Trans-SEC

Innovating pro-poor Strategies to safeguard Food Security using Technology and Knowledge Transfer

Byproducts for Bioenergy - advanced firewood substitution by simultaneous cooking and charring application

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Introduction

Fuel availability and fuel quality are major drivers to utilize efficient technology for cooking. Three billion people worldwide still cook and heat with open fire or improperly constructed stoves. This results in two major effects, the emission of toxic pollutants to living areas leading directly or indirectly to the death of over 4 million people annually, and the waste of energy caused by low efficiency, leading to an over proportional fuel demand and an unnecessary emission of GHG.

Background

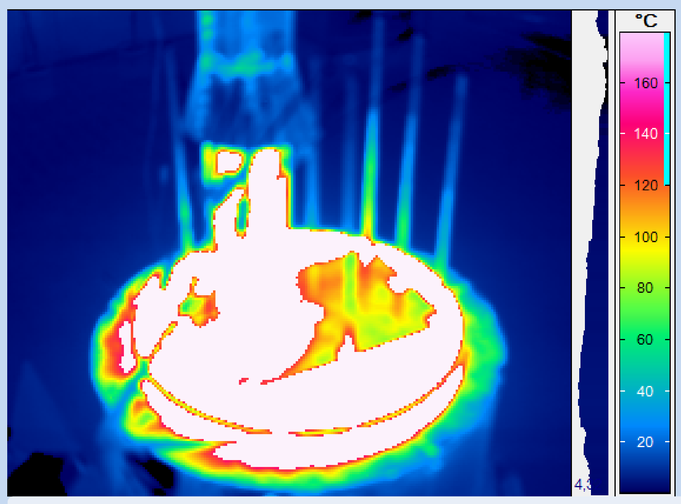
In rural Tanzania, open fire cooking with wood as the primary source of fuel is common practice. Also charcoal is produced in large quantities to be sold to more urban regions for the generation of additional income. The fuelwood for charcoal production usually comes from illegal logging and is being produced remotely in small and inefficient earth pits.

Objectives

- Cooking suitability evaluation
- Charcoal yield estimation
- Life cycle assessment
- Process modelling for up and down-scaling

Material & Method

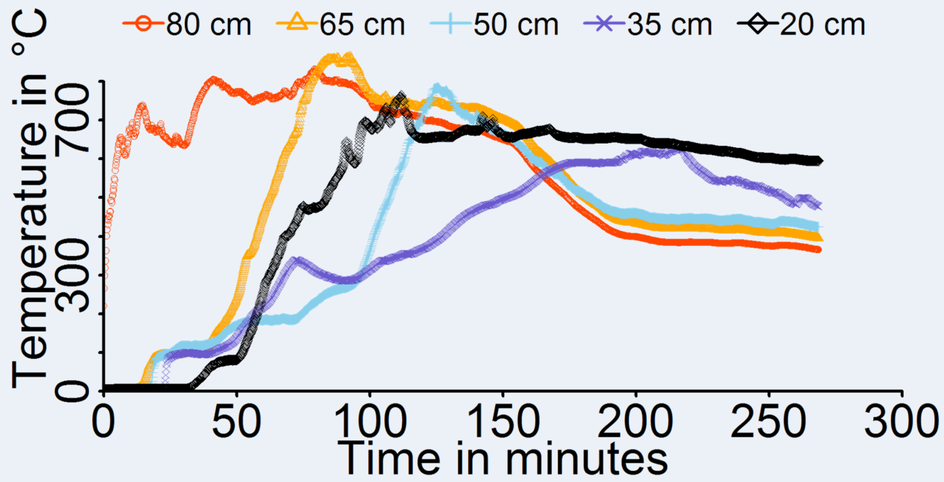
- Top-lit up-draft reactor (TLUD)
- Modified for agricultural wastes
- Hotplate for cooking on top
- Multiple sensors (Temperature, airflow, mass, emissions)
- Hot plate evaluation



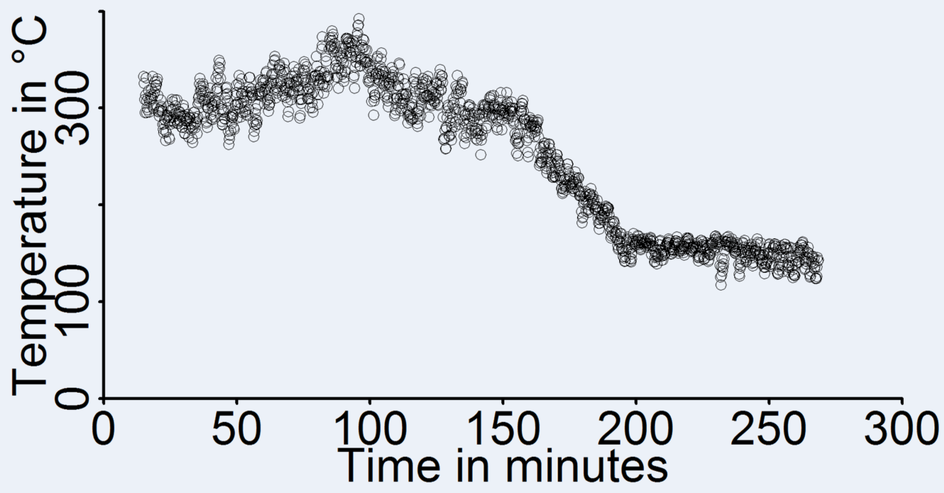
After 10 minutes the hotplate reached 190°C with a slightly uneven distribution.

Results

- 32 kg wood chips resulted in 7.4 kg char (23 %)
- 864°C max. reactor temperature
- 268 minutes process time
- 392°C max. hot-plate temperature
- 253 minutes cooking time (>100°C)



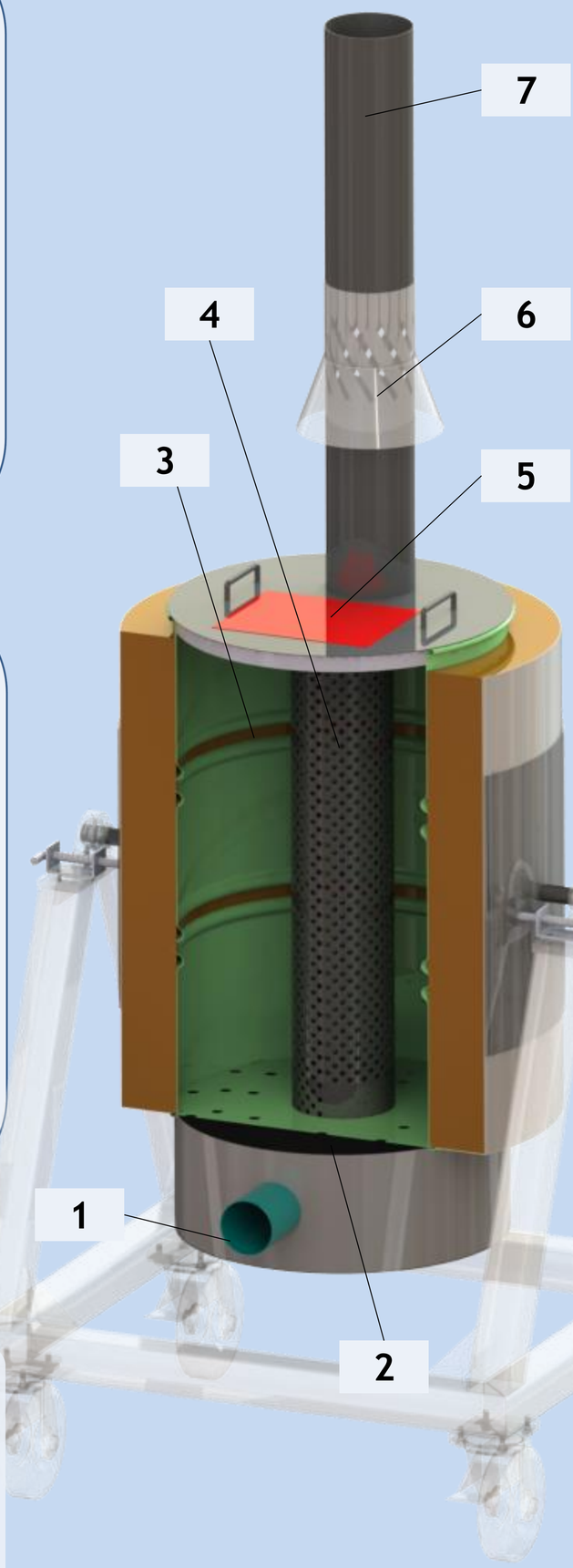
Temperature development inside the reactor in different heights from the bottom



Mean temperature on hot plate during the charring process

The Reactor

1 Primary air inlet
2 Adjustable air flap
3 Fuel chamber
4 Convection channel
5 Hot plate
6 Secondary air inlet
7 Chimney



Conclusion

- Char yield remarkably higher than in earth pits
- Cooking time and cooking temperature are sufficient, even for full meal preparation
- Process burns completely smokeless

If stakeholders are educated properly, the introduction of modified TLUD charring reactors has the potential to increase income and reduce GHG emissions.

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