Peel of prickly pear (*Opuntia ficus-indica*) fruit as an innovative ingredient for processed food

S. Bouazizi*, G. Montevecchi**, F. Masino**, A. Antonelli**, M. Hamdi*

** Laboratory of Ecology and Microbial Technology (LETMi). The National Institute of Applied Science and Technology INSAT. Carthage University. 2 Boulevard de la Terre, BP 676, 1080 Tunis, Tunisia (E-mail: souhir.Bouazizi@esiat.u-carthage.tn)*

*** Department of Life Sciences (Agri-Food Science Area), BIOGEST - SITEIA Interdepartmental Centre, University of Modena and Reggio Emilia Piazzale Europa 1, Reggio Emilia, Emilia-Romagna, 42124, Italy (E-mail: giuseppe.montevecchi@unimore.it; francesca.masino@unimore.it; andrea.antonelli@unimore.it)*

LWT - Food Science and Technology 124 (2020) 109155

Contents lists available at ScienceDirect

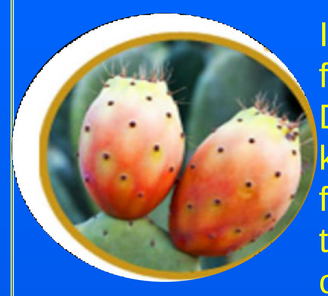
LWT - Food Science and Technology

journal homepage: www.elsevier.com/locate/lwt

Effects of prickly pear (*Opuntia ficus-indica* L.) peel flour as an innovative ingredient in biscuits formulation

Souhir Bouazizi[a], Giuseppe Montevecchi[b,*], Andrea Antonelli[b], Moktar Hamdi[a]

Introduction



In Tunisia, the number of companies that extract oil from cactus seeds has grown in the last decade. Despite this thriving business, the millions of kilograms of prickly pear (*Opuntia ficus-indica*, PP) fruit peels per year represent a huge disposal problem to be addressed. Indeed, peel represents around 50% of the whole fruit.

An investigation on the chemical and physical characterization of this by-product could conveniently lead to its rational use as an important source of nutrients, fibers, minerals, and phytochemicals, such as phenolics, carotenoids, betalains, and other pigments with high antioxidant activity.

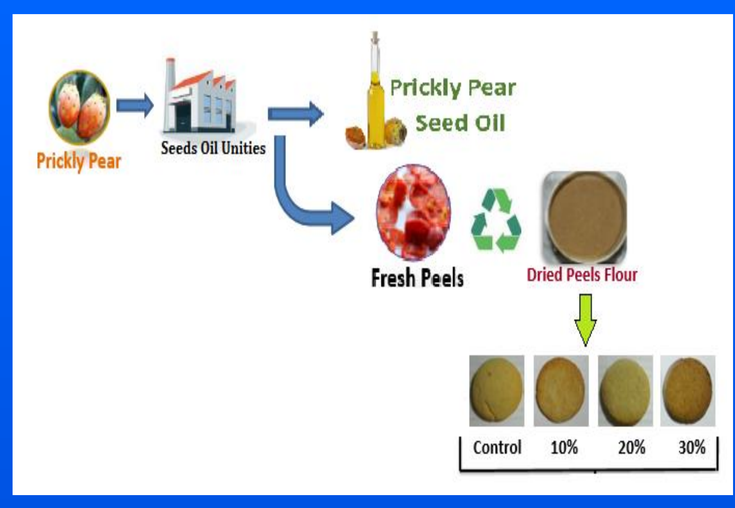


Figure 1: Scheme of valorization of prickly pear fruit for oil and peel flour production

Prickly pear peel has already been tested as an ingredient for the preparation of biscuits (Bouazizi et al, 2020), as exemplified in figure 1.

Aims

The present study aimed at assessing comprehensively the aptitude of prickly pear peel to be transformed into flour and at obtaining its chemical and physical characterization to contribute for the valorization of this by-product.

Results & Discussion

1. Proximate composition of fresh and dry PP fruit peels

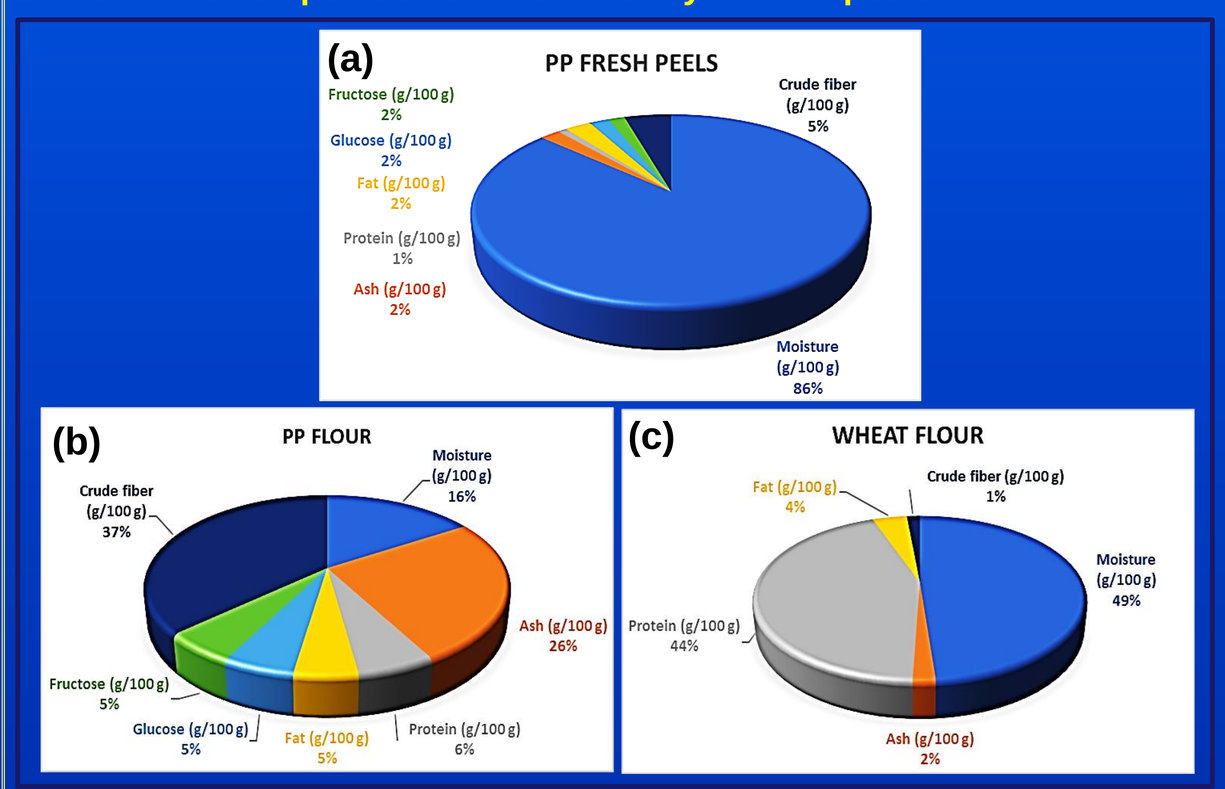


Figure 2: Pie chart of the chemical composition of prickly pear (PP) peels (a) fresh peels, (b) dry peels flour, (c) wheat flour as a control

► The moisture content of fresh peel was as high as 90.38, while it dropped to 9.11% in the dried peel. Strong dehydration is necessary to stabilize and preserve the material also because its pH is not sufficiently low (pH= 4.67).

► The drying and grinding processes caused the loss of some nutrients to vary degrees. The evident loss of glucose and fructose after peel drying can be explained by their reaction (non-enzymatic browning) with protein substances guided by an adequately high pH.

► The crude dietary fiber (20.70 g/100 g D.W.) represents one the most relevant substance contained in prickly pear peel due to its key role in the human diet as well as in the structure of some processed food such as bakery goods. As for ash, cations like magnesium and calcium improve the mechanical characteristics of gluten for interactions with amino acid side groups

- ❖ For Energy: PP flour < wheat flour (937 < 13474 Kj/100 g)
- ❖ Richness on crude fiber: PP flour >> wheat flour (20.7 >0.44 g/100g)
- ❖ Ash content: PP flour >> wheat flour (14.57 > 0.53 g/100g)

2. Total polyphenols, pigments and antioxidant activity of fresh and dried PP peels

Table 1: Prickly pear peel bioactive compounds and antioxidant activity

	Fresh peel	Dried peel
Total carotenoids (mg beta-carotene equivalents/100 g)	2.47 ± 0.05	10.90 ± 0.04
Total chlorophylls (mg/100 g)	6.86 ± 0.83	14.06 ± 0.12
TPC (mg gallic acid equivalents/g)	3.03 ± 0.01	277.6 ± 0.4
Antioxidant activity RSA (%I)	33.29 ± 0.21	82.7 ± 0.2

3. Functional proprieties and Biscuits formulations

PP peel flour is suitable for baking products formulations

Table 1: PP flour functional Proprieties

		wheat flour	PP flour
WAC	(gwater/g sample)	0.63	0.95
OAC	(goil/g sample)	0.77	0.84
WHC	(gwater/g sample)	0.63	2.59
OHC	(goil/g sample)	0.78	0.94
WSI	% (g/g)	8.12	43.77
BD	g/mL	0.8	0.68

✔ The initial hypothesis of using PP peels of partial sugar and gluten replacer was ascertained by biscuit acceptability and textural properties.

✔ The presence of fiber and polyphenols favours techno-logical properties such as the aptitude to kneading, the flavour retention, and the antioxidant capacity

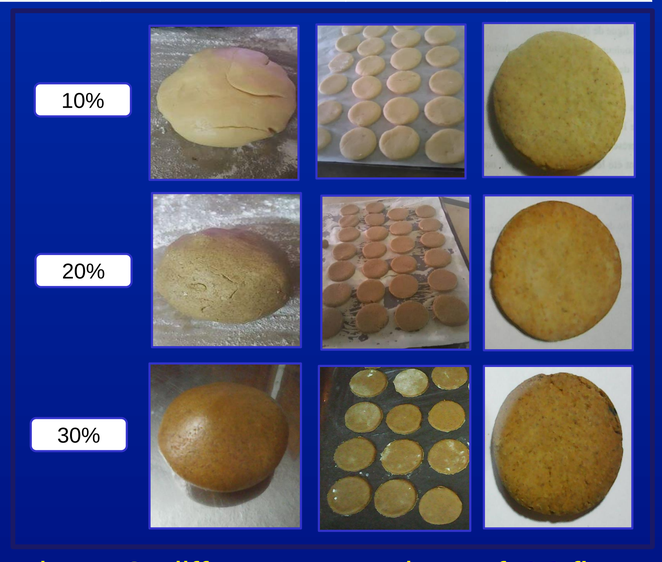


Figure 3: different proportions of PP flour incorporation into the dough used for biscuits production

Conclusions

The results obtained showed that the prickly pear peels usually considered as agro-wastes are a rich source of minerals, fibers, and antioxidant compounds. Furthermore, they have shown to be suitable for stabilization in the form of flour and usable in the preparation of baked products. Other possible explorable applications include prickly pear peel flour as an antibacterial edible coating, an emulsifying agent in food preparation, and a filler for the production of biocomposite materials. Agro-industrial by-products, such as prickly pear peels is an overlooked nutritional and antibacterial source which should be widely valorized as food additives.