HYDROTHERMAL CARBONIZATION COUPLED WITH ULTRASOUND ASSISTED EXTRACTION FOR RECOVERY OF PHENOLIC COMPOUNDS

Pablo J. Arauzo, University of Hohenheim, Germany
Pabloj.arauzo@uni-hohenheim.de
Michela Lucian, University of Trento
Maciej P. Olszewski, University of Hohenheim, Germany
Lin. Du, University of Hohenheim
Andrea. Kruse, University of Hohenheim, Germany
Luca. Fiori, University of Trento

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Since the world average population is expected to grow during the next years, also coffee production and consumption is going to increase as well. This makes necessary to find a valuable way to valorize the residues generated by instant coffee production called exhausted or spent coffee ground (SCG).

SCG is a wet organic material with lignocellulosic structure (Silva et al. 1998), containing a high amount of valuable compounds, such as polysaccharides, proteins, lipids, aliphatic acids, alkaloids, tannins, polyphenols (Campos-Vega et al. 2015) and high calorific value. Thus aims to find a proper way to treat SCG to produce value-added products and/or use the remaining solid for a suitable application, depending on the specific scenario.

Hydrothermal carbonization (HTC) is a promising technology for the treatment of wet feedstock (up to 80 wt.%), at temperatures between 180 to 260 °C during a reaction time between 30 min to several hours. The main product of HTC is hydrochar, and a co-product called process water (PW). Ultrasound assisted extraction (UAE) is an eco-friendly technology suitable for the extraction of valuable compounds in the SCG, such as phenols and tannins. The target of this study is the production of hydrochar and the quantification of the total phenolic content (TPC) (mg GAE/g dry solid) after HTC and UAE.

With this objective SGC is initially treated by HTC under different temperatures (200, 230, 260 °C) and reaction times (1 and 3 h). Afterwards, it was applied a UAE to the produced hydrochars at determined as the optimum operating conditions to extract maximum phenolic compounds, 40°C, 40 min, S-L (1:25, g/ml), three solvents (water, methanol, water: methanol, 50:50) and an ultrasonic bath of 100W.

The results of the study may be summarized as follow:

a) The increase of the severity during HTC produces an increment of 71 wt. % of the fuel ratio (fixed carbon/volatile matter). Additionally, the low ash content 2.38 wt. % and 33.17 (MJ/kg) of the hydrochars make suitable to use them as co-fuel.

b) TPC (mg GAE/g dry solid) in the PW after HTC decrease with the increment of the severity during HTC.

c) The results obtained after the UAE of the produced hydrochars shows that the use of methanol as solvent increases the yield of extraction of the TPC (mg GAE/g dry solid) and hydrochars produced at 200 °C during 1h reaction time contains the highest amount of TPC (mg GAE/g dry solid).

References
