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Agri-food Waste Management for Sustainable bio-economy through Higher Education curricula and upskilling

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Extraction of bamboo stalk and leaves by subcritical water: chemical and bioactivity comparison

INTRODUCTION

Subcritical water extraction is green extraction technique that is gaining increasing interest in research, owing to the fact that water properties can be fine tuned by heating and pressurization. While maintaining water in its liquid state by pressure, temperature increase causes drop in water polarity, together with change of other physicochemical properties relevant for the extraction (surface tension, viscosity, density etc.). This possibility of modification of water polarity allows the extraction of wide array of chemical compounds with safe and green solvent. In this research bamboo stalks and leaves were extracted with subcritical water under moderate conditions to avoid possible degradation of bioactive compounds. The extracts of stalks and leaves, obtained under same operational conditions were compared in respect to their selected composition and activity.

MATERIALS & METHODS

Subcritical Water Treatment:
20 bars N_2, T = 130°C, t = 30 min,
500 rpm, sample-to-solvent ratio = 1:20

Chemical and biological characterization

RESULTS & DISCUSSION

Table 1. Comparison of chemical composition and activity of bamboo stalk and leaves extracts obtained by subcritical water (mean±2SD)

	Bamboo stalk	*Bamboo leaves*
Extraction yield (%)	34.00 ± 1.41	19.50 ± 0.71
Total phenols (mg GAE/ml)	302.57 ±0.79	117.10 ± 2.37
Total flavonoids (mg RE/l)	149.04 ± 5.44	52.68 ± 0.83
Total antioxidant activity (mg AAE/l)	1554.17 ± 7.22	712.50 ± 24.75
DPPH (mg AAE/l)	130.84 ± 0.47	14.63 ± 0.87
Total sugars (g GE/l)	7.39 ± 0.53	3.03 ± 0.01
ABTS IC_{50} (mg d.ex./ml)	11.25±0.70	8.77±0.40

Table 2. Phytoscreening of bamboo stalk and leaves extracts obtained by subcritical water

Chemical class	*Bamboo stalk*	*Bamboo leaves*
Free flavooids	+	+
Anthocyanines	-	-
Total tannins	+	-
Galic tannins	+	+
Reducing sugars	-	-
Glycosides	-	-
Alkaloids	+	-
Coumarins	+	+
Saponosides	-	-
O-heterosides	++	+
C-heterosides	+++	++

CONCLUSIONS

Aqueous extracts of both bamboo stalk and leaves, obtained by hot compressed water, exhibited good antioxidant and antiradical properties. Surprisingly, bamboo stalk extracts superseded leaves extract in respect to total antioxidant activity (~ 2 fold) and against DPPH radicals (~9 fold). These findings correlated well with greater concentrations of total phenols and total flavonoids found in stalk extracts. In respect to phytoscreening, total tannins were detected in stalk extracts, but not in the leaves. C- and O-heterosides were higher in bamboo stalk extracts.

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