

Upcycling of Waste from Mango Processing to Support Circular Economy in East Africa

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BIOL_EN 4995H – Undergraduate Honors Research in Biological Engineering

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9 December 2020





Mango Postharvest Losses in the Value Chain

40-50%

Estimated Total Loss
Postharvest loss not measured across the country. Large scale processors suggest the figure is ~15%

13%

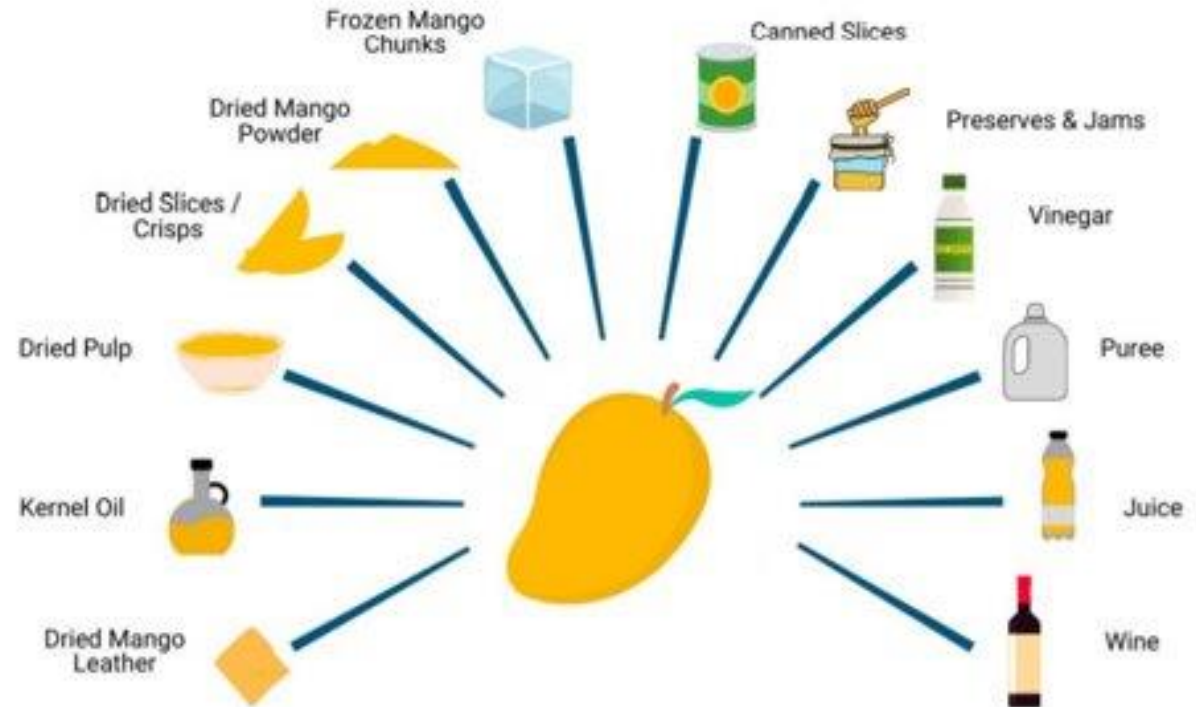
Lost On The Farm
~80% of these result from pests, disease and poor harvesting & handling methods

5-7%

Lost Through Transportation
Poor packing mangoes results in bruising leading to losses during transportation through the value chain

5-10%

Lost At The Local Fresh Mango Market
Due to lack of proper storage facilities



Postharvest Loss

Postharvest Loss

40-50% mangoes are lost in the postharvest stage in East Africa¹

39% of a mango is lost as a by-product²

The most common products produced in East Africa are pulp, juice, dried slices, puree, and jam¹

Mango by-products (peel and kernel) can be further processed to derive different products



Mango peels



Dryer



Pulverizer



Mango peel powder

Mango Peel Powder

Mango Peel Powder

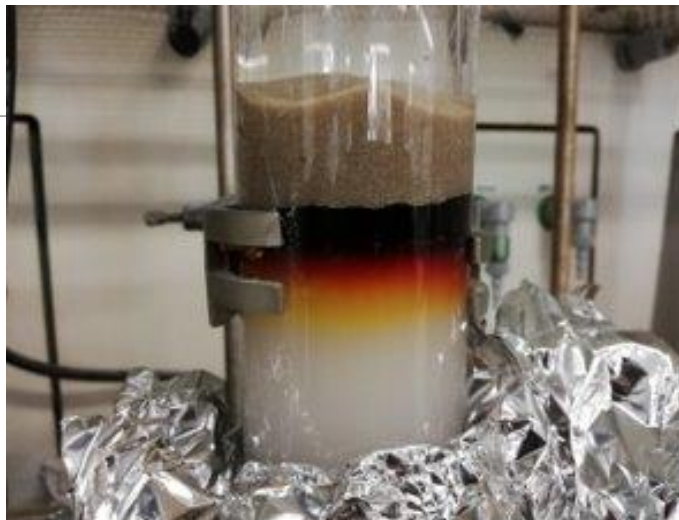
Mango processing facilities in East Africa focus on primary products instead of byproducts

Mango peel powder can be easily made with a dehydration and pulverization system and sold to other processing facilities

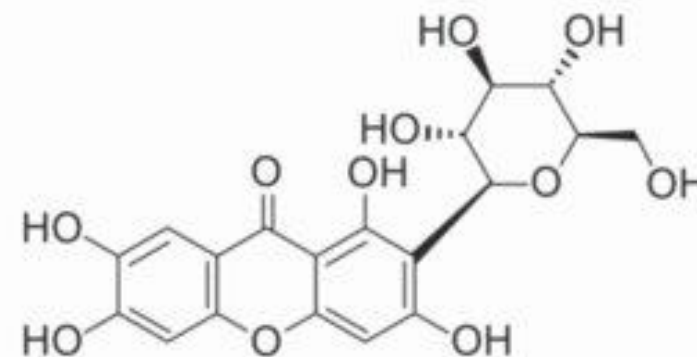
Mango peel powder can enrich foods with dietary fiber and antioxidants³



Mango peel powder



Column chromatography



Mangiferin

Polyphenols

Polyphenols

Extracted from dried peel powder using column chromatography⁴

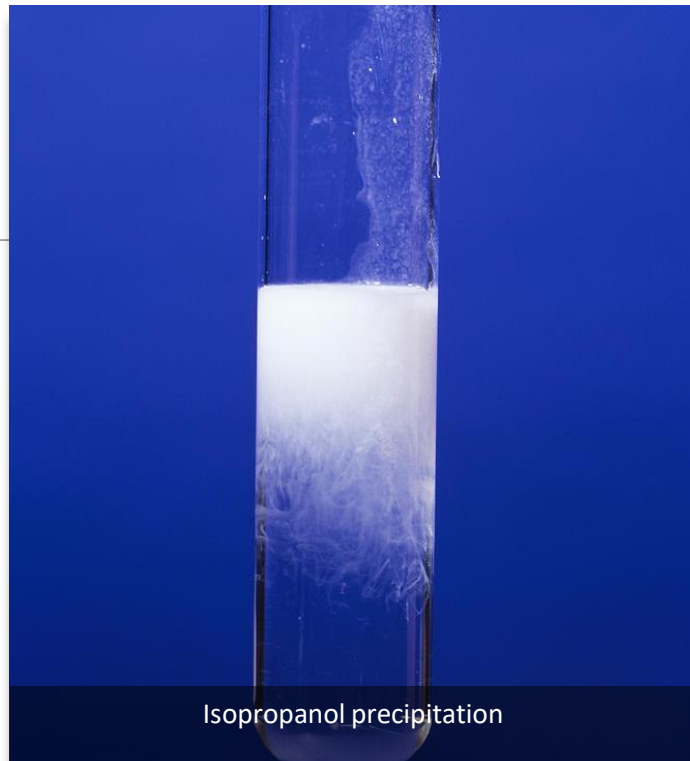
Low yield compared to other byproduct sources⁵

Ideal source of mangiferin, a bioactive compound with potential pharmacological and food supplement uses⁶

- Treating diabetes
- Inhibiting cancer cell growth
- Treating neuroinflammation
- Protecting the body against cardiac damage, neurodegenerative diseases, cancer, obesity, cardiovascular disease, diabetes



Mango peel powder



Isopropanol precipitation



Pectin: gelling agent and emulsifier

Pectin

Pectin

Extracted from dried peel powder using isopropanol precipitation⁴

Potential for high yield compared to lemon and orange byproducts⁵

Used as a gelling agent or as an emulsifier⁷

- Used in jams, confectionaries, yogurts, and milk drinks

38,500 tons of pectin are produced worldwide each year⁷



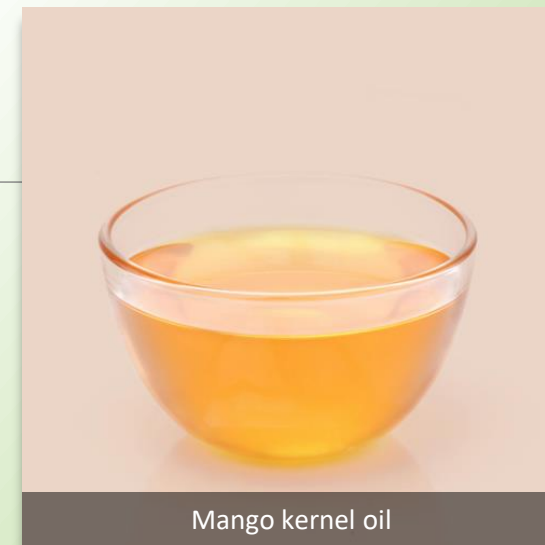
Mango seed with kernel



Cold press machine



Mango kernel butter



Mango kernel oil

Kernel Oil

Kernel Oil

Mango kernels are found inside the seed, which takes up 20% of the fruit⁸

Mango kernel butter is extracted using a cold press or solvent extraction method⁹

Mango kernel oil is a refined form of the butter⁹

Mango kernel butter or oil can replace cocoa or shea butter in cosmetic and food products¹⁰

A blend of 80% mango kernel oil and 20% palm oil is a cheaper alternative to cocoa butter with the same fatty acid content¹⁰



Mango seed with kernel



Flour mill



Mango kernel flour

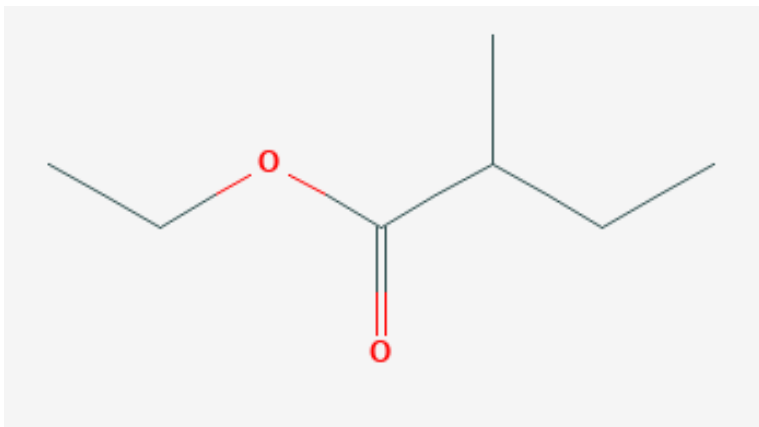
Kernel Flour

Kernel Flour

Made by grinding up mango kernel¹¹

Very high yield at 80.6%¹¹

Can be combined with wheat flour to make nutritious food products in countries that can't grow wheat¹²



Ethyl 2-methylbutanoate, most potent odor-active compound in mango



Mango essential oil



Mango perfume

Odor-Active Compounds

Odor-Active Compounds

Molecular compounds that are responsible for mango scent/taste¹³

More potent in mango peels than in edible portion¹³

Useful in cosmetic and food products to add a natural mango scent¹³



Mango butter vs.
Cocoa butter



Mango peel powder and
kernel flour vs wheat flour



Application in East Africa

Application in East Africa

Mango peel powder, kernel oil, and kernel flour present the largest opportunities for mango processors in East Africa

Cocoa butter is highly sought after in the food and cosmetic industries, but cacao tree farming has low yields and ethical concerns^{14,15}

Mango oil can be blended with palm oil to produce a suitable cocoa butter replacement¹⁰

Mango peel powder and kernel flour require minimal equipment and may be in high demand in East Africa as a wheat flour replacement and nutritional substitute

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