2 include limited dissolving capability, high cost of solvent recovery, uncontrollable side reactions, and instability during cellulose processing and/or derivatization. In contrast, the Lyocell process is based on direct dissolution of cellulose in an environmentally friendly polar solvent, N-methylmorpholine-N-oxide (NMMO). However, the Lyocell production process is more expensive than rayon due to the high cost of NMMO and the use of high temperatures for dissolving cellulose. Hence, although cellulosic fibers are increasingly used in textile products, current rayon and Lyocell methods for production of cellulose-based textiles suffer certain economic and/or environmental drawbacks. We have developed a new, cost-effective and environmentally-friendly (CS_2-free) process that overcomes some of the shortcomings of the existing rayon and Lyocell technologies. The process is based on a modified method for periodate oxidation of cellulose that is then cross-linked with chitosan and extruded to obtain cellulosic fibers in the form of textile yarns. The produced yarns have low content of aldehyde groups (~2 mmol/g cellulose) and water retention values of 1.5-2.0 g/g yarn. The new process makes use of both hardwood and softwood pulps, and offers significant yield advantages over the use of dissolving pulp as a raw material. The mechanical, water absorbency and morphological properties of the new cellulosic yarns and their potential applications will be discussed. The techno-economic and environmental benefits of the process will be reviewed. The new cellulosic fibers have the potential to compete in textile applications with the established rayon and polyester markets, and create new uses that go beyond the traditional textile applications.

Paper-ID	46231
Paper title	Fractionation of brewer's spent grains by acid pretreatment under mild conditions
Presentation format	Poster
Date of submission	30.01.2017 12:45 Uhr

Authors

- INMACULADA ROMERO *(iromero@ujaen.es)* (Presenter)
- José Antonio Rojas *(jrojas@ujaen.es)*
- ENCARNACIÓN RUIZ-RAMOS *(eruiz@ujaen.es)*
- CRISTÓBAL CARA *(ccara@ujaen.es)*
- SOLANGE MUSSATTO *(smussatto@biosustain.dtu.dk)*
- EULOGIO CASTRO *(ecastro@ujaen.es)*

Content

Biomass generated from brewery industry constitutes a by-product yearly generated in big amounts with scarcely economic feasible applications [1]. Brewer's spent grain (BSG) is formed mainly by the residual components of barley malt and includes most of the barley grain shells and minor fractions of the pericarp and endosperm fragments [2]. This agro-industrial residue does not compete with food use and it can serve as a feedstock for second-generation ethanol production [1].

The aim of this work is to solubilize the hemicellulosic fraction of BSG leaving a cellulose-rich solid to be hydrolysed by enzymes. This hemicellulosic sugar solution could be later fermented to produce ethanol using unconventional microorganisms capable of assimilating both pentoses and hexoses. BSG was washed and characterized according to the NREL (National Renewable Energy Laboratory) methodology. BSG characterization determined 52% carbohydrate and 26% protein. In order to achieve high yields of fermentable sugars recovery, BSG was pretreated with sulfuric acid in an autoclave at different conditions (temperature, sulfuric acid concentration, and process time). The highest overall sugars yield was reached at 130 °C, 3% H_2SO_4 and 15 min pretreatment time. These conditions allowed the fractionation of this biomass and more than 90% of hemicellulosic sugars were recovered in the prehydrolysate. Thus, a solution with 44 g/L of hemicellulosic sugars (50% xylose and 25% arabinose) and low level of inhibitory compounds was obtained. Phenolic compounds were identified in this prehydrolysate and its antioxidant capacity was determined according to different methods, DPPH and β-carotene. Likewise, a cellulose-enriched solid (38% cellulose content) highly digestible was obtained after pretreatment. This pretreated solid yielded 89 g glucose/100 g glucose in pretreated BSG by enzymatic saccharification that corresponds to 75.4 g glucose/100 g glucose in original BSG.

Acknowledgments: Financial support from Universidad de Jaén (project UJA2015/07/21)

References

1. Mussatto SI, Roberto IC P, (2005). Acid hydrolysis and fermentation of brewer's spent grain to produce xylitol. J. Sci. Food Agric. 85, 2453-2460.

2. Meneses N, Martins S, Teixeira JA, Mussatto SI, (2013). Influence of extraction solvents on the recovery of antioxidant phenolic compounds from brewer's spent grains. Sep. Purif. Technol. 108, 152-158.

Paper-ID	46266
Paper title	Fractionation of brewer's spent grains by acid pretreatment under mild conditions
Presentation format	Poster
Date of submission	30.01.2017 12:45 Uhr

Authors

- INMACULADA ROMERO *(iromero@ujaen.es)* (Presenter)
- José Antonio Rojas *(jrojas@ujaen.es)*
- ENCARNACIÓN RUIZ-RAMOS *(eruiz@ujaen.es)*
- CRISTÓBAL CARA *(ccara@ujaen.es)*
- SOLANGE MUSSATTO *(smussatto@biosustain.dtu.dk)*
- EULOGIO CASTRO *(ecastro@ujaen.es)*

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Paper-ID	84586
Paper title	Micro-cellulose sponge from sugarcane bagasse as controlled-release bioactive carriers from Croton oblongifolius
Presentation format	Poster
Date of submission	28.02.2017 13:44 Uhr
Authors	- Chutimon Satirapipathkul *(chutimon.s@chula.ac.th)* (Presenter) - Nasjarin Limsaree *(nasjarinlims9@gmail.com)*

Content

Croton oblongifolius has potential for many applications in pharmaceutical and food industries as a natural additive (antimicrobial and antioxidant) [1-4]. In this study, micro-cellulose sponges (MCS) from waste cotton are used as the carrier for bioactive agent to produce a controlled release system. Different solvent types of varying polarity were examined and compared their capabilities to extract essential active agents from dried herb. Ethanol (95% w/w) was found to be the best among solvents for extraction. Ethanol yields 21.3% whereas dichloromethane and hexane can extract only 6.72 % and 4.17% of dried herb, respectively. The ethanoic extract exhibited the highest content of total phenolic compounds. Compared to all other extracts, the ethanoic extract was found to exhibit the most significant antibacterial activity against all types of bacterial strains. The phenolic compound loaded micro-cellulose sponges were produced by acid hydrolysis and a freeze drying method. The microparticles were characterized in terms of size and morphology, total phenolic compound loading, and physical state of the encapsulated phenolic compounds. Phenolic compound release from the microparticles was assessed by dissolution tests. The particles had spherical shapes with amorphous form. The controlled phenolic compound release was tested by using different concentration. The results showed that the structure of micro-cellulose sponges, the media type and the solubility of the phenolic compound influenced the polyphenol-release behavior. Since the release of the phenolic compound is controlled by the structure and interactions between the microparticles and the cellulose matrix, modulation of the matrix formers enable a control of the phenolic compound release rate. These structures of micro-cellulose sponges can be very useful in many pharmaceutical micro-particle applications.

Reference

[1] Roengsumran, S., Achayindee, S., Petsom, A., Pudhom, K., Singtothong, P., Surachetapan, C., Vilaivan, T. Journal of Natural Products, 1998, 61: p. 652.

[2] Roengsumran, S., Singtothong, P., Pudhom, K., Ngamrochanavanich, N., Petsom, A., Chaichantipyuth, C. , Journal of Natural Products , 1999, 62 : p. 1163.

[3] Roengsumran, S., Petsom, A., Sommit, D., and T. Vilaivan, Phytochemistry. 1999. 50: p. 449.

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Paper-ID	22591
Paper title	New pilot plant for hemicellulose extraction with hot pressurized water
Presentation format	Oral presentation
Date of submission	16.01.2017 16:49 Uhr
Authors	- Gianluca Gallina *(gianluca.gallina87@gmail.com)* (Presenter) - Pierdomenico Biasi *(bpierdom@abo.fi)* - Juan Garcia Serna *(jgserna@iq.uva.es)* - Maria Josè Cocero Alonso *(mjcocero@iq.uva.es)*

Content

Industrial systems for extracting hemicellulose from lignocellulosic biomass, use acids or bases; with the need to purify the product and eliminate toxic waste. However, hemicellulose can be extracted with water at a temperature above 100 ° C. This has numerous economic and environmental advantages, as well as that no toxic waste is produced. The main problem is that the wet biomass swells and compacts in the system, with high difficulties in removing it at the end of the process. Existing plants using this process are usually stopped once the extraction is completed, opened to remove the biomass and replenished with fresh biomass. This involves very long downtime.

A pilot plant was built, consisting of 5 reactors, each of which works in series with the others or can be excluded from the system. Until 97 % of energy is recovered through a heat exchanging system

The system makes the extraction operation possible in a continuous way, without having to stop the plant during the loading and unloading phases. Different types of biomass can be used, without limitations due to the particle size. The system also allows to collect entirely the exhausted solid, critical operation in the process.

Experiments at different temperatures (140, 150, 160, 170 ºC) were carried out with using 3 reactors in series; each one filled with 200g of chips of catalpa wood. Extraction yields and molecular weights of hemicelluloses were studied, analyzing the decomposition of oligomers in the solution, flowing from one reactor to the others.

It was observed that:

- Hemicelluloses with a controlled molecular weight can be produced only by changing the extraction temperature.
- Product is not degraded by flowing from one reactor to the other; molecular weight does not change.
- The efficiency of extraction is the same in all the reactors.

In conclusion, this plant makes possible the continuous production of hemicellulose with high selectivity in composition and molecular weight.

Acknowledgements

The authors acknowledge the Spanish Economy and Competitiveness Ministry, Project CTQ2015-64892-R (MINECO/FEDER). MEng. Gianluca Gallina wish to acknowledge the Spanish Economy and Competitiveness Ministry for the scholarship/predoctoral contract BES-2013-063556

Paper-ID	22616
Paper title	New pilot plant for hemicellulose extraction with hot pressurized water
Presentation format	Oral presentation
Date of submission	16.01.2017 16:49 Uhr

Authors

- Gianluca Gallina *(gianluca.gallina87@gmail.com)* (Presenter)
- Pierdomenico Biasi *(bpierdom@abo.fi)*
- Juan Garcia Serna *(jgserna@iq.uva.es)*
- Maria Josè Cocero Alonso *(mjcocero@iq.uva.es)*

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