INVESTIGATING COB'S WATER RESITANCE USING BIO-POLYMERS AND LINSEED OIL- BEESWAX

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Introduction

This research investigates the water-resistance performance of traditional COB (clay–sand–straw) building material when enhanced with natural biopolymer coatings. Surface treatments and internal additives such as chitosan, sodium alginate, linseed oil, and variants combined with beeswax were tested to address key durability and moisture challenges in earthen construction.

Methods

Sample Variants : 13 variants

Size: 100 × 100 × 20 mm

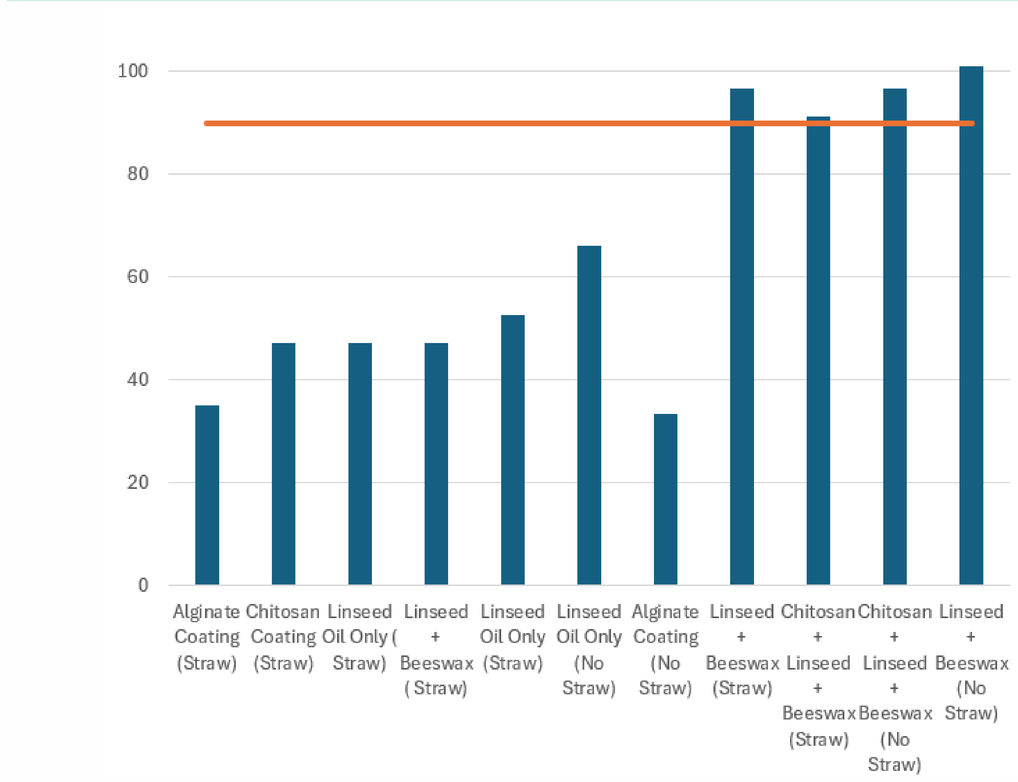
Treatments:

- Internal mixing
- External coating

Tests:

- Water Contact Angle
- Capillarity
- Water Absorption

Water Contact Angle

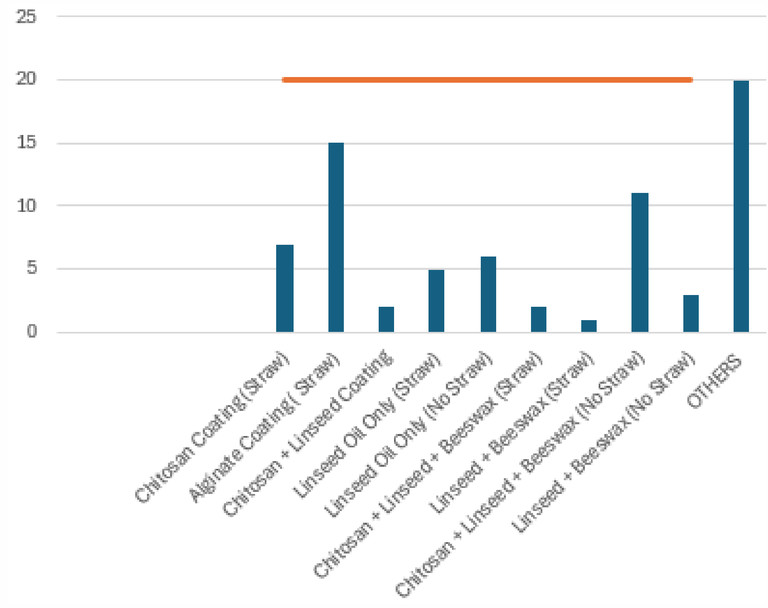


Average Water Contact Angles for Treated Cob Samples

Variant	Avg. WCA (°)
• No-Straw + Linseed + Beeswax	100.87°
• Straw + Linseed + Beeswax	97.03°
• Straw + Chitosan + Linseed + BW	91.23°

Capillarity (Rise in mm)

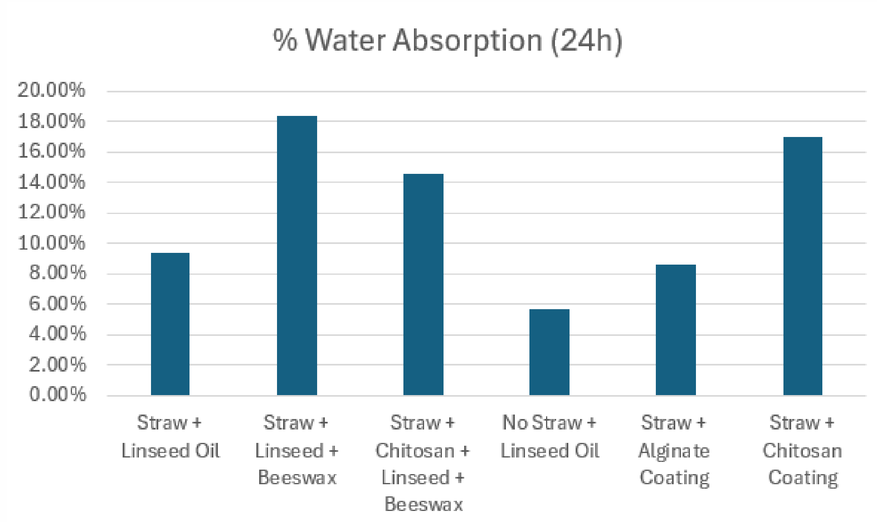
Variant	Capillary Rise (mm)
• Straw + Linseed + Beeswax	1 mm
• Straw + Chitosan + Linseed + BW	2 mm
• Straw + Linseed Only	5 mm



Capillary Rise in Cob Samples After 1-Hour Immersion

Water Absorbtion

Variant	% Gain (24h)
• No-Straw + Linseed Oil Only	+5.70%
• Straw + Linseed Oil Only	+9.34%
• Straw + Chitosan + Linseed + BW	+14.56%



Water Absorption After 24 Hours

Conclusion

Natural coatings like linseed oil and chitosan significantly improved cob's water resistance. The best-performing sample in water absorption was linseed oil only (no straw), while chitosan + linseed oil + beeswax showed the highest surface hydrophobicity. These findings support the use of bio-based treatments to enhance traditional earth-based materials in a simple, sustainable way.

References

1.Khatri, S., Joshi, R., & Soni, P. (2015). The potential use of chitosan as a biopolymer additive for enhanced mechanical properties and water resistance of earthen construction. *Journal of Building Engineering*, 3, 1–8. https://doi.org/10.1016/j.jobe.2014.12.001

2.Phan Grace Pantjadarma,(2025). The effects of salt in Zeeland clay on cob as an earthen building application, HZ University Applied Of Science.