PROFILE COMPARISON IN THE EXTRACTION OF LIPIDS, CARBOHYDRATES, AND PHENOLIC COMPOUNDS OF SPENT COFFEE GROUND FROM DIFFERENT CONTINENTS

AMERICAN UNIVERSITY
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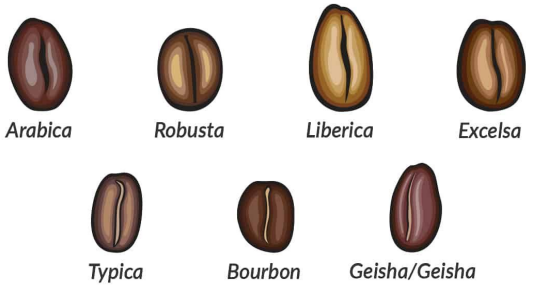
Fall 2021

CHEM 671 – Experimental Biological Chemistry I

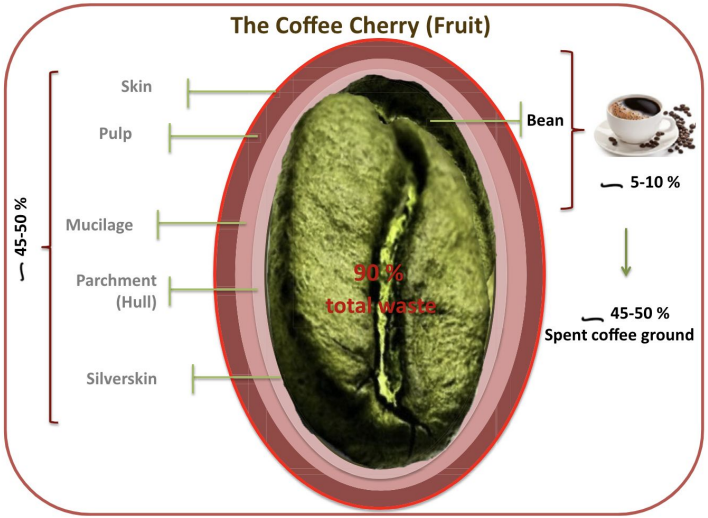
pinterest.com

Background Information



RoastyCoffee.com

thejakartapost.com



Kovalcik, et al [13].

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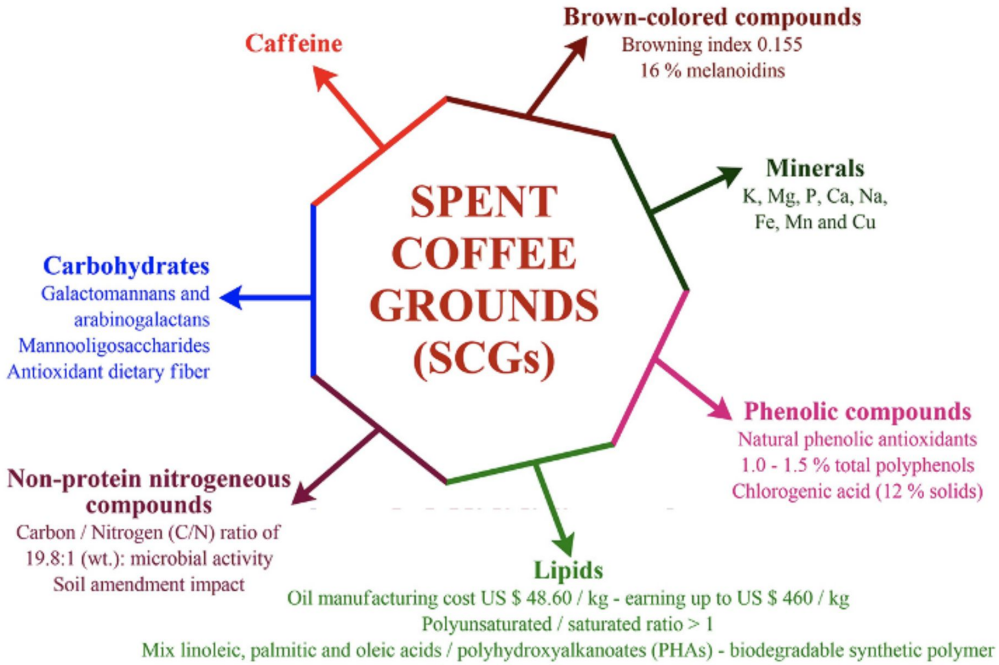

Dattatraya Saratale, et al [30].

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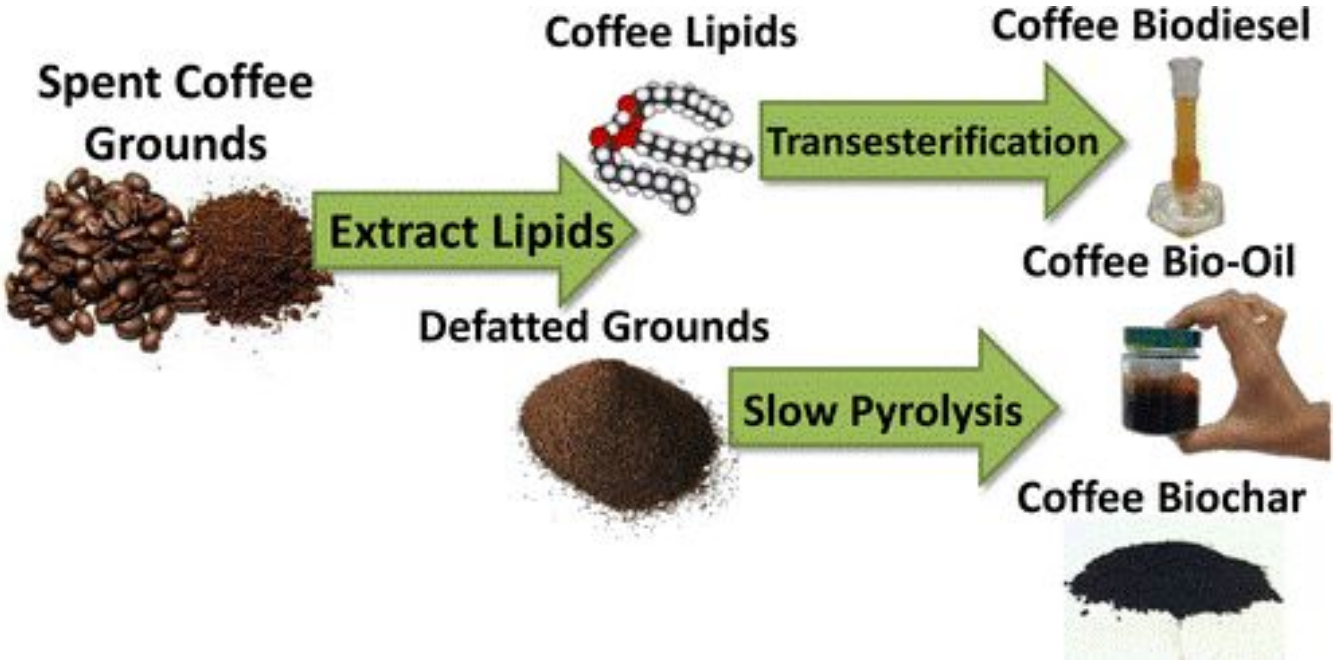

istc.illinois.edu

Goals of the experiment

istockphoto.com

Goals of the experiment

Crude SCG:

SEM | jeol.co.jp

After extraction of each group:

UV-Vis | scinteck.com

ICP | Agilent.com

LC/MS | Agilent.com

Techniques & methods

Raw Material:
- Coffea Arabica
- Light roasting profile

Preparation of SCG:
- 16h
- 60°C

Solvent Extraction:
- Polyphenol
- Lipids
- Carbohydrates

30s* | 8min

Amazon.com

Oven | thermobid.com

Sample for Trials

* Asia, America, Europe and sample for trial.

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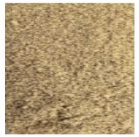
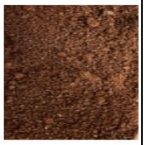
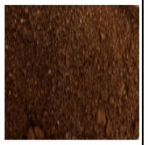
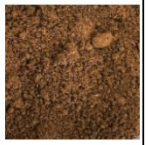
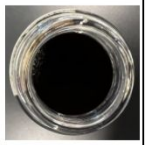
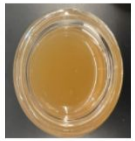
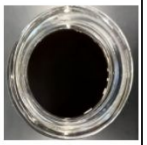
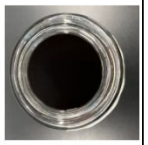
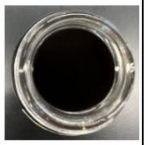
Coffee Samples

CODE	AE	OP	AS	AG	EI
Continent	Africa	Oceania	Asia	America	Europe
Country	Ethiopia	Papua New Guinea	Indonesia	Guatemala	Italy
Region	*Unknown*	Western Highlands	Sumatra Mandheling	Antigua Valley	Naples
Image					

Images: Amazon.com

Sample Preparation

CODE	AC	AE	OP	AS	AG	EI
Whole bean						
Grind coffee						
SCG						
Brewing						

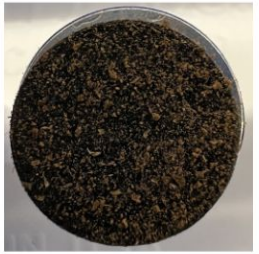
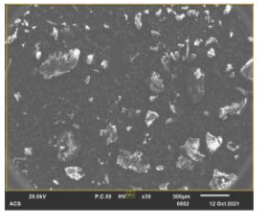
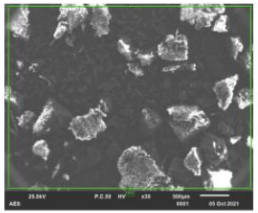
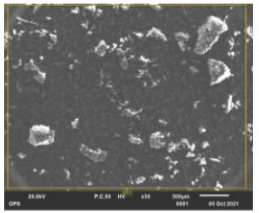
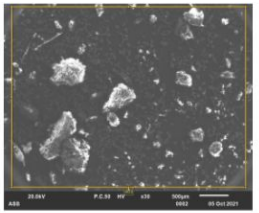
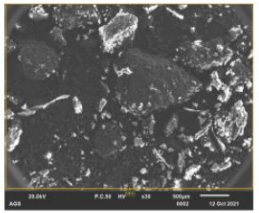
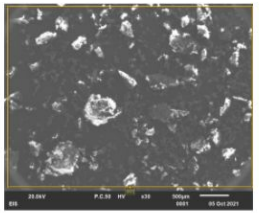
Techniques & methods

Color Tests:

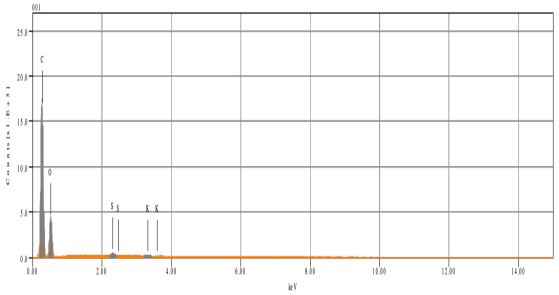
- Molisch's test →Carbohydrates
- Barfoed's test → Carbohydrates
- Benedict's reagent → Carbohydrates
- $FeCl_3$ test → Phenols
- Sudan IV (Red) test → Lipids
- Sudan Black B test → Lipids
- Biuret test →Protein

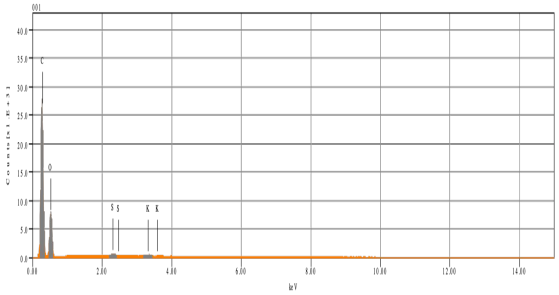
POLYPHENOLS	CARBOHYDRATES	LIPIDS
Trial 1 5g SCG methanol:water:acetic acid 70:25:5 Sonicator 15 minutes Filtration Separatory funnel 24h **Trial 3 5g SCG** 500 DI water Stir for 40 mins at 80°C. Then shake it for 15 mins. Centrifuge for 15 mins at 1500 rps **Trial 2 5g SCG** Water: ethanol 75:25 Sonicator 60 minutes, room temperature Filtration Separatory funnel 20h	**Trial 1 2.5g SCG** Water: ethanol 75:25 Sonicator 60 minutes, room temperature Filtration Separatory funnel 20h **Trial 3 5g SCG** 500 DI water Stir for 40 mins at 80°C. Then shake it for 15 mins. Centrifuge for 15 mins at 1500 rps	**Trial 1 5g SCG** Water: chloroform 50:50 Sonicator 15 minutes Filtration Separatory funnel 24h **Trial 2 5g SCG** Hexane:water: ethyl acetate 50:20:30 Sonicator 15 minutes Filtration Separatory funnel 24h **Trial 2 5g SCG** Water:ethyl acetate 40:60 Sonicator 15 minutes Separatory funnel 24h

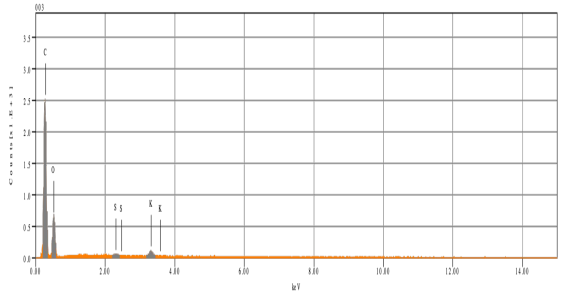
Elemental Analysis

AC	AE	OP	AS	AG	EI
					
					
Elements identified: C, O, S & K	Elements identified: C, O, S & K	Elements identified: C, O, S & K	Elements identified: C, O, S & K	Elements identified: C, O, S & K	Elements identified: C, O, S & K

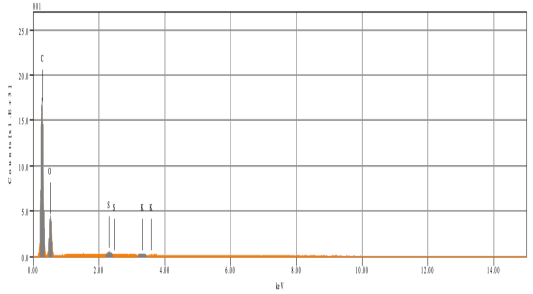
Elemental Analysis

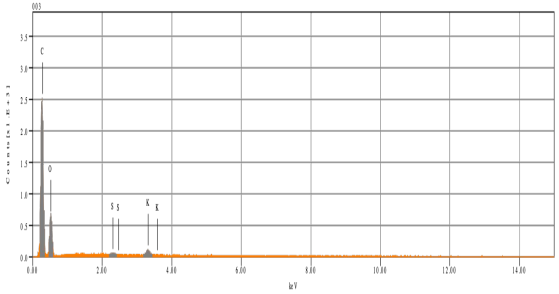


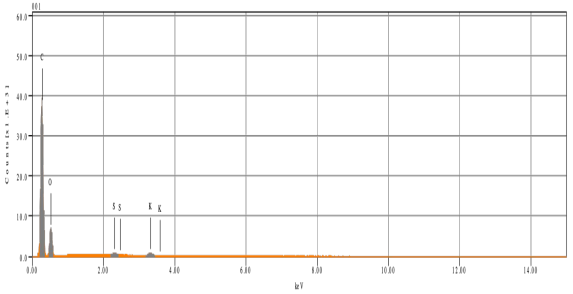




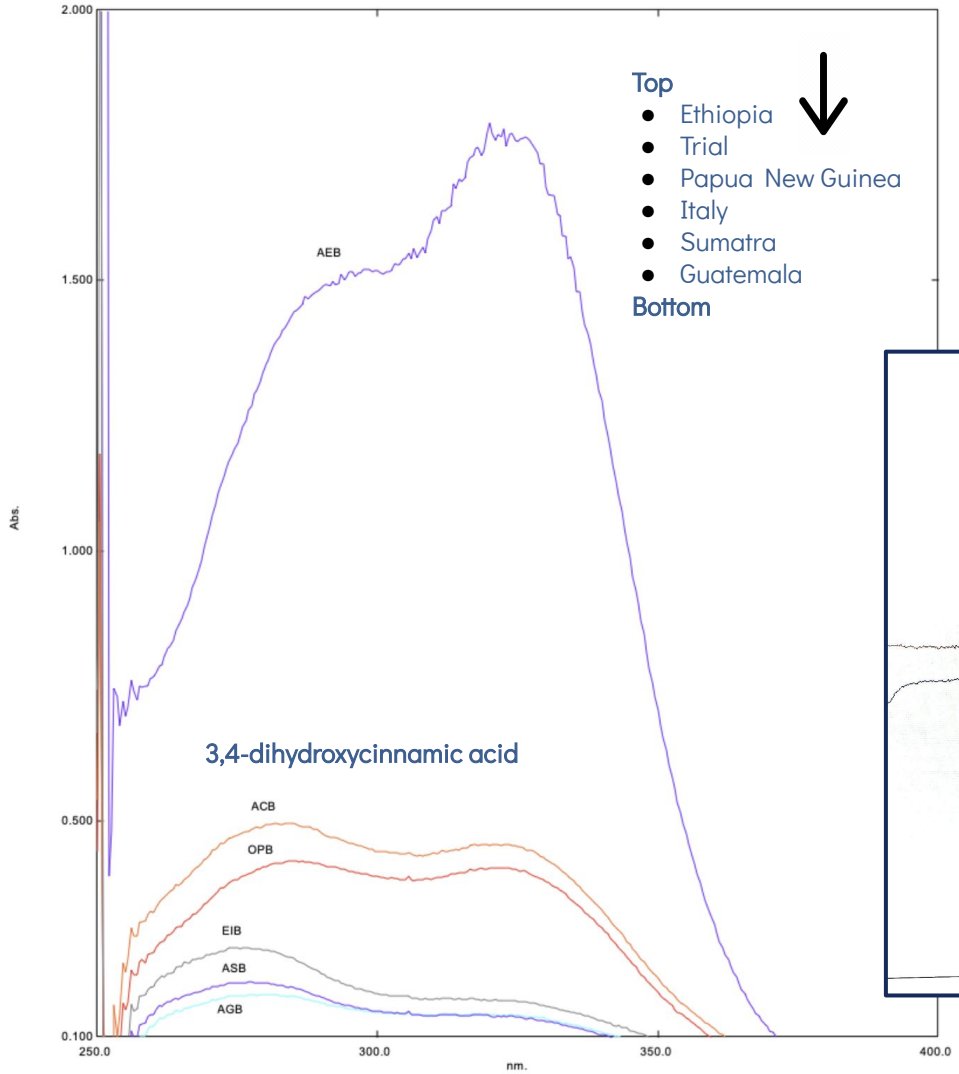
Elemental Analysis for the different coffee samples showed similar findings







Results

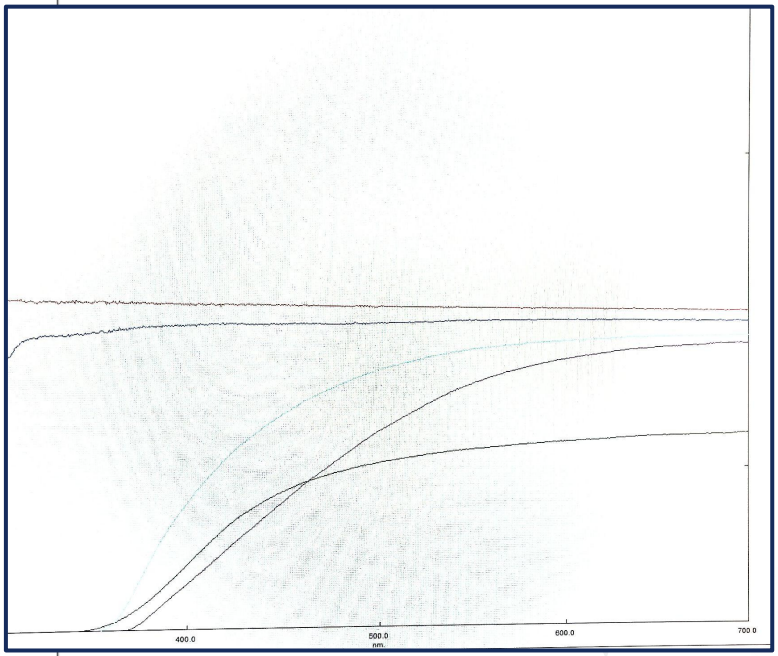


Top

- Ethiopia
- Trial
- Papua New Guinea
- Italy
- Sumatra
- Guatemala

Bottom

3,4-dihydroxycinnamic acid



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Relevance to the course

- The current project allowed us to design an experiment based on chemistry by using the resources provided by American University, including equipment, solvents, and glassware.

- The spent coffee ground is a considerable biowaste increasing annually which can cause an increase of landfill as it could affect the environment and our approach to find ways to recycle or reuse the SCG.

- We aimed to identify the coffee components based on their geographical location in this specific project. According to our findings, there was no significant difference in compositions.

Long-term implications

- Recycling and reusing the SCG will help reduce the amount of biowaste and its impact on the environment.
- The SCG consists of some active compounds that can be remanufactured and used in different fields, such as cosmetics.

Ideas for improvement

- This initial project is considered the qualitative aspect. It is encouraged to do the quantitative analysis using MS for future experiments.
- For further research, since the Elemental analysis cannot detect the trace amount of elements, it is suggested to use the ICP-MS to investigate the impurities in the SCG.
- Finding an appropriate way to extract the proteins and detect their bioactivity will be considerable for extended research.

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31.

شكراً

Gracias

Thank you

CHEM 671 – Experimental Biological Chemistry I