

Project Background

Single-use plastic waste is a growing environmental challenge in Uganda's Nakivale and Oruchinga refugee settlements, clogging drainage systems and harming the surrounding environment. In partnership with Shared Action Africa (SAA), a women-led nonprofit organization, our project aims to develop an **alternative biodegradable packaging** made from **banana pseudostem fibers**, an abundant **agricultural byproduct** in the region.



Fig. 1



Fig. 2

Fig. 1: A section of the banana pseudostem before fiber extraction
Fig. 2: A row of banana plants at **Going Bananas Farm** in Homestead, Florida where our banana stems were sourced

Fiber Extraction

Banana pseudostems were processed into usable fibers through a **multi-step extraction and treatment process** designed to produce material suitable for **mechanical testing** and **prototype fabrication**.



Fig. 3

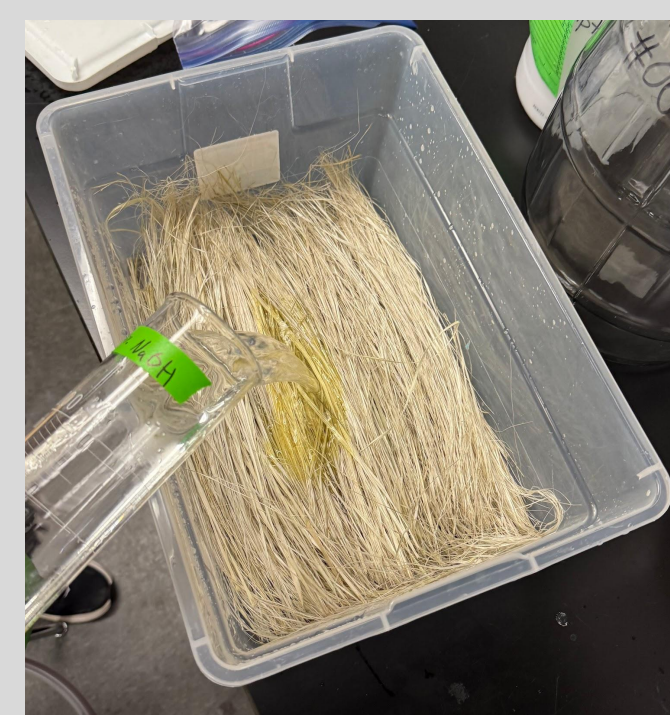


Fig. 4



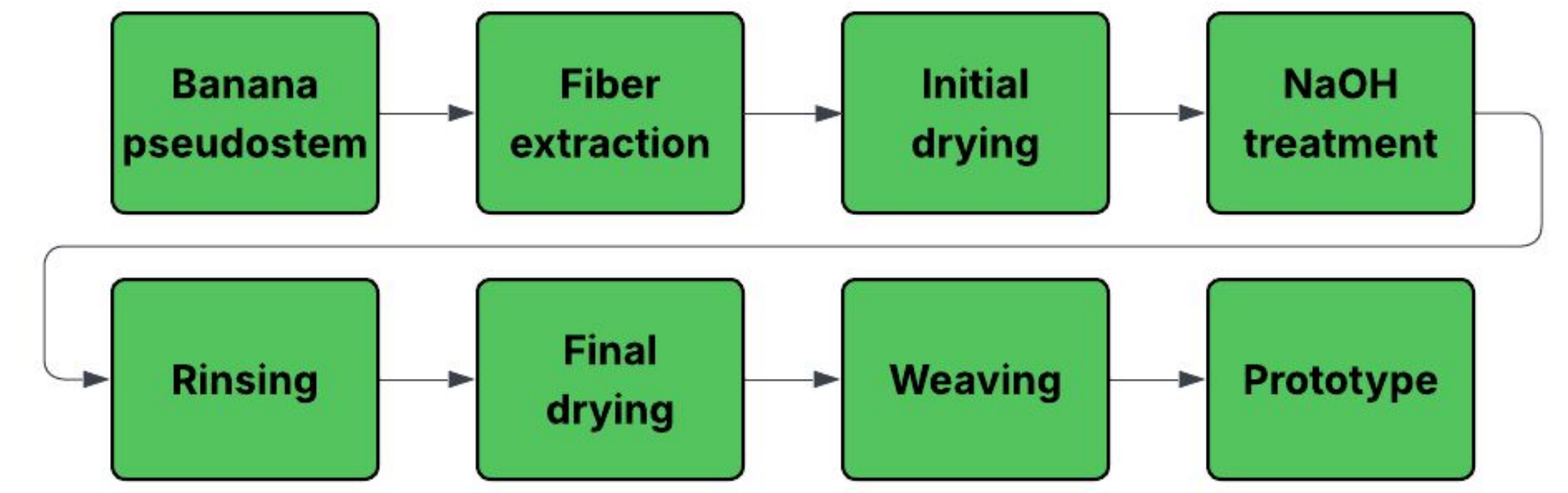
Fig. 5



Fig. 6

Fig. 3: Fibers manually extracted using a custom scraping tool
Fig. 4: Chemical treatment (NaOH) used to improve fiber separation
Fig. 5: Rinsing removed residual chemicals after treatment
Fig. 6: Two-stage oven drying controlled moisture before and after processing

Fiber Processing

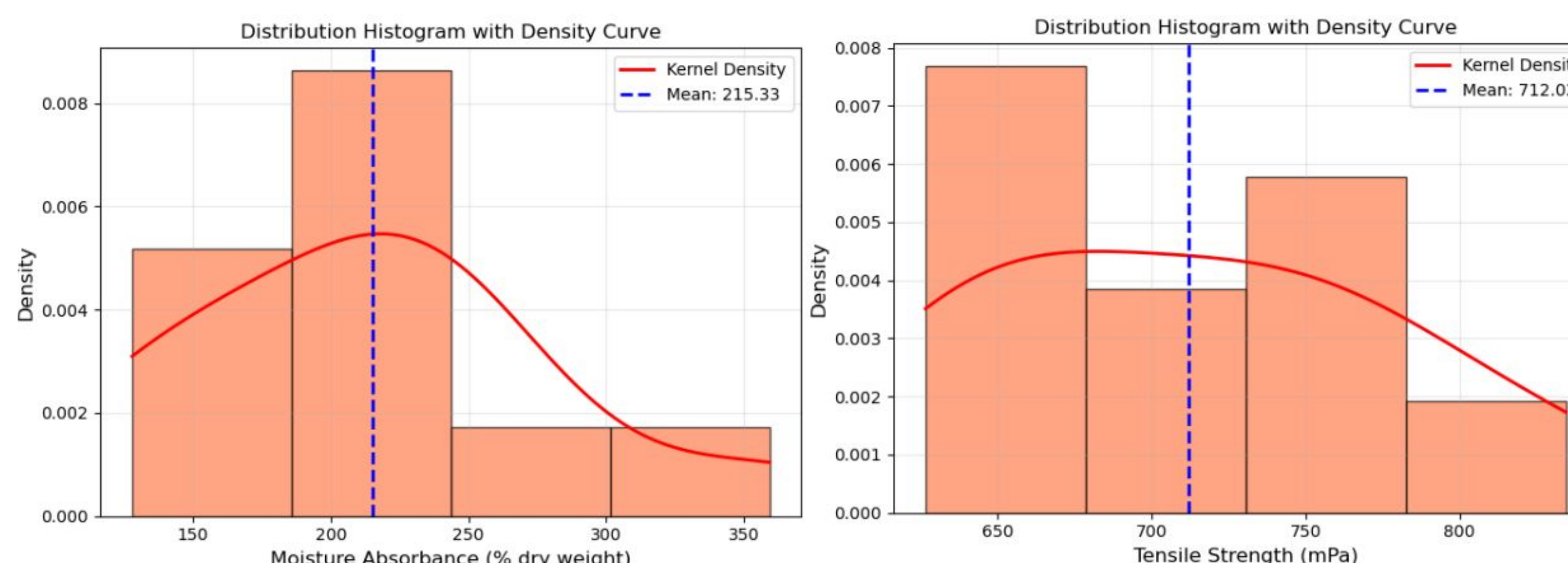


Key Process Outcomes:

- Successfully converted **agricultural waste** into usable fiber
- Developed a **repeatable, low-cost, low-energy** intensive extraction method
- Generated material suitable for **testing and prototype fabrication**
- Adaptable to **low-resource environments**

Prototype Design

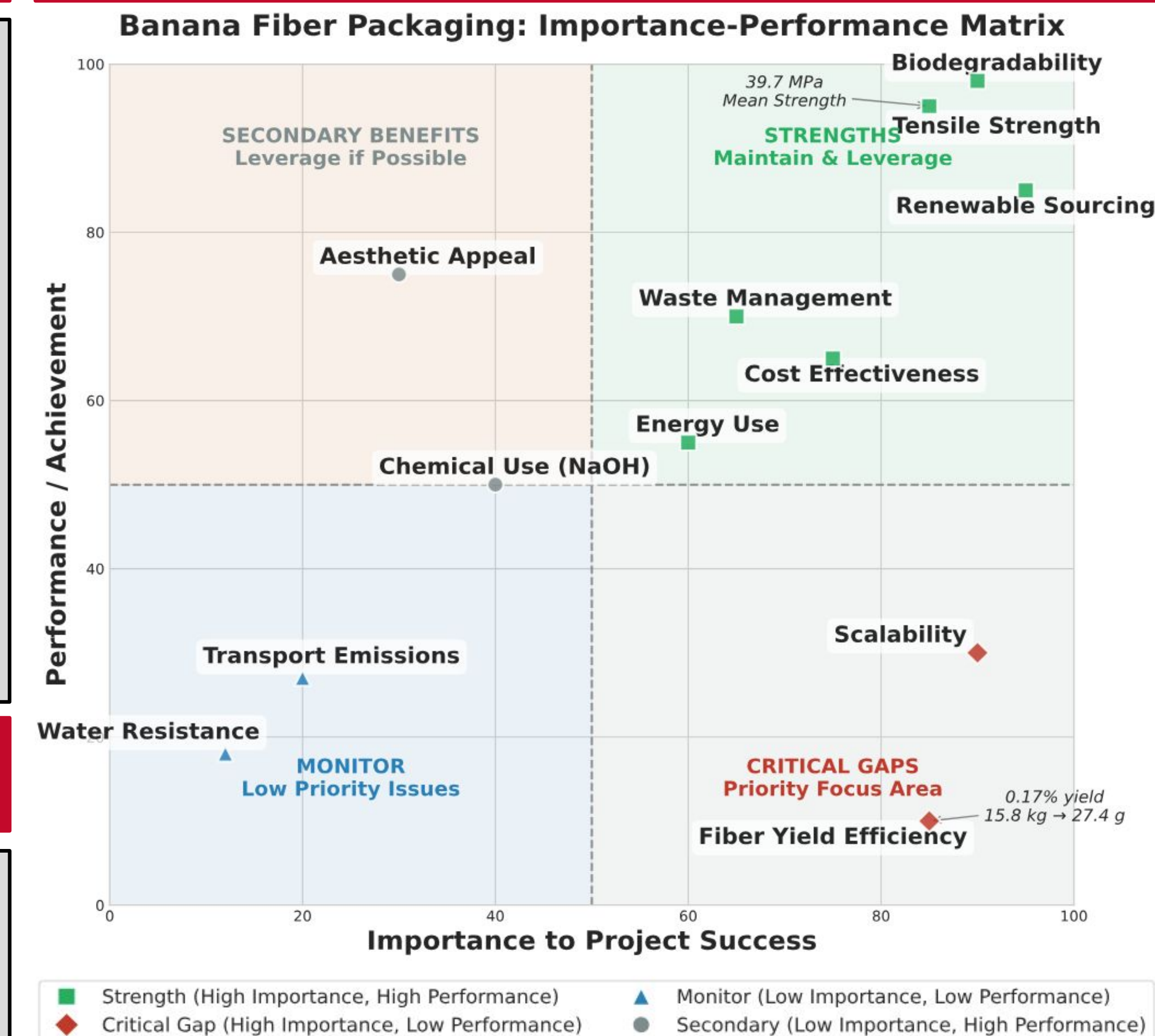
Fibers were cleaned, aligned, and spun by hand or with a spindle to form continuous cordage. Strands were braided and knotted into a net-style bag. Additional samples were produced for **tensile** and **water-absorption testing**.



All testing measurements were recorded and analyzed using **Excel and Python**.

Testing of **dimensions, tensile strength, moisture absorbance, and alkaline treatment effects**. The procedure involved water retting, manual extraction, oven drying, moisture testing, sodium hydroxide treatment as well as recording fiber thickness and tensile strength.

Results Matrix



Life Cycle Assessment

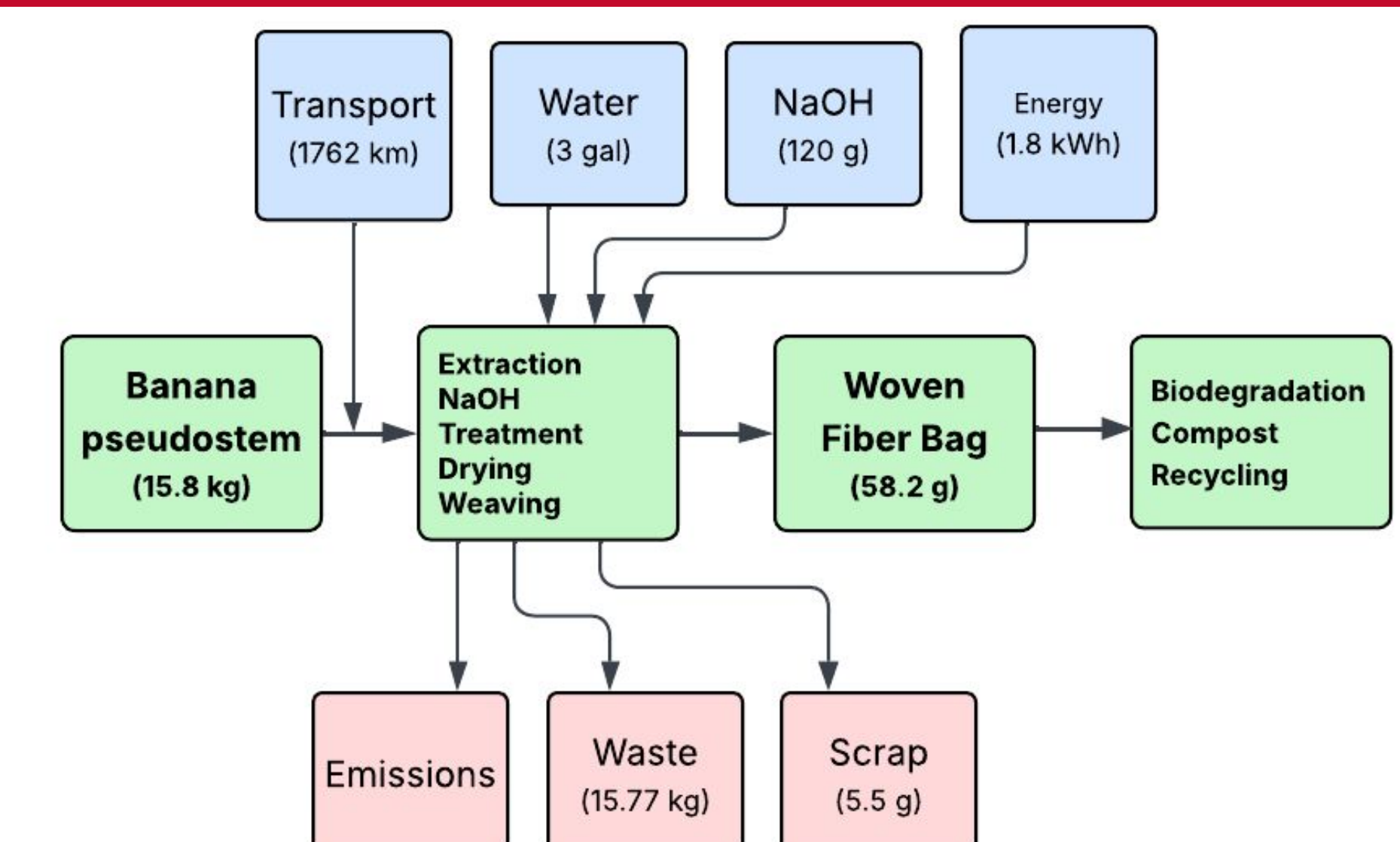


Fig. 10: Small-scale study; results may vary in Uganda due to environmental conditions, infrastructure, and resource availability. Biodegradation emissions are negligible.

Acknowledgements

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