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Valorization of Coffee Brew By-products Via Recovery of High Nutritional Value Bioactive Ingredients and Their Incorporation into Bakery Products

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Abstract

Coffee is one of the world's most popular daily consumed beverages. Spent Coffee Ground-SCG is the main byproduct generated in coffee beverage preparation and instant coffee manufacturing (45%). About 2 kg of wet SCG are obtained from 1 kg of instant coffee produced, with an annual generation of around 6 million tons worldwide. The most common applications of SCG include animal feed, biofuels, composts, biosorbents and enzymes. More recently, there is a growing interest in food and health applications as SCG contains large amounts of organic compounds, polyphenols and fibers that can be exploited as a source of value-added food ingredients. The aim was (i) the recovery of high nutritional value bioactive ingredients (antioxidant and dietary fibers) from SCG and (ii) the enrichment of bakery products with these ingredients obtained from SCG. The ultimate goal was to evaluate the potential use of SCG as a food ingredient (application in bakery products). Freeze-dried SCG was subjected to oil and flavor removal with successive solvent extraction (water, methanol:water, acetone:water, acetone). The remaining solvent was removed from the solid residue by vacuum evaporation and further nitrogen purge to obtain a defatted, odorless powder with high antioxidant and dietary fiber content. Then, SCG was incorporated into cookie formulation: 0%(control), 4% and 7% SCG/g. Packed cookies were stored at (T:)25, 35, 45 °C, and their quality was monitored during storage. Total Phenolic Content (TPC:Folin-Ciocalteu), Peroxide Value (PV:oxidation-reduction titration), Total Dietary Fibers (TDF:Megazyme Assay Kit) and Chlorogenic Acids (CGA:HPLC) were determined. Sensorial characteristics (individual and overall: 1-9, coffee aroma intensity: 1-9), instrumental texture (hardness:texture analyzer) and color (CIELab:chromatometer) were evaluated. SCG presented high TPC and TDF: 21,566±627 ppm (dry) and 66.69±4.54% w/w (dry), respectively. 4% and 7% SCG enriched cookies also presented high TPC: 588±24 and 1,017±5 ppm per cookie, respectively, and TDF. 7% SCG cookies could be classified as source of dietary fiber (EU Regulation No:1924/2006). SCG cookies were characterized by light-to-dark brown color, crispy texture and pleasant coffee flavor/aroma. Based on total sensory quality, the shelf life of 0%, 4% and 7% SCG cookies (25 °C) was calculated: 359, 541 and 409 days,

respectively. TPC slightly decreased during storage; PV increased but it was in acceptable levels. The significance of the study is to propose an innovative use of SCG in food industry producing high nutritional value products and reducing coffee brewing byproducts.

Keywords: spent coffee ground, fibers, antioxidants, cookies