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THE PRICKLY PEAR PEEL (OPUNTIA FICUS-INDICA (L.) MILL.): AN EXAMPLE OF SOURCE OF A BIOACTIVE COMPOUNDS OBTAINED USING AN ECO-INNOVATIVE EXTRACTION TECHNOLOGY, EXTRACTOR NAVIGLIO®

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The Prickly Pear (Opuntia ficus-indica L. Mill.) Belongs to the Cactaceae family and grows in different parts of the world such as: in North America (Mexico and the United States), in South America (Argentina, Peru, Bolivia and Brazil), in Africa (Morocco, Tunisia, Eritrea, Ethiopia and South Africa), in Europe and Asia (Spain, Italy, Israel and Iran). Among these, Mexico is the world's largest producer of prickly pear (more than 400,000 tons/year)[1]. The prickly pear shows an enormous genetic variability being a polyploid, in particular octoploid; this variability could reflect the diversity of the colors of the prickly pear fruit that varies between red, purple, green, orange and yellow[2]. Prickly pear has a high quantity of peel (between 40-45% of the total weight of the fruit), which generally represents the discarded fruit processing. However, this by-product can be a good source of bioactive compounds[3] that could be obtained using different technologies and eco-innovative extraction techniques such as the Extractor Naviglio®[4]. This is one of the techniques that has itself best to solid-liquid extraction in the field of bioactive molecules and compounds. In fact, from the peel natural pigments can be extracted which, in modern industry, have attracted the attention of both producers and consumers thanks to their proven safety with respect to synthetic dyes. Natural pigments are generally compounds that promote beneficial health effects, positively influencing biological activities[5] due to their antioxidant potential, for anti-inflammatory, antidiabetic, antitumor and antimicrobial activity, showing preventive effects against various diseases such as cancer, neurodegenerative and cardiovascular diseases, among others[6]. The color stability and antioxidant activity of these pigments, however, are limited due to their rapid degradation in the presence of factors such as oxygen, light, pH or temperature[7]. The peel of prickly pears is rich in betalain which are generally classified into two groups, betacyanins and betaxantines, based on their structural characteristics and light-absorbing properties. Both are water-soluble pigments: the betacyanins give the red-violet color and the betaxantines confer the yellow-orange color[8]. All betalain are based on a common structural unit, betalamic acid (Figure 1), which condenses with various amino acids or groups of free amines, or structures containing indoline to form betaxanthins or betacyanins respectively[9]. The present study deals with the evaluation of the application, for the first time, of the dynamic solid-liquid extraction method of the Extractor Naviglio®, of the effects of the pH (pH≤5.0), of the extraction solvent

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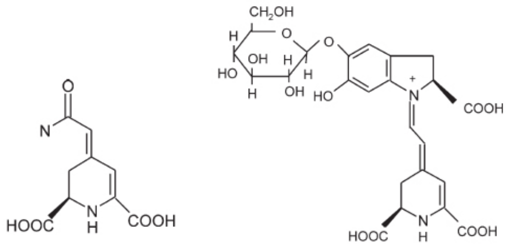
(water mixture: ethanol in 80:20 ratio) and storage conditions (environment and refrigeration) on the content of betacyanin and betaxantine in prickly pear skin extracts. It was noted that factors such as pH, storage time and temperature influenced color stability, according to literature data[10]. Water extraction and the use of lower temperatures (≈4°C) could be applied to extract a more interesting quantity of betacyanins and betaxantines from prickly pear skin. A good recovery of these colors of prickly pear peel, which today is a waste product of the food industry, could allow an interesting use as an alternative to synthetic dyes.



Betalamic acid **Betanin**

Figure 1. Structures of betalamic acid and betanin.

References

[1] Cano M. P., Gómez-Maqueo A., García-Cayuela T. and Welti-Chanes J., , Food Chem., 2017, 237, 612–622.
[2] Jimenez-Aguilar D. M., Lopez-Martınez J. M., Hernandez-Brenes C., Gutierrez-Uribe J. A. and Welti-Chanes J., J. Food Compos. Anal., 2015 41, 66–73.
[3] Barba F. J., Putnik P. and Bursa D., Trends in Food Science & Technology, 2017, 67, 260–270.
[4] Naviglio D., Naviglio's principle and presentation of an innovative solid-liquid extraction technology: Extractor Naviglio®, Anal. Lett., 2003, 36, 1647–1659.
[5] Murthy K. N. C. and Manchali S., Anti-diabetic Potentials of Red Beet Pigments and Other Constituents. in Red Beet Biotechnology, Springer US, 2013, 155–174.
[6] Carocho M., Morales P. and Ferreira I. C. F. R., Trends Food Sci. Technol., 2018, 71, 107–120.
[7] Celli G. B. and Brooks M. S., Food Res. Int., 2017, 100, 501–509.
[8] Betancourt C., Cejudo-bastante M. J., Heredia F. J. and Hurtado N., Food Res. Int., 2017, 101, 173–179.
[9] Gandía-Herrero F., Escribano J., Garcia-Carmona F. and Grand F., Biological Activities of Plant Pigments Betalains Biological Activities of Plant Pigments Betalains, 2016, 8398.
[10] Smeriglio, A. et al., Opuntia ficus - indica (L .) Mill. fruit as source of betalains with antioxidant, cytoprotective, and anti-angiogenic properties, 2019, 1–12.