Spent coffee grounds – a coffee by-product abundant of bioactive compounds with antioxidant properties

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Introduction

Food processing industries have been facing ever-growing difficulties related with the plant waste accumulation and environmental degradation recently. To overcome these problems, circular economy conceptualization (CEC) was brought to life [1]. SCG are solid coffee waste material abundant in various chemical compounds, which are only partially isolated from grounded coffee in the process of coffee brewing. These compounds include: polyphenolic compounds, caffeine, melanoidins and fatty acids [2].

Due to the aforementioned, the main goal of the present research was to evaluate quality of spent coffee grounds blend collected after coffee beverage preparation in local commercial establishments serving coffee.

Materials and methods

Collecting spent coffee grounds (SCG)

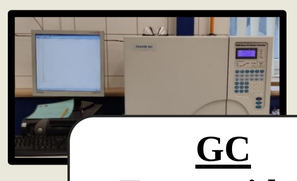
Preparation of representative laboratory SCG blend sample

The ultrasound-assisted extraction with 60% hydroethanolic solution

The conventional solid-liquid extraction with hexane

SCG extract

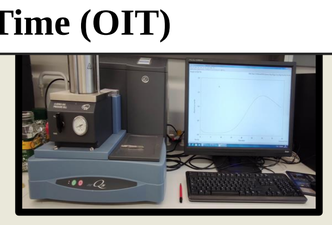
SCG oil



HPLC
- **Caffeine content**
- **Chlorogenic acids (CQA) content**

GC
- **Fatty acids profile**

PDSC
- **Oxidation Induction Time (OIT)**



SPECTROPHOTOMETER
- **Total polyphenols content (TPC)**
- **$ABTS^{\bullet+}$ Radical Scavenging (ABTS) assay**
- **Ferric reducing antioxidant power (FRAP) assay**
- **Browning index (BI)**

Results

Tab 1. The quality evaluation of SCG extract by using following spectrophotometric and chromatographic determinations: TPC (total polyphenols content), antioxidant acivity by using ABTS and FRAP assays, BI (browning index), caffeine and chlorogenic acids (CQA) contents. Data are shown as mean value ± standard deviation. Abs_{420} – spectrophotometric measurements of absorbance at 420 nm wave length ***** – analysis performed using a high-performance liquid chromatograph

Sample	Analysis	Result
SCG extract	TPC [mg GAE/g SCG d.m.]	33.79 ± 0.07
	ABTS [mg Trolox/ g SCG d.m.]	72.83 ± 0.10
	FRAP [µmol Fe(II)/g SCG d.m.]	71.39 ± 0.10
	BI (Abs_{420})	0.20 ± 0.01
	Caffeine content* [mg/g SCG d.m.]	9.06 ± 0.07
	CQA content* [mg/g SCG d.m.]	7.52 ± 0.05

Tab 2. Fatty acids profile present in SCG oil (SFA – saturated fatty acids, MUFA – monounsaturated fatty acids, PUFA – polyunsaturated fatty acids). Data are shown as mean value ± standard deviation.

Fatty acids group	Fatty acid	Fatty acid share [%]	Fatty acid group share [%]
SFA	C16:0	37.18 ± 0.50	46.92 ± 0.43
	C18:0	8.21 ± 0.16	
	C20:0	1.53 ± 0.01	
MUFA	C18:1n9-c	11.08 ± 0.22	11.08 ± 0.22
PUFA	C18:2n6c	39.69 ± 0.52	41.64 ± 0.34
	C18:3n-3c	1.95 ± 0.02	

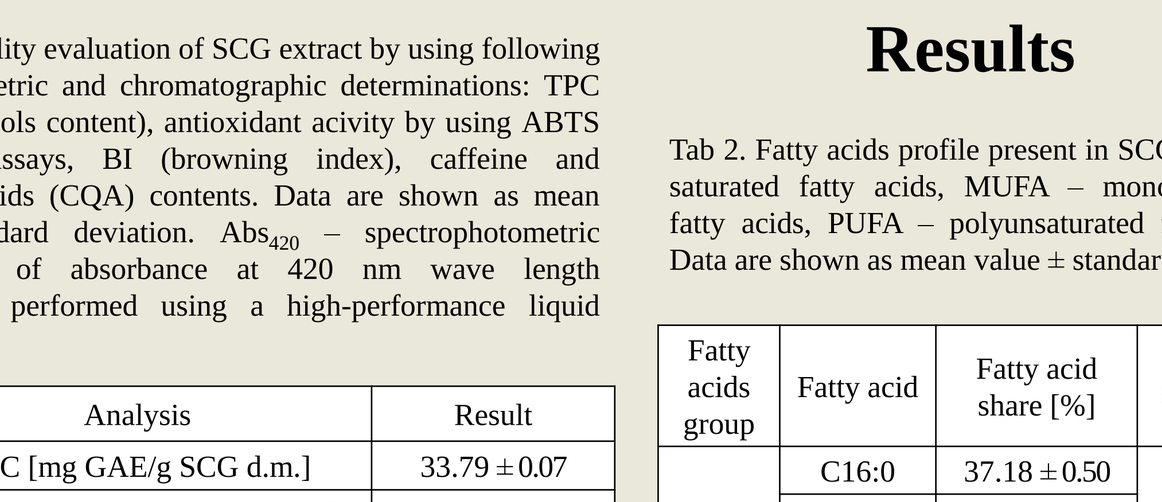
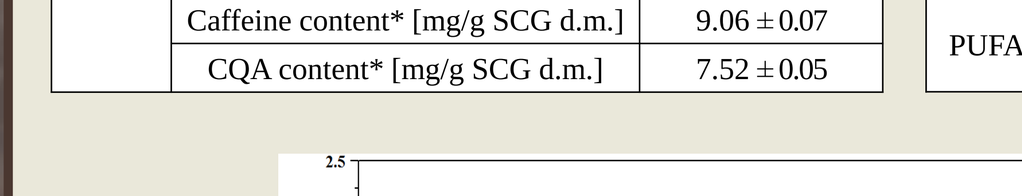


Fig 1. PDSC curve of oxidation induction time (OIT) of oil extraxcted from SCG blend.

Conclusions

1. The analysed SCG blend could be recognized as a coffee by-product abundant of bioactive antioxidant compounds, especially caffeine and chlorogenic acids.
2. The SCG oil mainly contained palmitic acid and linoleic acid. Also the high share of unsaturated fatty acids was indicated.
3. The oxidation induction time of SCG oil reached 43.8 min.
4. Further scientific investigations will be recommended to examine the possibility of the apllication of SCG in various forms as a new ingredient of functional food commodities.



References

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2. Campos-Vega, R.; Loarca-Piña, G.; Vergara-Castañeda, H.A.; Oomah, B.D. Spent coffee grounds: A review on current research and future prospects. Trends Food Sci. Tech. 2015, 45, 24–36