Characterization of soluble coffee and spent coffee grain extracts

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INTRODUCTION

Near the end of the Maillard reaction several polymer-like compounds are formed. These compounds can be extracted from by-products of processed foods such as spent coffee grounds (SCG), allowing for their valorization. They possess several biological properties that may improve human health, such as antioxidant, antimicrobial, anti-inflammatory, anticarcinogenic, and prebiotic activities.

The raw materials from where these compounds can be obtained (soluble coffee (SC) and SCG) also have some of the same biological properties, and therefore were characterized regarding these properties. Antioxidant activity as well as several physicochemical and thermal properties of soluble coffee and spent coffee grounds were characterized in this work.

METHODS

SCG extract preparation

90 mins at 80-85 °C; centrifuged for 15 mins at 15000 rpm; filtered with 0.22 µm filter paper

SC extract preparation

SC grinded until homogeneous; stir for 15 mins until complete dissolution

Physicochemical Analyses

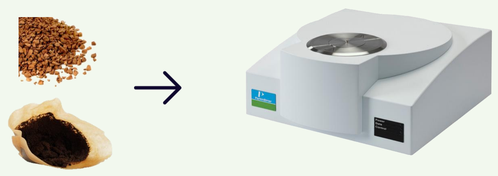
3 g of sample;
Boiling: 100 min, 90 °C
Rinsing: 180 min, 90 °C
Recovery: 50 min, 90 °C

10 g of sample
100 ml of deionized water,
30 min homogenization
decant solids

0.5 g of sample
10 ml of sulfuric acid;
kjeltab
1 hour at 450 °C;
Titrate samples

1 g of sample;
dry overnight to constant weight

Thermal Analyses

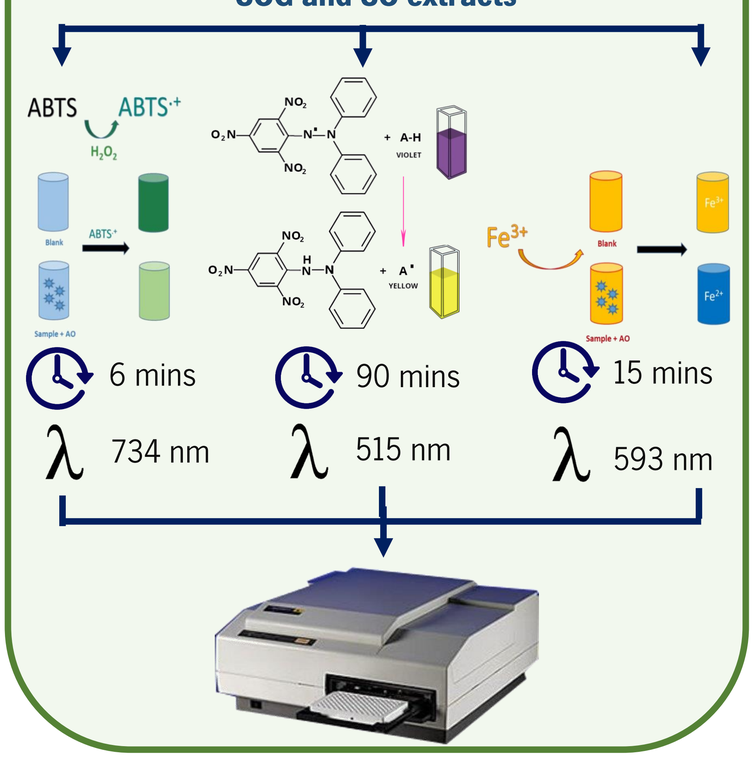


TGA - ≈15 mg of sample:
Hold for 1 min at 30 °C; Heat from 30 °C to 700 °C at 10 °C/min

DSC – ≈5 mg of sample
Hold for 1 min at 5 °C; Heat from 5 °C to 220 °C at 10 °C/min

Antioxidant Activity

SCG and SC extracts



RESULTS

Table 1. TGA results for SCG and SC

	SCG			SC	
	Water	LMWC	HMWC	Water	CP
ΔW %	4.167[a]	46.096	33.665	2.737[b]	74.544
T (° C)	81[a]	299	393	90[b]	277

Table 2. DSC results for SCG and SC

	SCG	SC
ΔH (J/g)	94.241[a]	68.800[b]
T (° C)	152.157[a]	163.727[a]

Table 3. Physicochemical analysis results for SCG and SC

	SCG	SC
Protein (%)	13.650[a]	21.949[b]
Moisture (%)	3.550[a]	4.917[b]
Solids (%)	96.450[a]	95.083[b]
Ash (%)	2.065[a]	33.277[b]
pH	4.967[a]	5.437[b]
A_w	0.165[a]	0.326[b]

Table 4. IC50 (g/l) results for SCG and SC by DPPH and ABTS methods

DPPH			ABTS		
SCG	SC	Trolox	SCG	SC	Trolox
0.0163	0.0005	0.0565	N.A.	0.0007	0.1133

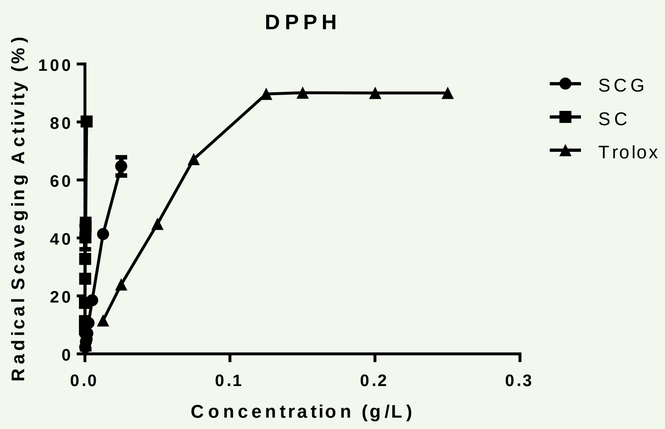


Figure 1. Radical scavenging activity of SCG and SC extracts and a Trolox standard.

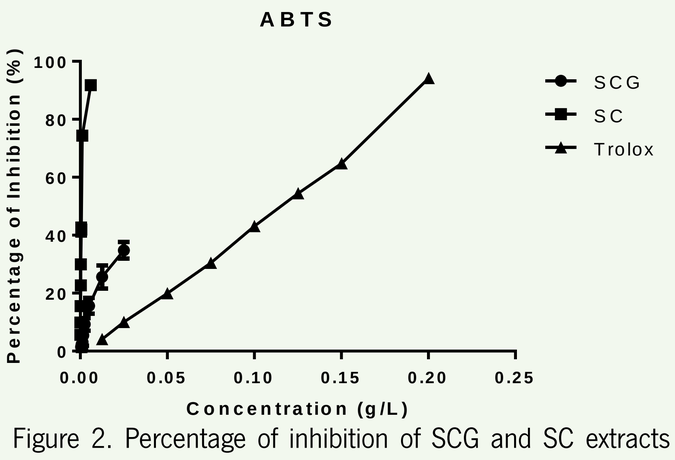


Figure 2. Percentage of inhibition of SCG and SC extracts and a Trolox standard.

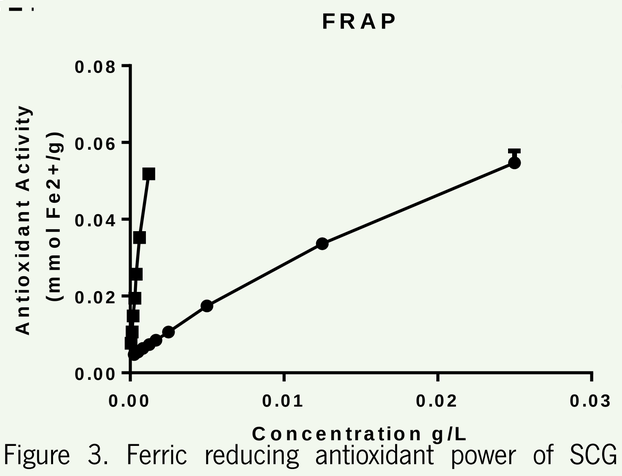


Figure 3. Ferric reducing antioxidant power of SCG and SC extracts.

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SUMMARY

- DSC results show similar melting peaks for SCG and SC despite different ΔH values
- TGA results for SCG show three different degradation phases, water, LMWC and HMWC, while SC has two (water and coffee polysaccharides)
- Antioxidant activity was confirmed, with results showing higher antioxidant activity values for SC than for SCG, as expected.

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