1.36 FRACTIONATION OF WHEAT STRAW USING IONIC LIQUIDS AS A TOOL OF PRE-TREATMENT

Andre M. C. Lopes
Karen G. João
Rafał Bogel-Łukasik*

The pre-treatment of lignocellulosic biomass with ILs is a promising and challenging process for an alternative method of biomass processing [1]. The high selectivity of ILs demonstrated to achieve a complete dissolution of all lignocellulosic components at mild conditions [2].

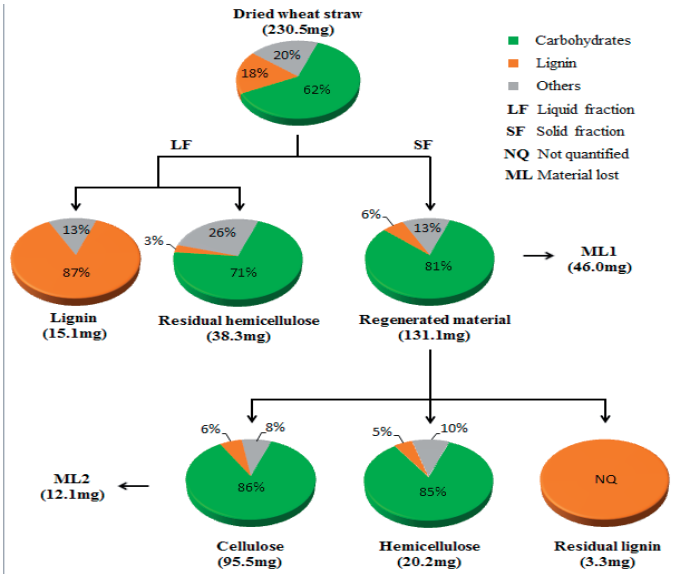
A pre-treatment methodology of wheat straw with 1-ethyl-3-methylimidazolium acetate ([emim][CH_3COO]) and subsequent fractionation to cellulose, hemicellulose and lignin fractions was developed. After pre-treatment the antisolvent allowed the regeneration of carbohydrate-rich material dissolved in IL and simultaneously the extraction of lignin from wheat straw. The regenerated carbohydrate-rich material later might be fractionated into cellulose and hemicellulose. Lignin can be recovered by precipitation from the liquid stream. The fractionation of completely dissolvent biomass in the studied IL (Figure 1) led to production of cellulose and hemicellulose with maximum of 86wt% and 85wt% carbohydrate content, respectively. A high purity lignin was also obtained reaching 87wt% lignin content.

After pre-treatment, the crystallinity of cellulose decreases forming an amorphous structure beneficial for saccharification. The lignin extraction is also a major factor for enhancement of enzymatic hydrolysis [3,4]. In order to verify the potential further applicability of obtained carbohydrate-rich fractions as well as to evaluate the pre-treatment effi-

Laboratório Nacional de Energia e Geologia, Unidade de Bioenergia, 1649-038 Lisboa, Portugal.
* Corresponding author. *E-mail:* rafal.lukasik@lneg.pt

Figure 1

Composition of fractionated samples and mass balance of pre-treatment process



ciency, the cellulose-rich fraction achieved from the treatment with [emim][CH_3COO] was applied for the enzymatic hydrolysis. Achieved results showed a very high digestibility of cellulose-rich sample and confirmed a high glucose yield.

Keywords: ionic liquids, pre-treatment, biomass.

References

[1] Lopes A. M. C., Joao K. G., Morais A. R. C., Bogel-Lukasik E., Bogel-Lukasik R. Ioni liquids as a toll for lignocellulosic biomass fractionation. Biomass & Bioenergy 2013, submitted.

[2] Sun N, Rahman M, Qin Y, Maxim ML, Rodríguez H, Rogers RD. Complete dissolution and partial delignification of wood in the ionic liquid 1-ethyl-3-methylimidazolium acetate. Green Chemistry 2009;11:646.

[3] Tan HT, Lee KT. Understanding the impact of ionic liquid pretreatment on biomass and enzymatic hydrolysis. Chemical Engineering Journal 2012;183:448.

[4] Samayam IP, Hanson BL, Langan P, Schall CA. Ionic-liquid induced changes in cellulose structure associated with enhanced biomass hydrolysis. Biomacromolecules 2011;12:3091.