Applications of mango byproducts in the food industry

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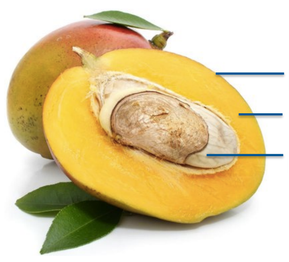
Introduction

Mango (*Mangifera indica* L.) is a tropical fruit, worldwide appreciated due to its sensory features and nutritional properties. In 2018, mangoes were the most produced tropical fruit (excluding bananas) and ranked sixth place considering worldwide production of all fruit crops[1].



Peels and stones represent about 35 - 60% of the total mango weight[2].

Fig 1 – Anatomical parts of mango / mango fractions denominated by the processing industry.

Overall, mango peels and stones are not consumed or included in processed products. It is estimated that, each year, **14.537 – 22.844 million tonnes of mango byproducts are generated**[1]. Currently, most mango byproducts are discarded in landfills or incinerated, which leads to **economic losses** and **severe environmental problems**. However, mango byproducts have a high potential to be used as a source of functional ingredients and food preservatives due to their high nutritional value and bioactive properties[2].

The goal of this work was to present and discuss the potential applications of mango byproducts in the food industry.

Nutrtional Value and Bioactivity of Mango Byproducts

Mango peels contains high amounts of **fiber**, **ascorbic acid**, **tocopherols**, **phenolic compounds** and **carotenoids**[2]. In turn, mango kernel are a good source of **edible fat**, **essential amino acids**, **antioxidant minerals, vitamins A, E, K, and C** and **phenolic compounds** [3].

Table 1 – Nutritional composition of mango byproducts

	Carbohydrates	Fiber	Fat	Protein	Ash	Reference
Peels	80	51	2	4	3	[4]
Kernel	32 - 77	0.3 - 5	6 - 15	6 - 10	1 – 4	[3]

All values are expressed on a dry weight basis (g / 100 g of dried peels)

Regarding bioactivity, mango byproducts had **antioxidant, anti-proliferative**, **anti-inflammatory** and **antibacterial properties**[2,3]. Furthermore, mango peels also show **prebiotic activity**[5].

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Mango peels have potential to be used as source of **pectin** and **natural food additives** namely, **antioxidants**, **antimicrobials** and **co-pigments**[2,6] .

In turn, mango kernels are a good source of **edible fat** and **starch**. Mango kernel fat has several advantages, namely, resistance to auto-oxidation, the capacity to prevent lipid oxidation of other oils and the absence of trans fatty acids. Furthermore, their chemical and physical features are very similar to cocoa butter[3].

Besides that, one of the most promising strategies to reuse both mango byproducts is to convert them in added value **powders / flours** [2,3].

1. Pre-treatment	2. Drying	3. Milling	4. Storage
Remove dirt particles and decreased microbial load. More information about its impact on mango byproducts properties is needed.	Dried mango byproducts kept high amounts of bioactive compounds and high antioxidant capacity.	More information about the effect of different milling processes on properties of mango byproducts is needed.	More information about the effect of storage conditions on properties of mango byproducts is needed.

Fig 3 – Processing of mango byproducts in added value powders / flours [2,3].

Fig 4 - Incorporation of mango byproducts powders in food products improved their nutritional properties and bioactivity [2,3].

Conclusion

The application of mango byproducts in the development of functional ingredients and natural preservatives represents a new source of income to mango processing industries and reduce the biowaste discarded. Besides that, these applications avoid over-exploitation of natural resources to produce the same ingredients or additives that can be replaced by mango byproducts compounds.

Until now, the incorporation of mango byproducts powders has been studied mostly in bakery products. A better understanding of the impact of different processing methods on mango peel powders' properties can contribute to reinforce their use in bakery products and also to expand their application to other types of food products.

References

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