Optimization of mixing ratios of binders and organic matter for charcoal briquette using biochars derived from water hyacinth

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Introduction

<Two problem in Ethiopia>

- Lake Tana, Ethiopia, the overgrowth of the **water hyacinth** is having a negative impact on the lake ecosystem and the local people.
- **charcoal made from acacia trees** is widely used as cooking fuel in Ethiopia[1]. Deforestation due to mass logging is becoming more serious.

⇒The production of **biochar** from water hyacinth can reduce the deforestation caused by the use of acacia charcoal.

<Charcoal briquette>

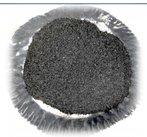
One of the fuel applications of biochar is charcoal briquettes[2]..

Objective

optimize the binders and organic matter for water hyacinth biochar briquette compared to the Acacia charcoal briquette used in Ethiopia.

Material

	Binder	Firelighter
Conventional charcoal briquette: Acacia charcoal	clay soil	Organic matter(OM)
Water hyacinth Biochar briquette <8 test area>: Water hyacinth 400℃ (WHB400)	Molasses	Organic matter(OM) (4:0)
Water hyacinth 800℃ (WHB800)	clay soil	No Organic matter (3:1)



Water hyacinth biochar

Charcoal(Biochar) briquette

Methodology: High Heating value and compressive strength

High heating value （MJ kg^{-1}） = 0.35 C + 1.38 H - 0.015 Ash - 124.69 (O + N) + 71.26 [4]

C,H,N,O measurement: Analyzing the elements using a fully **automatic elemental analyzer**

Analyze of Ash content: Hold the maffle furnace at 500 ℃ for 8 hours to ash

Compressive strength: **Max strength of charcoal briquette** using **a single column type material testing machine**

Results

Molasses didn't affect the OM. Clay affect the OM.

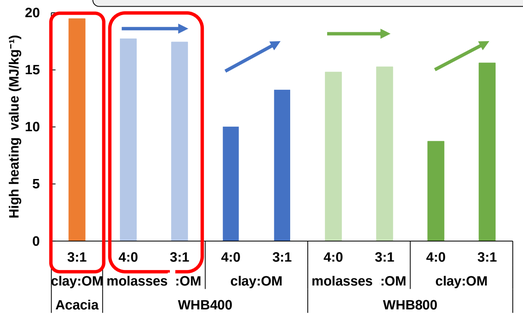


Fig.1 High heating value of different binders and mixture ratio of different charcoal briquette

WHB400:molasses:OM (6:4:0) biochar briquette showed **17.4 MJ kg^{-1}**, which was the closest heating value to that of ACB:clay:OM (6:3:1) charcoal briquette used in Ethiopia.

WHB400+molasses is high strength.

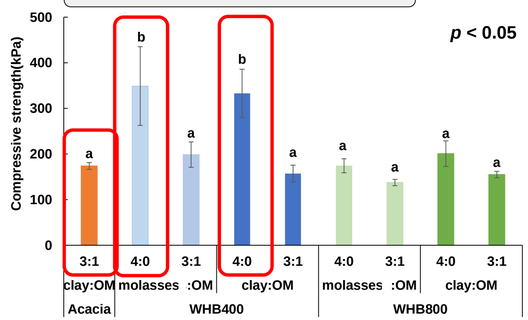


Fig.2 Compressive strength of different binders and mixture ratio of different charcoal briquette

WHB400:molasses:OM (6:4:0) biochar briquette showed **349 kPa**, which was the higher compressive strength than that of ACB:clay:OM (6:3:1) charcoal briquette used in Ethiopia.

Conclusions

<High Heating value>

WHB400:molasses:OM (6:4:0) biochar briquette was the closest heating value to that of ACB:clay:OM (6:3:1) charcoal briquette used in Ethiopia.

<Compressive strength>

WHB400:molasses:OM (6:4:0) biochar briquette was the higher compressive strength than that of ACB:clay:OM (6:3:1) charcoal briquette used in Ethiopia.

WHB400:molasses:OM (6:4:0) is the optimal mixing ratio of binder and organic matter, and has potential to be used as an alternative fuel in Ethiopia.

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Acknowledgments

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References

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