Recovery of antioxidants and xylose production from almond tree pruning biomass

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Almond tree pruning is generated annually by the necessary removal of the old branches of the almond trees. The usual disposal method is just by burning, 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. In Spain, the production of almond tree pruning is estimated at more than 0.8 million tons/year [1]. The almond tree pruning biomass, as a lignocellulosic material, is a renewable raw material interesting for the 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 biomass 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 recover antioxidants; leaving a cellulose-rich solid which could be subject to a pretreatment or enzymatic hydrolysis to obtain glucose (Figure 1). Crushed biomass from almond tree pruning was treated in a reactor (with liquid to solid ratio 20 %w/v) according to a central composite experimental design, with 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 maximum xylose concentration in liquors is obtained at 185 ºC and 1.5% phosphoric acid concentration, with an estimated value higher than 25 g/l and the concentration of antioxidants higher than 2 g gallic acid equivalent/l.

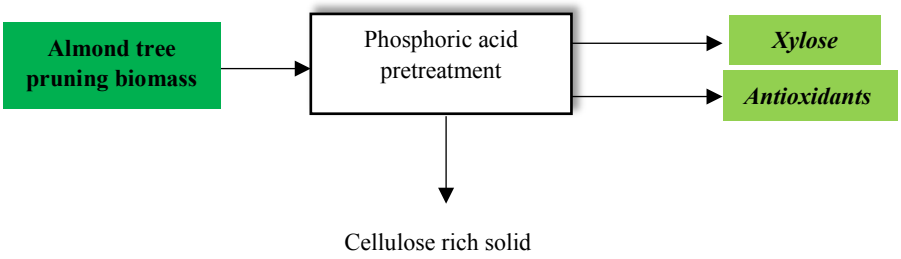

Figure 1. Fractionation of almond pruning biomass to produce xylose and antioxidants.

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

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