Optimization of xylose production and recovery of antioxidants from almond tree pruning

J.M. Romero-García[1,2*], M. Ruiz-Martínez[1], X. Valles-Novoa[3], I. Romero[1,2], E. Ruiz[1,2], E. Castro[1,2]

[1]Department of Chemical, Environmental and Materials Engineering; [2]Centre for Advanced Studies in Earth Sciences, Energy and Environment (CEACTEMA), Universidad de Jaén, Campus Las Lagunillas, 23071 Jaén, Spain

[3] Instituto de Energías Renovables, Universidad Nacional Autónoma de México, ENES Juriquilla, 76230, Querétaro, México

e-mail: jrgarcia@ujaen.es, mrm00086@red.ujaen.es; ximenovoa@comunidad.unam.mx; iromero@ujaen.es; eruiz@ujaen.es; ecastro@ujaen.es

Keywords: Almond tree pruning, Antioxidants, Phosphoric acid pretreatment, Xylose.

*Presenting author email: jrgarcia@ujaen.es

Almond tree pruning is generated annually by the necessary removal of the old branches of the almond trees. Its current disposal is performed burning it, which contributes to the global warming. The valorization of this lignocellulosic biomass could have important environmental and socioeconomic advantages with the development of a new industry. The production of this product in Spain is more than 0.8 million tons/year [1]. The Almond tree pruning as a lignocellulosic material, is a renewable raw material interesting for production of 2nd generation bioethanol and other added value compounds such as, oligosaccharides, antioxidants, xylitol, etc., under a biorefinery approach.

The aim of this work was to study the optimal conditions to solubilize the xylose of almond tree pruning with the maximum concentration, which could be later fermented to produce ethanol using unconventional microorganisms capable of assimilating pentoses, or xylitol, or other products and to recovery of antioxidants; leaving a cellulose-rich solid which could be subject to a pretreatment or enzymatic hydrolysis to obtain glucose (Figure 1). Crushed almond tree pruning were treated in a reactor (with liquid to solid ratio 20 %w/v) according to a central composite experimental design, temperature (170-200 ºC) and phosphoric acid concentration (0.5-1.5 %w/v) as variables (Table 1). The analysis of results with Response Surface Methodology indicates that the optimun xylose concentration in liquors is obtained at 188.5 ºC and 1.5% phosphoric acid concentration, with an estimated near 20 g/l and the concentration of antioxidants higher than 2.6 g gallic acid equivalente/l.

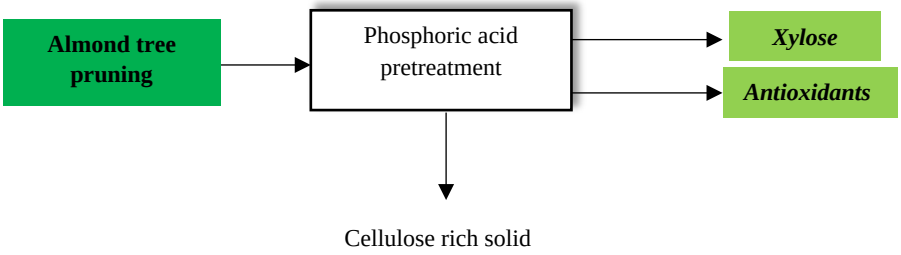

Figure 1. Fractionation of almond pruning to produce xylose and antioxidants.

Table 1. Central composite experimental design.

Run	Temperature (°C)	Phosphoric acid concentration (% w/v)
1	185	1.71
2	163.79	1.00
3	206.21	1.00
4	200	1.50
5	185	1.00
6	170	0.50
7	185	1.00
8	185	1.00
9	185	1.00
10	170	1.50
11	185	0.29
12	200	0.50
13	185	1.00

Acknowledgements
Financial support from Agencia Estatal de Investigación and Fondo Europeo de Desarrollo Regional (Reference projects PID2020-112594RB-C31). Carmen Padilla-Rascón expresses her gratitude to the Universidad de Jaén for financial support (grant R5/04/2017). J.M. Romero-García expresses his gratitude to the Junta de Andalucía for financial support (Postdoctoral researcher R-29/12/2020).

References
[1] Quantification of the residual biomass obtained from pruning of trees in Mediterranean almond groves Velázquez-Martí, B., Fernández-González, E., López-Cortés, I., & Salazar-Hernández,D. M. (2011).. Renewable Energy, 36(2), 621–626.