RETASTE Conference Abstracts
Vol. 4 RETASTE-NOV-651- In-person Poster
Archanes, Greece, 25-27 September, 2024

DOI:10.5281/zenodo.14164151

Investigation of Thermal Properties of Beetroot Pomace Flour: Implications for Food Processing and Storage

[1]Darko Micić, [1]Snežana Zlatanović, [1]Sanja Ostojić, [2]Ferenc Pastor and [1]Stanislava Gorjanović

[1]*Institute of General and Physical Chemistry, Studentski trg 12/V, 11158 Belgrade, Serbia*
[2]*University of Belgrade – Faculty of Chemistry, Studentski trg 16, 11158 Belgrade, Serbia*

Abstract

The processing of fruits and vegetables yields substantial quantities of pomace, a valuable byproduct often disregarded as waste, yet rich in bioactive compounds absent from the modern diet. Particularly, the beetroot processing industry contributes significantly to this waste stream. Given the rising popularity of beetroot (*Beta vulgaris* L.) as a potential functional food, the volume of pomace generated by beetroot processing continues to escalate. Consequently, there is growing interest in adopting sustainable practices to utilize minimally processed beetroot pomace, thereby transforming it into value-added products. With this aim in mind, the objective of this study was to examine the thermal properties of flours obtained from whole beetroot (WBF), pomace from peeled (PBPF) and whole beetroot (WBPF). Determining the thermal properties is crucial to achieve valuable insight required for the planning of storage and processing methods applicable in the production of final food products. A Differential Scanning Calorimeter and Thermogravimetric Analyzer (DSC Q1000 and TGA Q500, TA Instruments, New Castle, USA) were used to perform experiments. Glass transition temperature (T_g), onset temperature (T_{on}) of degradation process, and degradation mechanism were parameters examined for all three flours. Additionally, kinetic parameters (activation energy – E_a and rate constant at 200 °C – k_{200}) of the degradation process were determined using the isoconversional differential Friedman method. The glass transition temperature was highest for WBPF – 39.2 °C, lowest for PBPF – 33.0 °C, while for WBF sample it was 36.2 °C. In the temperature range from 25 to approximately 120 °C, moisture was released from the flours upon heating, resulting in a mass loss of around 4.7-6.2% for all flours. Thermal degradation of all flours commenced at approximately same temperatures (T_{on} ~ 177 °C) and proceeded through three steps, as inferred from the presence of three peaks observed on the derivative thermogravimetric curves. The first step corresponds to the degradation of simple sugars present in the flours (sucrose, glucose and fructose), while the second and third steps involve the degradation of complex organic compounds such as polysaccharides and proteins. To determine the thermal stability of the analyzed

samples, in addition to the T_{on}, it is necessary to consider the kinetic parameters of the degradation process (E_a and k_{200}), as they provide deeper insights into the process itself, rather than just its onset. Sample WBPF had the highest values of E_a and k_{200} (123 kJ/mol and 0.58 min^{-1}, respectively), while samples WBF and PBPF had approximately equal values of Ea (100-123 kJ/mol), with PBPF exhibiting the lowest value of k_{200} (0.24 min^{-1}, and 0.35 min^{-1} for WBF), indicating that it is the most stable among all samples when exposed to a temperature of 200 °C, which is a common baking temperature in the food industry.

Keywords: beetroot, pomace, thermal analysis, glass transition

Acknowledgments: This research was supported by the Science Fund of the Republic of Serbia, 7439 GRANT No, From Waste to Food and Soil Enrichment - minimizing waste by applying circular economy in fruits/vegetables processing industry – WasteBridge, and by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, grant numbers: 451-03-66/2024-03/200051.