PROXIMATE ANALYSIS OF SELECTED AGRO-FOOD INDUSTRIAL WASTES: Eggshells, spent coffee grounds and brown onion skin

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ABSTRACT

The agro-food industry generates a vast amount of residues (wastes) every year due to its own constant growth as a number of population is increasing. Food loss and industry food waste has become an issue of great public concern. Among many types of food wastes, eggshells, spent coffee grounds and brown onion skins, stand out by their low reusability. Most of these wastes end up in the environment, which is a concerning fact since, according to literature-available data on chemical composition, represent high-value material that can be used as secondary feedstock. The eggshells are rich in calcium, while spent coffee grounds and brown onion skins have high content of cellulose, hemicellulose, and valuable bioactive components. The aim of this work was to evaluate the chemical composition of these agro-industrial wastes and point out their possible utilization in vary industries for production of different added value products and eventually as a potential candidates for biorefinery concept.

METHODS

EGGSHELLS & WASHED EGGSHELLS

EGGSHELL WASHING: 3 x 10 min with distilled water 1:10 (*w/V*), then dried 18 h at 60 °C

MOISTURE DETERMINATION: drying 24 h/100 °C

ASH DETERMINATION: drying at 650 °C

PROTEIN DETERMINATION: standard Kjeldahl method

LIPIDS DETERMINATION: standard Folch method

CALCIUM DETERMINATION: complexometric titration

SPENT COFFEE GROUNDS & BROWN ONION SKIN

SAMPLE PREPARATION: drying 24 h/60 °C

MOISTURE DETERMINATION: drying 4 h/103 °C

ASH DETERMINATION: 550 °C until constant weight

PROTEIN DETERMINATION: standard Kjeldahl method

LIPIDS DETERMINATION: standard Soxhlet method

NDF, ADF and ADL: method described in Van Soest et. Al., 1991.

TOTAL PHENOLS DETERMINATION: modified method described by Matić et. al., 2017.

TOTAL FLAVONOIDS DETERMINATION: modified method described by Matić et. al., 2017.

MATERIALS

EGGSHELLS

SPENT COFFEE GROUNDS

BROWN ONION SKIN

RESULTS

Table 1 Chemical composition of eggshells and washed eggshells

	EGGSHELLS	WASHED EGGSHELLS
Moisture [%, db]	15.00 ± 2.31	0.23 ± 0.02
Ash [%, db]	52.81 ± 0.50	53.62 ± 1.85
Protein [%, db]	5.35 ± 0.14	2.42 ± 0.15
Lipids [%, db]	0.59 ± 0.04	0.51 ± 0.05
Calcium [% $CaCO_3$, db]	90.79 ± 1.20	89.97 ± 0.81

Table 2 Chemical composition of spent coffee grounds and brown onion skin

	SPENT COFFEE GROUNDS	BROWN ONION SKIN
Moisture [%, db]	61.88 ± 2.72	12.69 ± 0.23
Ash [%, db]	2.23 ± 0.20	6.93 ± 0.57
Protein [%, db]	16.40 ± 1.06	19.96 ± 0.96
Lipids [%, db]	12.30 ± 0.73	0.55 ± 0.22
Crude fiber [%, db]	32.21 ± 0.98	32.62 ± 0.32
NDF [%, db]	54.83	38.64
ADF [%, db]	30.88	30.20
ADL (lignin) [%, db]	10.01	1.29
Total phenols [%, db]	1.47 ± 0.10	3.00 ± 0.06
Total flavonoids [%, db]	1.96 ± 0.28	2.66 ± 0.27

CONCLUDING REMARKS

The results (Table 1) show that calcium carbonate is the most abundant component of the eggshells, which proportion ranges from 89.97 ± 0.81% in washed eggshells to 90.79 ± 1.20% in crude eggshells. Accordingly, the calcified eggshell matrix represents a significant source of natural calcium that can be further used to produce a variety of products including dietary supplements, additives, pharmaceuticals or calcium salts. Chemical composition of spent coffee grounds and brown onion skin, as is shown in Table 2, allows to conclude that they are lignocellulose materials composed of high levels of proteins (16 -19%) and fibers (32%). Therefore, they potentially could be use as functional ingredient rich in fibers. On the other hand, they also could be used as preservatives in food formulations, as natural sources of antioxidants for use in food and pharmaceutical products due to the content of bioactive components (total phenols and flavonoids; 3.43 - 5.66%). Thus, egg shells, spent coffee grounds and brown onion skin can be used, as secondary raw materials, to produce functional ingredients with important health properties. Moreover, if the recovery and production of new products from these agro-food industrial wastes proves successful, the disposal of such wastes should no longer be an environmental problem.