*proceedings*

*Abstract*

# Antioxidant Properties of Tomato Waste: An Exploration into Aerial Parts †

**Simona Marcu-Spînu, Mihaela Dragoi Cudalbeanu and Alina Orțan ***

Faculty of Land Reclamation and Environmental Engineering, University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăști Blvd., 011464 Bucharest, Romania; simona.spinu@fifim.ro (S.M.-S.); mcudalbeanu@gmail.com (M.D.C.)

* Correspondence: alina.ortan@fifim.ro

† Presented at the 19th International Symposium "Priorities of Chemistry for a Sustainable Development", Bucharest, Romania, 11–13 October 2023.

**Keywords:** tomato plant waste; pistils and stamens; antioxidant activity; MAE; UAE

The tomato plant (*Lycopersicon esculentum* (Mill.)) is one of the most widely cultivated and utilized plants in the world [1,2]. The aerial parts of tomato plant waste, such as leaves, stems, and flowers, can be of significant importance to bioeconomy to maximize resource efficiency, sustainability, and the creation of value-added products. Tomato aerial-part waste, often discarded in large quantities, represents an underutilized and valuable resource within the agricultural industry. The flower parts of tomatoes after fruit ripening often remain unexploited, yet their post-harvest role holds significance in the plant waste-recovery domain. The pistils and stamens, representing these components, retain valuable bioactive compounds even after the fruit's development and ripening. The aim of this study was to identify the bioactive compounds present in tomato plant waste (stamens and pistils) from *Lycopersicon esculentum* (Cheramy RZF1), potentially unlocking new avenues for the food and pharmaceutical industries. The vegetal material subjected to analysis was collected from mature tomato plants cultivated in a greenhouse in Romania in 2023 and consisted of pistils and stamens left after fruiting and ripening. After lyophilization, the vegetal material was subjected to extraction, using three different methods: microwave-assisted extraction (MAE), ultrasound-assisted extraction (UAE), and UAE followed by MAE (cascade extraction). In all cases, the extraction parameters were: temperature—100 °C, irradiation time—60 min, solvent—ethanol/water (50%–50% *v*/*v*). The microwave and ultrasound power was set at 500 W, and 750 W, respectively. The phytochemical screening was performed using HPLC-DAD, and the antioxidant activity was determined via the DPPH (2,2-Diphenyl-1-picrylhydrazyl) method. The HPLC-DAD analysis allowed the identification of bioactive compounds present in the stamen and pistil extracts. Phenolic acids were the dominant bioactive compounds identified in all the extracts obtained. Among these were protocatechuic acid, caffeic acid, chlorogenic acid, p-coumaric acid, ferulic acid, and ellagic acid. All extracts exhibited good antioxidant activity, with no significant differences among the performed extraction methods. The radical inhibition percentage, at 517 nm, in the case of MAE, was 85.49 ± 0.29%, UAE followed by MAE—85.78 ± 0.66%, and UAE—85.46 ± 0.81%. The present study indicates a relatively strong antioxidant activity in stamen and pistil extracts from tomato plant waste. Demonstrating this activity in greenhouse tomato flower parts, considered waste, qualifies it as a resource rather than a simple by-product, thus leading not only to the discovery of unexploited economic and environmental benefits, but also to a reduction in waste and the promotion of sustainability.



**Citation:** Marcu-Spînu, S.; Cudalbeanu, M.D.; Orțan, A. Antioxidant Properties of Tomato Waste: An Exploration into Aerial Parts. *Proceedings* **2023**, *90*, 18. https://doi.org/10.3390/proceedings2023090018

Academic Editors: Mihaela Doni, Florin Oancea and Radu Claudiu Fierăscu

Published: 8 December 2023

**Author Contributions:** Conceptualization, S.M.-S. and A.O.; methodology, M.D.C.; software, S.M.-S.; validation, S.M.-S., A.O. and M.D.C.; investigation, S.M.-S., A.O. and M.D.C.; writing—original draft preparation, S.M.-S.; writing—review and editing, A.O. and M.D.C.; supervision, A.O. All authors have read and agreed to the published version of the manuscript.

**Funding:** The authors gratefully acknowledge the support provided via a grant from the Romanian Ministry of Research, Innovation and Digitalization CCCDI-UEFISCDI, project number PN-III-P3-3.5-EUK-2019-0226, contract 220/2020.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Not applicable.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

1. Lu, S.; Chen, S.; Li, H.; Paengkoum, S.; Taethaisong, N.; Meethip, W.; Surakhunthod, J.; Sinpru, B.; Sroichak, T.; Archa, P.; et al. Sustainable Valorization of Tomato Pomace (*Lycopersicon esculentum*) in Animal Nutrition: A Review. *Animals* **2022**, *12*, 3294. [CrossRef] [PubMed]
2. Production. Available online: https://www.wptc.to/production/ (accessed on 25 September 2023).