

Surface-Mediated Emission
Suppression in Solid Biomass Fuels
Using Low-Cost Mineral Additives
for Safer Cooking Practices

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Background and Hypothesis

- Millions of people die from cooking with charcoal, mainly in low/middle-income countries
- All existing research to reduce charcoal emissions has focused on inaccessible internal binders in charcoal to reduce emissions that aren't feasible for most people.

Question

- How does the application of a calcium carbonate and kaolin clay slurry affect carbon monoxide and particulate matter emissions in charcoal briquettes?

Hypothesis

- Both Kaolin and calcium carbonate will cause at least a 30% reduction based on the effects seen with internal additives.

Reasoning

Logic/process behind combustion

- Plain charcoal briquettes release high levels of CO and PM because of a lack of adequate oxygen and heat within the briquette.
- Mineral coatings would seal the surface and cause slower, more steady combustion without affecting quality.
- Complete combustion would be promoted, releasing the safer CO₂ rather than CO.

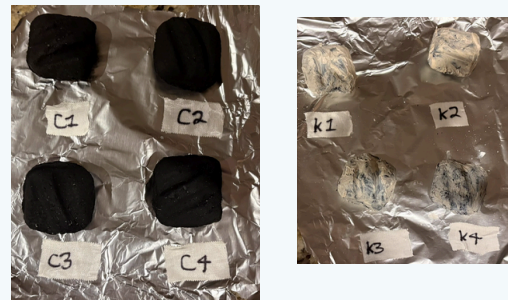
Existing Research

- Previous research involved mixing kaolin within the briquette before it was fully processed
- The logic of promoting complete combustion was hypothesized to carry to external additives.
- Calcium carbonate was hypothesized to behave the same way by acting as a barrier.

Methodology



Mix 10g of CaCo3 or Kaolin powder with 5g of water.



Place finished briquette in water to cool, dispose of ashes once fully cooled.

Divide and apply evenly to surface of each briquette

Place in combustion chamber and record data for 5 minutes using CO probe.

Allow to dry for 24 hrs.

Allow to burn for 120 secs until briquette is glowing.

Place 1 briquette in metal tin and apply 5ml of lighter fluid to its surface.

Ignite with lighter for 3 seconds.



Implications and Significance

- The use of **kaolin clay** to **reduce emissions** is statistically **supported** and could be implemented by **households, NGOs, or governments**.
- The reduction in CO, which is correlated with lower particulate matter could mean a much **lower risk of CO poisoning, lung harm, and pollution**, potentially **saving millions of lives**.
- Other mineral compounds similar to kaolin could show similar results to improve health and environmental outcomes.

References

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