



# CONVERSION OF SPENT COFFEE GROUNDS INTO A VALUABLE PRODUCT

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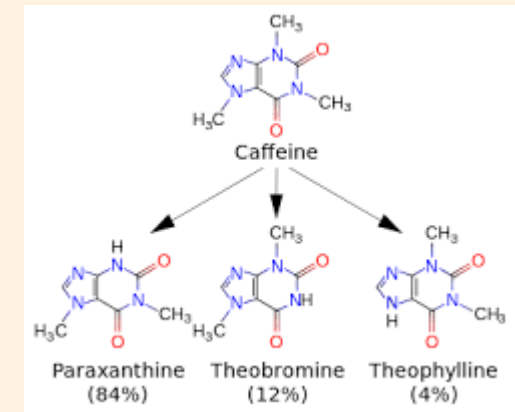
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# INTRODUCTION



- Spent coffee grounds (SCG) constitute a significant portion of the food waste from cafes.
- SCG contain large amounts of organic matter, including polysaccharides, especially cellulose, and hemicellulose, which together make up half of the SCG dry mass.
- SCG are characterized by a great caffeine content, but the specific value depends on the coffee sort and processing.
- Currently, most SCG are landfilled or end up in the sewer system, which is a serious environmental problem.



# INTRODUCTION



- Composting using earthworms is known as **vermicomposting**.
- **Vermicomposting** is a biooxidative and stabilizing process of organic materials conversion, which uses interactions between earthworms and microorganisms.
- Final product - vermicompost is characterized by very good maturity and stability, containing high-quality humic substances, enzymes, and plant growth hormones.



# OBJECTIVES

- **The objective** of this study was to investigate the efficacy of vermicomposting with continuous earthworm feeding on the transformation of SCG into a value-added product with regard to chemical and biological properties.
- **The novelty** is the vermicomposting of SCG with the addition of straw pellets and finding the optimal ratio of these two feedstocks in terms of processing speed. This research characterizes in detail the individual layers of the vertical-flow system.
- Our research results are useful for food waste producers, small-scale processors and large-scale vermicomposting plants, and vermicompost users, especially growers.

# MATERIAL AND METHODS

- The experiment was set up under laboratory conditions in plastic vermicomposters Worm Factory with four perforated trays of individual size 40 x 40 x 18 cm, marked from oldest (I) to youngest layer (IV).
- They were gradually filled with biowaste every 6 weeks during 6 months.
- Five treatments were established:
  - 1: SCG 100% vol. with *Eisenia andrei*
  - 2: SCG 75% vol. + straw pellets 25% vol. with *Eisenia andrei*
  - 3: SCG 50% vol. + straw pellets 50% vol. with *Eisenia andrei*
  - 4: SCG 25% vol. + straw pellets 75% vol. with *Eisenia andrei*
  - 5: SCG 50% vol. + straw pellets 50% vol. without earthworms



Spent coffee grounds



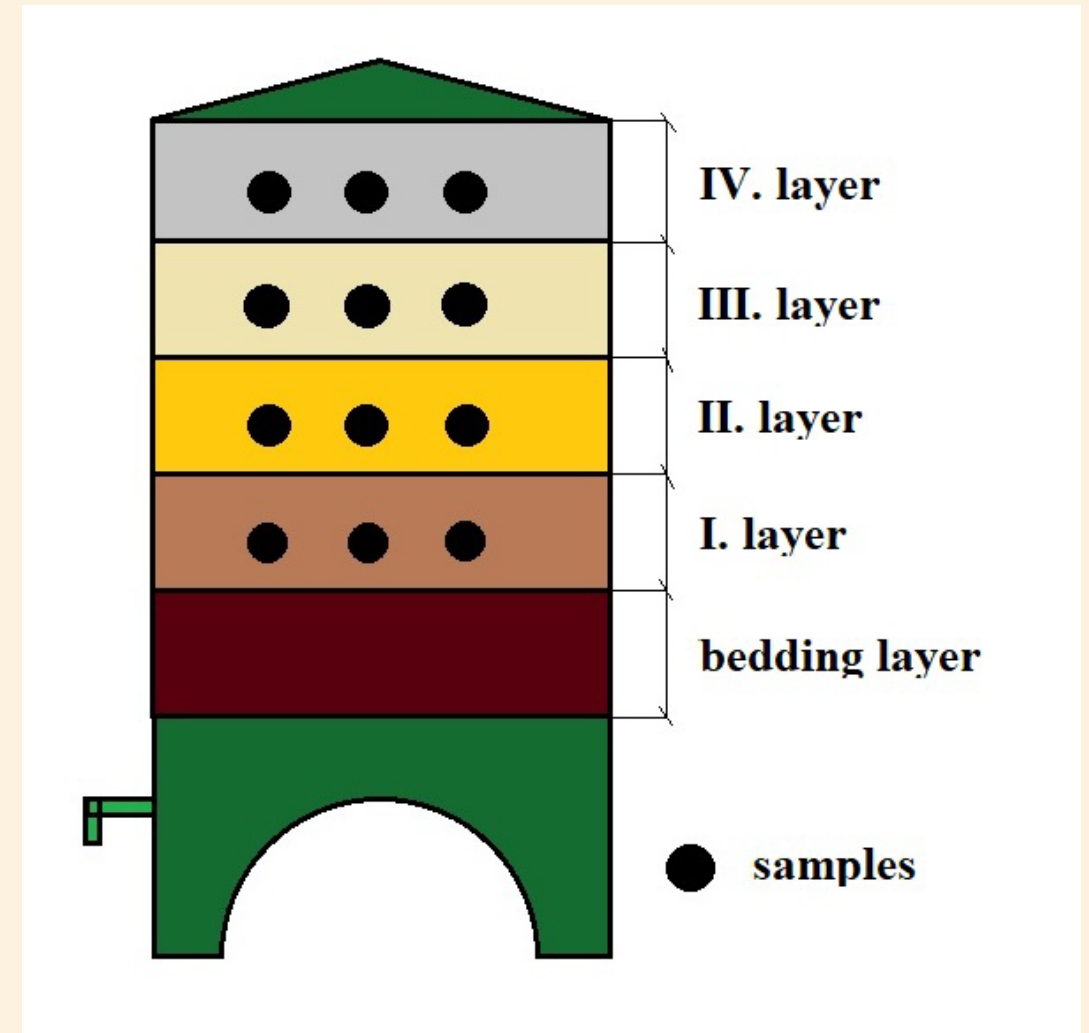
Straw pellets



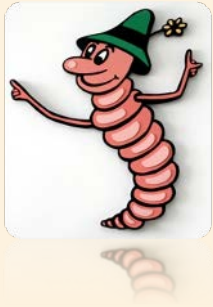
*Eisenia andrei*

# MATERIAL AND METHODS

- Three 1 kg samples were taken from each layer.
- All potential earthworms were manually separated, counted, and weighed.
- Enzymatic activity was measured by fluorescence and spectrophotometry methods using a Tecan Infinite® M200.
- The content of caffeine was measured by Agilent 1260 Infinity II LC system coupled to the Agilent 6470 LC/TQ mass spectrometer equipped with Agilent Jet Stream electrospray ion source.



# RESULTS AND DISCUSSION



Number and biomass of earthworms in individual layers during vermicomposting of 50% SCG with 50% of straw pellets (treatment 3), 25% SCG and 75% of straw pellets (treatment 4).

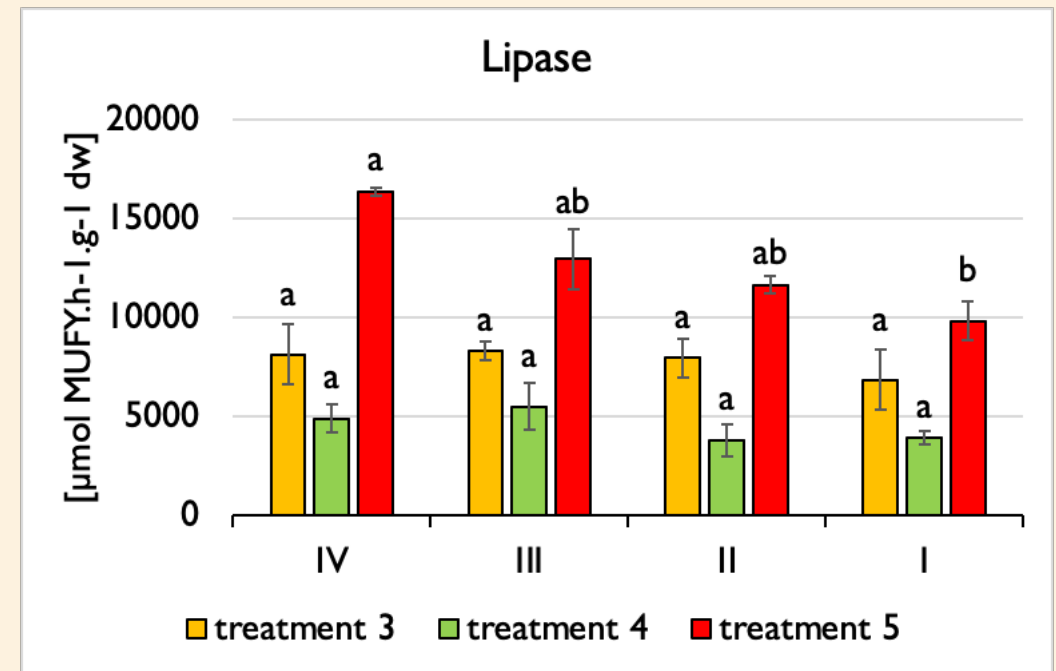
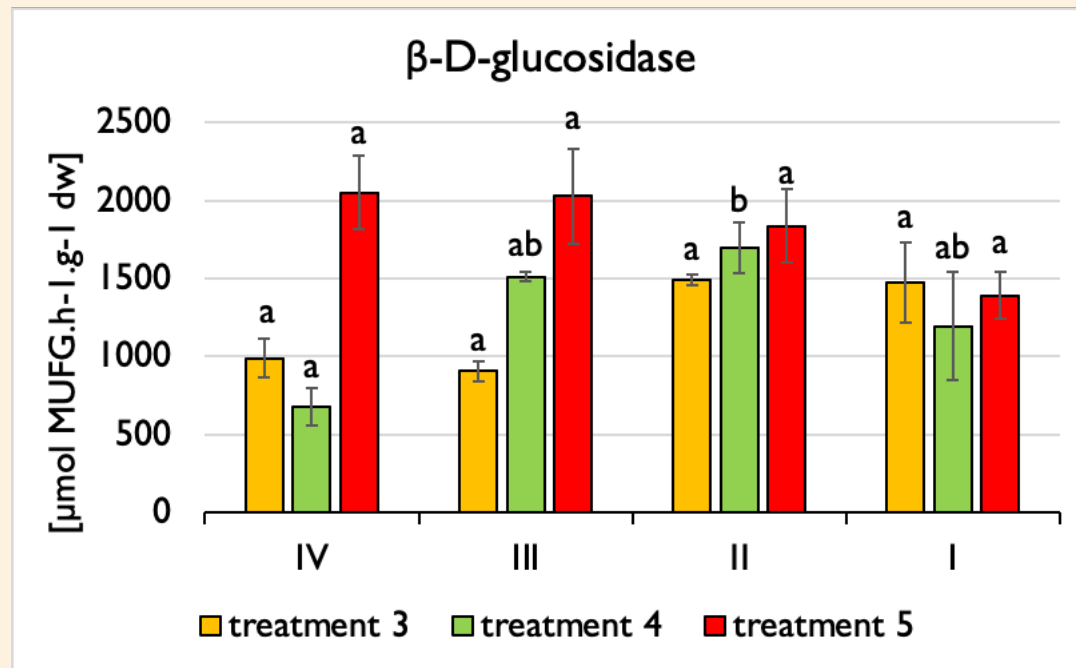
	50% SCG + 50% straw pellets (Treatment 3)		25% SCG + 75% straw pellets (Treatment 4)	
Layer	Number [pcs/kg]	E. biomass [g/kg]	Number [pcs/kg]	E. biomass [g/kg]
IV	70 ± 13	27.5 ± 3.4	629 ± 83	71.5 ± 7.1
III	31 ± 8	13.6 ± 3.9	354 ± 66	28.4 ± 5.5
II	8 ± 1	2.8 ± 1.4	320 ± 6	15.8 ± 0.6
I	1 ± 1	0.2 ± 0.2	400 ± 51	16.0 ± 0.2

Values are the means ± SD (n=3).



# RESULTS AND DISCUSSION

Changes in enzymatic activity of  $\beta$ -D-glucosidase and lipase of treatments 3; 4 and 5.



Values are the means  $\pm$  SD (n=3). Letters indicate significant differences (Kruskal-Wallis test,  $P \leq 0.05$ ) among layers within a treatment.



# RESULTS AND DISCUSSION

Caffeine content in layers IV, III, II, and I of treatments 3; 4 and 5 (ng/g of dry matter)

	IV (45 days)	III (90 days)	II (135 days)	I (180 days)
<b>50% SCG + 50% straw pellets with earthworms (Treatment 3)</b>	42.0 ± 6.3 abAB	42.1 ± 4.6 abAB	73.9 ± 19.4 aAB	33.4 ± 2.3 bAB
<b>25% SCG + 75% straw pellets with earthworms (Treatment 4)</b>	26.8 ± 1.9 aA	20.7 ± 0.6 abA	17.7 ± 0.8 bB	20.6 ± 0.5 abB
<b>50% SCG + 50% straw pellets without earthworms (Treatment 5)</b>	2174 ± 620.3 aB	4809 ± 48.3 abB	283.2 ± 43.6 abAB	136.8 ± 18.9 bAB

Values are the means ± SD (n=3). Different lowercase letters in a column indicate significant differences among layers, capital letters indicate significant differences among treatments (Kruskal-Wallis test, P≤0.05).

# CONCLUSION

- Vermicomposting is a convenient method for processing of SCG.
- The most suitable vermicomposting treatment with continuous feeding was 25% SCG and 75% straw pellets.
- The addition of straw pellets improved the SCG properties, which supports earthworm development and thus the perfect processing of the mixture.
- To speed up the process and simultaneously to create a quality vermicompost, an initial great earthworm density is desirable.
- The results obtained could encourage companies to effectively process this valuable food waste that is currently, unfortunately, often unnecessarily removed.

**THANK YOU FOR YOUR ATTENTION!**

