TRANSFORMATION OF SPENT COFFEE GROUNDS TO HIGH-VALUE ADDED PRODUCTS

Mirna Brekalo[1], Krunoslav Aladić[1], Lidija Jakobek Barron[1], Blanka Bilić Rajs[1], Jovana Stanojev[2], Nikola Maravić[3], Sandra Budžaki[1], Ivica Strelec[1]

[1] Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek, Franje Kuhača 18, 31000 Osijek, Croatia
[2] BioSense Institute, University of Novi Sad, Dr Zorana Đinđića 1, 21000 Novi Sad, Serbia
[3] Faculty of Technology Novi Sad, University of Novi Sad, Bulevar Cara Lazara 1, 21000 Novi Sad, Serbia

INTRODUCTION:

From one kilogram of espresso coffee, approximately 2 kg of spent coffee grounds are produced, which leads to the fact that 6 million tons of waste are produced annually in the world as a by-product. Spent coffee grounds are a renewable raw material and show great transformation potential. It is rich in polysaccharides, polyphenols, proteins and fibers, which give them significant nutritional and biotechnological value. In this research we have investigated the possibility of complete utilization of spent coffee grounds by sequential extraction with several solvents, followed by alkaline liquefaction of the solid residue. Soxhlet extraction of spent coffee grounds with *n*-hexane was used for the production of coffee oil and continuous sequential subcritical extraction of the defatted residue with 96% and 50% ethanol and water for the production of targeted bioactive compounds. The solid residue left after sequential subcritical extraction was subjected to alkaline liquefaction to produce a support for enzyme immobilization.

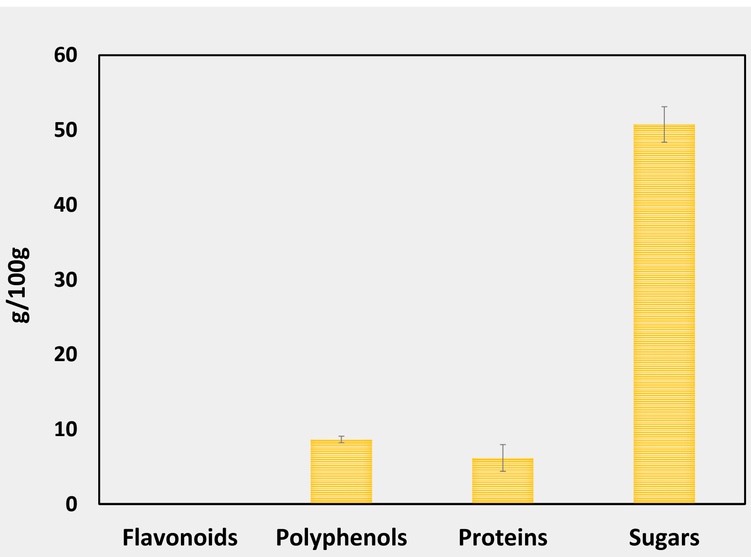
Fatty acid profile in oil extracted from coffee grounds

Fatty acid	Mark	Share in coffee grounds oil[%]
Palmitic acid	C16:0	33.59
Stearic acid	C18:0	7.02
Oleic acid	C18:1	9.56
Linoleic acid	C18:2 (n-6)	46.28
α-linolenic acid	C18:3 (n-3)	0.92
Arachidic acid	C20:0	2.63

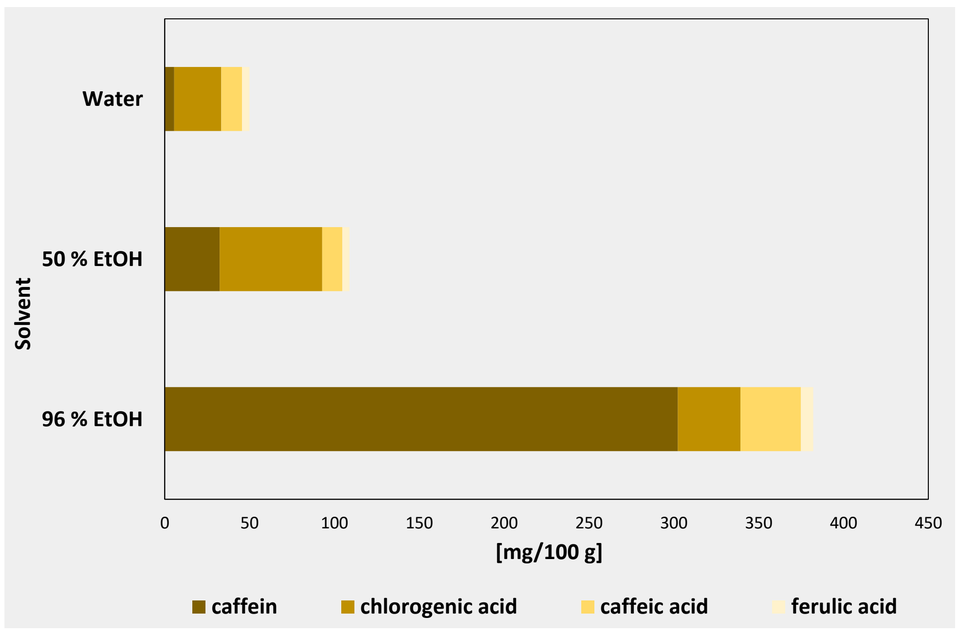
Solvent	Total polyphenols [g/100 g]	Total flavonoids [g/100 g]	Soluble proteins [g/100 g]	Total sugars [g/100 g]
96 % EtOH	2.14 ± 0.20	2.18 ± 0.12	0.94 ± 0.08	0.69 ± 0.06
50 % EtOH	2.50 ± 0.19	1.50 ± 0.15	1.44 ± 0.14	1.68 ± 0.16
Water	0.93 ± 0.10	0.59 ± 0.13	0.50 ± 0.09	2.17 ± 0.24
Total	5.57 ± 0.49	4.27 ± 0.4	2.88 ± 0.31	4.54 ± 0.46

Extracts during the preparation of carriers based on coffee grounds. Legend: 1-3 extracts after sequential extraction of coffee grounds; Extraction solvent: 96% ethanol (1), 50% ethanol (2), water (3)

ALKALINE LIQUEFACTION



Polyphenols, protein and sugar content of extracts after alkaline liquefaction.



Distribution of dominant polyphenols of coffee grounds in extracts after subcritical extraction of coffee grounds.

CONCLUSION

The complete utilization of 100 g of spent coffee ground containing 95% of dry matter resulted with the production of ~10.5 g of coffee oil rich in linoleic and palmitic acid, ~330 mg of caffeine and ~120 mg of chlorogenic acid and with ~20 g of chemically inert cellulose carrier for the enzyme immobilization. Based on the current evidence, it can be safely concluded that spent coffee grounds represent the valuable raw-material for the production of high value-added products instead being discarded on landfills.

ImoLip WASTE

19. međunarodni znanstveno-stručni skup Ružičkini dani
DANAS ZNANOST – SUTRA INDUSTRIJA
21. – 23. rujna 2022. | Vukovar, Hrvatska

PTFOS

HRZZ Hrvatska zaklada za znanost