OR03

VALORISATION OF SPENT COFFEE GROUNDS USING SUBCRITICAL WATER

Bruno Pedras[1], Susana Barreiros[1], Alexandre Paiva[1*] and Pedro Simões[1]

[1]LAQV-REQUIMTE, Departamento de Química, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, 2829-516 Caparica, Portugal
*abp08838@fct.unl.pt

Abstract

Coffee is one of the most consumed beverage in the world. Spent coffee grounds (SCG) is the by-product obtained in the preparation of instant coffee. Every year ca. 6 million tons of this residue are generated worldwide. SCG is a rich source of phenolic compounds [1] and is also rich in carbohydrates, which are present in a complex lignocellulosic matrix [2]. Several methods are reported for the extraction of phenolic compounds from SCG and hydrolysis of lignocellulose, mostly using organic solvents and acidic solutions.

Subcritical water (SBW) is an environmental friendly alternative to these conventional processes. SBW is liquid water at high temperatures and above its vapor pressure. Compared to water at ambient conditions, SBW has a lower dielectric constant, which increases the solubility of less polar molecules, and also a higher ionic product, which makes it a more reactive medium for the hydrolysis of lignocellulosic matrices [3].

Before the experiments with SBW, the chemical characterization of SCG used in this work was performed for carbohydrates (50%), proteins (13.4%), lipids (12.3%), lignin (12.8%), ash (1%) and phenolics (2.3%).

Several assays were performed with SBW at different temperatures (150, 180, 200, 220 °C). The increase in temperature led to an increase in the yield of phenolic compounds and carbohydrates recovered, up to 200 °C, leading to a maximum of carbohydrates and phenolics yield of 34 g sugars/100 g dry SCG and 4 g phenolics/100 g SCG, respectively.

It was observed that the extracts collected at lower temperatures, until 150 °C, had a higher content in phenolic compounds, while the samples collected at higher temperatures were richer in carbohydrates. These results were also confirmed by the determination of the antioxidant activity of the extracts, which was higher for the extracts richer in phenolic compounds. HPLC analysis determined the composition in carbohydrates, being mannose and galactose the most abundant monosaccharides, resulting from the hydrolysis of SCG hemicellulose.

References

[1] E.M.S. Machado, R.M. Rodriguez-Jasso, J. a. Teixeira, S.I. Mussatto, Growth of fungal strains on coffee industry residues with removal of polyphenolic compounds, Biochem. Eng. J. 60 (2012) 87–90.

[2] S.I. Mussatto, L.M. Carneiro, J.P.A. Silva, I.C. Roberto, J.A. Teixeira, A study on chemical constituents and sugars extraction from spent coffee grounds, Carbohydr. Polym. 83 (2011) 368–374.

[3] G. Brunner, Near critical and supercritical water. Part I. Hydrolytic and hydrothermal processes, J. Supercrit. Fluids. 47 (2009) 373–381.