

PHYSICOCHEMICAL CHARACTERIZATION OF BIOCHAR FROM COFFEE WOOD AS AFFECTED BY MOISTURE CONTENT

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Introduction

Biochar improves soil by enhancing water retention, nutrient cycling, and carbon storage. Coffee pruning provides a sustainable feedstock, yet biochar quality depends on production conditions. Initial wood moisture is a critical but underexplored factor influencing pyrolysis and final properties.

This study examines how different moisture levels in coffee wood affect biochar quality, aiming to optimize production protocols for sustainable coffee systems.



Figure 1: SPSC Vario L, coffee wood, and produced Biochar.

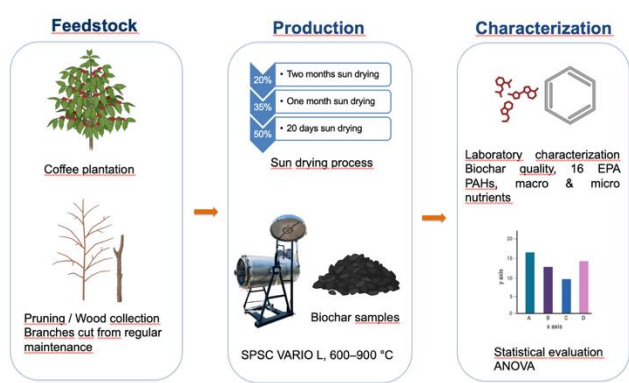
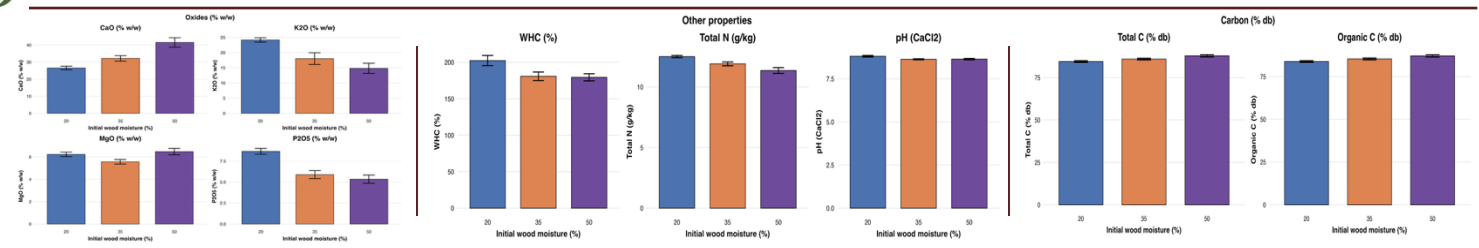


Figure 2: Workflow of biochar production and characterization.

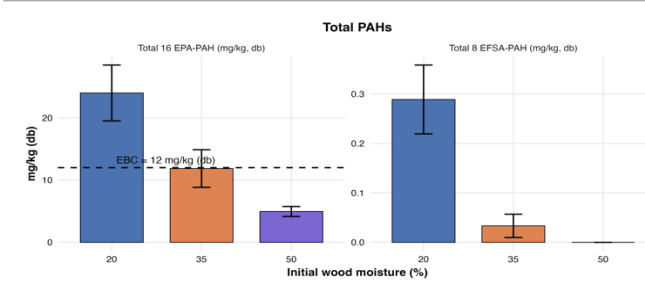
Materials/Methods

- **Study Location:** Farm in Chinchiná, Caldas, Colombia.
- **Biochar production reactor:** VARIO L mobile retort system (600–900 °C, ~1.9 m³ biomass/cycle).
- **Treatments:** Three initial wood moisture levels – 20%, 35%, 50%.
- **Biochar characterization at Eurofins lab:** Water holding capacity (WHC), pH.
- **Total & organic carbon, macronutrients:** CaO, MgO, K₂O, P₂O₅, N. 16 EPA-PAHs.
- **Statistics:** ANOVA to test differences among treatments.

Results/Discussion



- CaO increased with higher wood moisture.
- K₂O and P₂O₅ decreased as moisture increased.
- MgO showed minor changes.
- WHC highest at 20% moisture.
- Total N decreased with moisture.
- pH remained stable (~8.8).
- Total and organic C remained high (>80%), Slight increase with higher moisture



Biochar quality trade-offs with initial wood moisture

Wood moisture significantly influenced PAH formation (ANOVA, $p < 0.001$). Dry wood (20%) produced significantly higher PAH levels compared to medium moisture (35%) ($p < 0.05$), while fresh wood (50%) showed a tendency to lower PAHs, although differences were not statistically significant.

Conclusion/Perspectives

- Moist feedstocks (35–50%) reduced PAHs due to reactor conditions: sealed chamber, efficient gas extraction, and combustion of volatiles minimized PAH recondensation, approaching compliance with EBC limits.
- Findings support the development of protocols to convert coffee pruning residues into high-quality biochar.

References:

- Kiggundu, N., & Sittamukoty, J. (2019). Pyrolysis of coffee husks for biochar production. *Journal of Environmental Protection*, 10(12), 1553-1564.
- Domingues, R. R., Trugilho, P. F., Silva, C. A., Melo, I. C. N. D., Melo, L. C., Magriotis, Z. M., & Sánchez-Monedero, M. A. (2017). Properties of biochar derived from wood and high-nutrient biomasses with the aim of agronomic and environmental benefits. *PLoS one*, 12(5), e0176884.