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**Topic:**

# Economy and Socioeconomic of lingo-cellulosic materials

**Paper-ID** 23286

**Paper title** How the operational conditions influence in the physico-chemical properties of the lignin?

**Presentation format** Oral presentation

**Date of submission** 18.01.2017 10:30 Uhr

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**Content**

Plant biomass consists mainly of cellulose, lignin and hemicellulose. These three compounds have a huge potential of application, reason by which in the last years there are lots of investigation in separation technics and application. The agricultural activity generates each year large quantities of vegetable biomass, that by its composition is also called lignocellulosic material. The wheat straw represents an example of this type of lignocellulosic material.

The cellulose contained in this material can be exploited through different pulping processes, that separate cellulose from the other two components; lignin and hemicellulose. This cellulose can be used in molded pulp as example. The lignin will be held mostly in the black liquor generated in the pulping process, and it would be interesting to recover it in order to use all the components presented in the raw material.

This polymer represents a promising natural alternative to distinct thermosetting resins which are used in different industrial sectors.

In this work lignin-rich fractions have been obtained through an acid precipitation from three different black liquors. These liquors were generated after performing three pulping processes (Kraft, Organosolv and Soda) using wheat straw as raw material. The acid precipitation was performed with sulphuric acid and acidifying the black liquor until pH 2. The chemical composition of the distinct lignins fractions was studied. Also, a Fourier transform infrared spectroscopy (FT-IR) and a thermogravimetric analysis (TGA) were performed to analyse the chemical structure and thermal characteristics, respectively. Organosolv lignin is the purest sample obtained in this work and it would be the best option to be used in applications where a higher thermal decomposition temperature and a thermal stability are required.

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| **Paper-ID** | 23326 |
| **Paper title** | Influence of the soda pulping operation variables of wheat straw on the lignonanofibres of cellulose obtained by mechanical pre-treatment |
| **Presentation format** | Poster |
| **Date of submission** | 18.01.2017 11:03 Uhr |
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**Content**

It is known that the hemicellulose and lignin content of the cellulosic pulps affects the lignocellulose nanofiber's production process. Specifically, hemicelluloses content plays an important role in nanofibrillation because they inhibit the coalescence of cellulose microfibers, favoring nanofibrillation. Therefore, the present work studies the influence of pulping conditions of wheat straw on the production of lignocellulose nanofibers obtained by mechanical pretreatment. First, the wheat straw is pulped following an experimental design, whose independent variables were; temperature (100, 130 and 160 ° C), reaction time (60, 105 and 150 minutes), and soda concentration over dried material (7, 10 and 13%). In this way, 15 experiments were carried out obtaining 15 different cellulosic pulps that were submitted to a mechanical pretreatment followed by a high-pressure homogenization process to obtain the corresponding LCNF. The pulps obtained were characterized chemically (ash content, alcohol extractable, lignin, α-cellulose and hemicellulose) to study the effect of operating conditions on pulps in obtaining LCNF, which were characterized by determining the nanofibrillation yield, cationic demand and carboxyl rate. Also, thermal stability was determined by thermogravimetric analysis, crystallinity index using X-ray diffraction and hydrodynamic diameter and its Z-potential were determined by DLS.

**Paper-ID** 23356

**Paper title** Isolation and characterization of lignocellulose nanofibers from different wheat straw pulps

**Presentation format** Oral presentation

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**Content**

In this work the wheat straw was cooked under three different pulping processes: Soda (100◦C, 7% NaOH over dried material, 150 min), Kraft (170◦C, 16% alkalinity (o.d.m), 25% sulfidity (o.d.m), 40 min), and Organosolv (210◦C, 60% ethanol (o.d.m), 60 min). Once the pulps were obtained, lignocellulose nanofibers (LCNF) were isolated by mechanical process and TEMPO-mediated oxidation followed by a high-pressure homogenization. After pulping process, the different pulps were characterized and its chemical composition was determined (alcohol-extractives, ash, lignin, holocellulose and α-cellulose). The pulps characterization indicates that the Soda process is the process that, despite producing less delignification, retains much of the hemicelluloses in the pulp, being this content a key factor in the nanofibrillation process. The LCNF isolated were characterized by thermogravimetric analysis (TGA), X-ray diffraction (XRD), nanofibrillation yield, degree of polymerization, carboxyl content and cationic demand. Regarding the LCNF obtained by mechanical process, those nanofibers isolated from Organosolv wheat pulp (OWP) and Kraft wheat pulp (KWP) show low values for nanofibrillation yield, specific surface area and greater diameter. However, those nanofibers isolated from Soda wheat pulp (SWP) reach much higher values for these parameters and presents a diameter of 14 nm, smaller than those obtained by TEMPO-mediated oxidation from OWP. Smaller diameters are generally obtained in TEMPO-oxidized LCNF. It could be concluded that the lignin content does not affect greatly to obtain LCNF as does the hemicellulose content. So, it is accurate to use a soft pulping process, and that for an effective isolation of LCNF is required a pulping process that are able to maintain high hemicellulose contents, which in the case of this work is the soda process.

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| **Paper-ID** | 84031 |
| **Paper title** | Ligno-cellulosic biomass stock survey in Uruguay |
| **Presentation format** | Oral presentation |
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**Content**

Uruguay is a small country in South America (176.215 $km^2$, 3,4 millions people). Its economy is mainly based on the exploitation of natural resources and the main exportation products are bovine meat, cellulose, soy and milk. A development strategy includes the valorization of natural resources to produce chemicals and ligno-cellulosic biomass is an important raw material in this context.

The aim of the present work is to: 1.- evaluate the stock of Uruguayan lingo-cellulosic biomass resources, 2.- identify its geographic distribution, 3.- identify its availability and generation rate, 4.- record the ongoing fate of the residual biomass and 5.- estimate the chemical composition of biomass in terms of its major components.

For this purpose, cross-check data from various sources was conducted, and interviews were held to appropriate actors in order to exchange relevant information.

On the basis of data collected, five sources of ligno-cellulosic biomass were selected, based on the following criteria: they are produced in considerable amounts ((> 10000 ton/year, main criterion) and/or are of strategic importance, and/or the production is geographically concentrated and/or their currently fate has not high added value.

The ligno-cellulosic residues sources selected were: sugar & alcohol industry, rice industry, crops (wheat, rice, barleay, soy and sunflower), sawmills and forestry.

Removable soy crop residues are by far the most important, with 6E6 ton/year (a portion of crop residues has to be retained on site to avoid land degradation), followed by rice crop residues (2E6 ton/year) and wheat (1.2E6 ton/year). Removable residues from forestry are 2E6 ton/year. A complete table will be presented.

A geographic distribution map of the referred residues was developed. Considering their estimated individual chemical composition, total cellulose, hemi-cellulose and lignin sources map was also introduced.

This information will be used to evaluate the feasibility to produce several selected products in Uruguayan context.

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| **Paper-ID** | 61991 |
| **Paper title** | Spent liquor reuse strategy applied to levulinic acid production |
| **Presentation format** | Oral presentation |
| **Date of submission** | 30.01.2017 22:57 Uhr |
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**Content**

In Ligno-cellulosic Bio-refinery (LCBR), separation of valuable products from the spent liquor is one of the most important contributions in processing costs. For this reason liquid to solid ratio should be as little as possible.

Reuse of liquid is proposed to focus on reducing deconstruction and product separation costs. A sequential batch reaction mode is compared with the conventional batch process. The proposed scheme is presented in (Figure)

This strategy can be applied to pretreatment, hydrolysis, or reaction, as long as the desired product is not degraded in a extend that negatively affect production costs. More concentrated liquor is obtained and evaporation and heating costs are reduced.

A techno-economic analysis was performed for levulinic acid (LA) production from pine sawdust as an example. A sequence of alkaline pretreatment, followed by an acid hydrolysis and separation method in which furfural is used as solvent as proposed by [1] was considered. A kinetic model, based on chemical representation of these processes was implemented. Selected operating conditions, kinetic constants employed for the hydrolysis of hemicelluloses, and yield calculations were extracted of experimental data from [2].

More than 30 % reduction in operating cost expressed in USD.kg$^{-1}$LA is obtained by reuse of the liquor once. Further reuse cycles also improves process economy. The optimum number of spent liquor reuse was 3, and the resulting reduction in operating cost was more than 50%. To take into account the possibility of LA degradation due to water reuse, a first order kinetics degradation reaction will be considered, and cost analysis will be discussed considering this kinetic constant as a parameter.

References


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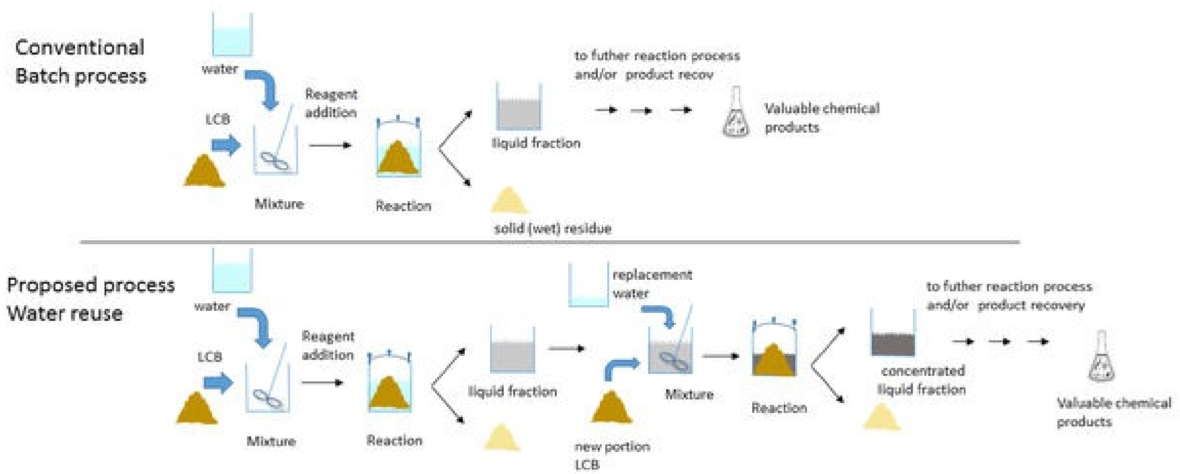

**Paper-ID** 47201

**Paper title** The physico-mechanical properties of wheat straw high density fiberboards made with lignin binder

**Presentation format** Poster

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**Content**

**Abstract**

Fiberboards are used mainly in the furniture industry and in the housing construction field. Its demand is continuously growing; however, wood supplies are diminishing because of the forest degradation activities. Wood has been traditionally used as the raw material in the boards manufacturing [1]. Furthermore, in these production processes, a synthetic resin such as urea-formaldehyde (UF), is often used to keep proper physical and mechanical properties. Nevertheless, the use of this conventional adhesive can cause serious health issues, such as cancer [2]. Therefore, in the recent years all efforts of the community industry are focusing on the elimination of these concerns. This paper describes the use of a natural adhesive such as lignin to produce high density fiberboards (HDF) made from wheat straw, which represents an example of alternative lignocellulosic material. In the present work, this agricultural residue was used to produce thermomechanical pulp and the used lignin was obtained from the spent liquors generated in the same process. The lignin was used as binder in manufacturing HDF and different content levels of this green adhesive (0, 2.5, 5.0, 7.5, 10.0, 12.5 and 15.0%) were targeted. A hot pressing process with different stages was conducted to manufacture these fiberboards. The wheat straw raw material and its pulp were characterized. Moreover, a morphological characterization of the obtained fibers was performed. Apart from that, the chemical composition and the thermal properties of the lignin sample were evaluated. The physical and mechanical properties of the resulting fiberboards were assessed. The results revealed that fiberboards made only with wheat straw fibers, had a flexural strength value (52.79 MPa) even above the value corresponding to the commercial HDF (41.50 MPa). Also, results showed that increasing lignin percentages from 0 to 15% the mechanical properties values were increased. The highest mechanical performance was reached for fiberboardas at 15% of lignin with a flexural strength of 96.81 MPa, a flexural modulus of 3.55 GPa and finally an internal bond of 1.46 MPa.

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