PROCEEDINGS OF THE

29th International Symposium on Analytical and Environmental Problems

Szeged, Hungary

November 13-14, 2023

University of Szeged

Edited by:
Tünde Alapi
Róbert Berkecz
István Ilisz

Publisher:
University of Szeged, H-6720 Szeged, Dugonics tér 13, Hungary

ISBN 978-963-306-963-9

2023.
Szeged, Hungary

The 29th International Symposium on Analytical and Environmental Problems

Organized by:
SZAB Kémiai Szakbizottság Analitikai és Környezetvédelmi Munkabizottsága

Supporting Organizations
Institute of Pharmaceutical Analysis, University of Szeged
Department of Molecular and Analytical Chemistry, University of Szeged

Symposium Chairman:
István Ilisz, DSc

Honorary Chairman:
Zoltán Galbács, PhD

Organizing Committee:
István Ilisz, DSc
professor of chemistry
University of Szeged, Institute of Pharmaceutical Analysis
Tünde Alapi, PhD
assistant professor
University of Szeged, Department of Molecular and Analytical Chemistry
Róbert Berkecz, PhD
assistant professor
University of Szeged, Institute of Pharmaceutical Analysis

Scientific Committee:
István Ilisz, DSc
Tünde Alapi, PhD
Róbert Berkecz, PhD
Daniela Sojic Merkulov, PhD
associate professor
University of Novi Sad, Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection

PHYSICO-CHEMICAL AND BIOLOGICAL CHARACTERIZATION OF POMEGRANATE (*PUNICA GRANATUM* L.) PEEL EXTRACT MICROENCAPSULATES

Milica Radan[1], Nada Ćujić Nikolić[1], Snežana Kuzmanović Nedeljković[1], Zorana Mutavski[1], Nemanja Krgović[1], Smilja Marković[2], Tatjana Stević[1], Jelena Živković[1], Katarina Šavikin[1]

[1] *Institute for Medicinal Plants Research Dr Josif Pančić, Tadeuša Košćuška 1, 11000 Belgrade, Serbia*
[2] *Institute of Technical Sciences of SASA, Knez Mihailova 35/IV, 11000 Belgrade*
e-mail: zmutavski@mocbilja.rs

Abstract

Peel of the pomegranate (*Punica granatum* L.) fruit takes up for approximately 50% of the total weight, is a byproduct which is usually discarded as waste. However, pomegranate peel (PP) is considered as a rich source of potent phenolic compounds, including ellagic acid and its derivatives which possess several functional and nutraceutical qualities, including lowering blood pressure, reducing oxidative stress, decreasing blood sugar and cholesterol levels, and restoring heart health [1, 2]. The main aims of this study were to develop preserved microencapsulated systems of the pomegranate peel (PP) extract by spray-drying using two biocompatible carriers (pectin and its mixture with HP-β-CD) and to evaluate their physico-chemical properties as well as *in vitro* antimicrobial, antioxidant, and antidiabetic activities. Obtained micro-sized powders were characterized with high values of powder yield (> 78%) and satisfied moisture content, flowability and cohesive properties. According to the DSC analysis, carrier addition showed favorable impact on the thermal stability (up to 200°C) of examined microencapsulated samples. Chemical analysis showed that total phenolic content in spray-dried powders of PP varied between 373.15 to 427.88 mg GAE/g DW, with the punicalagin, punicalin, gallic acid, and ellagic acid as the most abundant individual bioactive compounds. Despite dilution effect, comparable free radical scavenging ability in DPPH assay was observed for microencapsulated and carrier-free powders (IC_{50}: 6.51-7.60 μg/mL). Furthermore, examined samples showed great potential to control elevated glycemic levels demonstrating potent inhibition effects against α-amylase and α-glucosidase enzymes. Molecular docking analysis provided more deeper insight into molecular mechanisms of action, revealing high affinity of ellagic acid to inhibit α-amylase enzyme, while punicalagin and punicalin more selectively inhibited α-glucosidase. Antimicrobial activity assay revealed that the Gram-positive bacteria, including *S. aureus* and *S. epidermidis* as representative skin pathogens, were the most susceptible with the minimum inhibitory concentration of 1.75 mg/mL. On the whole, valorization of PP through microencapsulation process with pectin and pectin/HP-β-CD as coating materials represents a sustainable approach for the development of ellagitannin-rich products that have the potential to be developed into phytopharmaceutical and functional foods for the prevention and management of metabolic diseases.

References

[1] Y. Mo, J. Ma, W. Gao, L. Zhang, J. Li, J. Li, J. Zang. Front Nutr. 9;9:887113 (2022)
[2] H. B. U. Ain, T. Tufail, S. Bashir, N. Ijaz, M. Hussain, A. Ikram, M. A. Farooq, S. A. Saewan. Food Sci Nutr. 23;11(6):2589-2598 (2023)