IOCPS 2025 Conference

The 3rd International Online Conference on Polymer Science

19–21 November 2025 | Online

MDPI

Structural, Thermal, and Morphological Characterization of Biobased Wheat Straws as Sustainable Alternatives to Single-Use Plastics

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INTRODUCTION & AIM

- Plastic pollution from single-use products such as drinking straws has prompted a global shift toward sustainable, biodegradable alternatives.
- This study explores the potential of wheat-derived straws, produced from post-harvest agricultural residues in Central Macedonia, Greece, as eco-friendly substitutes for conventional plastic straws. Three wheat straw types (Staramaki K1, G1, and A1) were examined and compared with commercial straws made from reed, bamboo, paper, and bioplastics.

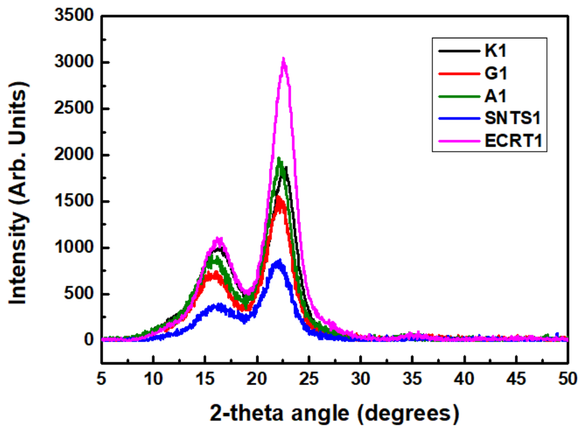
METHOD

- **XRD:** 2 cycle Rigaku Ultima+ diffractometer with Cukα radiation operating at 40 kV and 30 mA.
- **SEM:** SEM-EDS: 20kV JEOL 840A SEM with an OXFORD INCA 300 EDS analyzer.
- **Oxidation resistance:** Setaram SETSYS TG-DTA 16/18.
- **Absorption (%):** The samples were immersed for 30 min in drinking water, Coca-Cola, and fresh orange juice under identical temperature and liquid height.

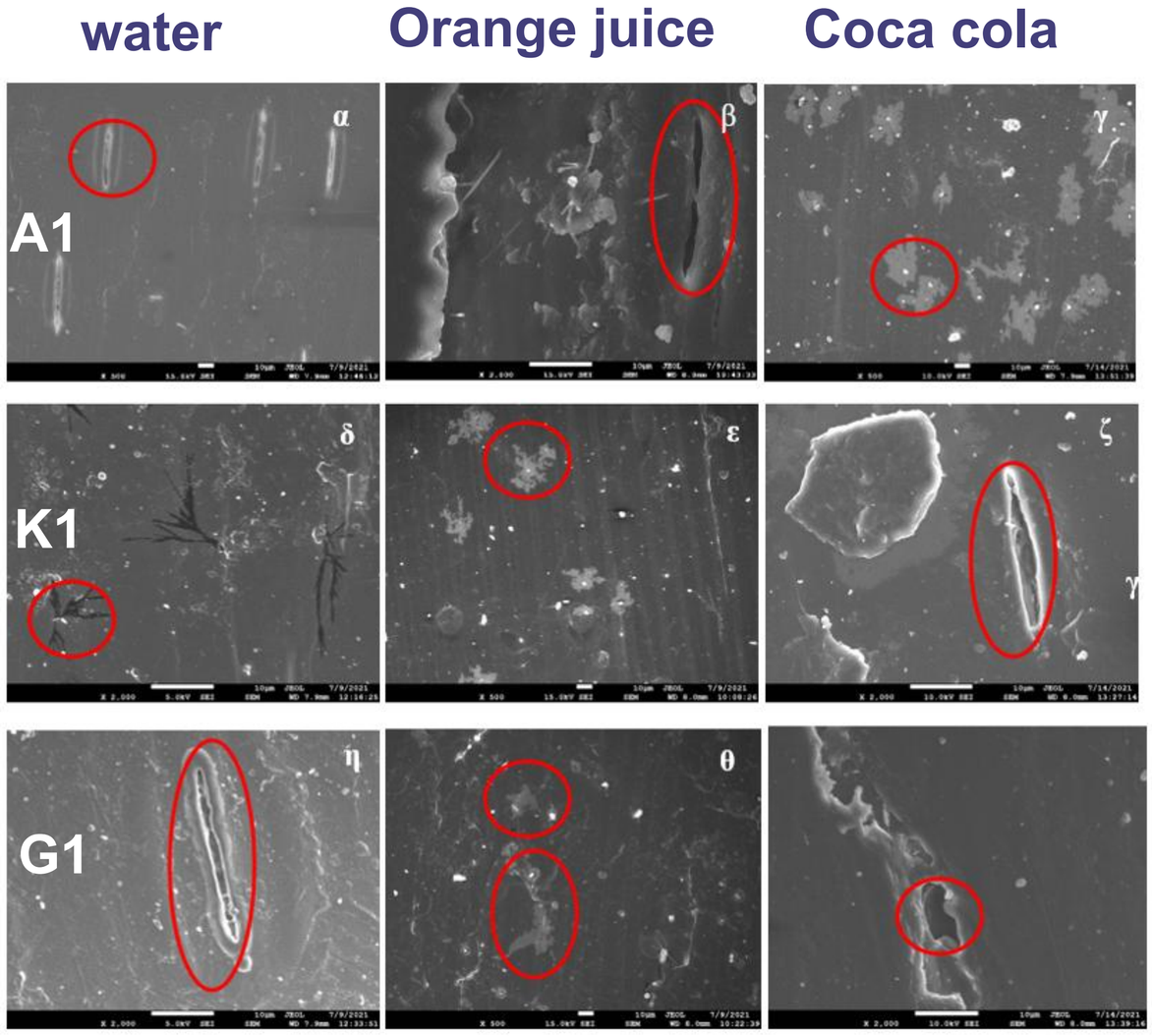
Table 1: Type of straws and raw materials

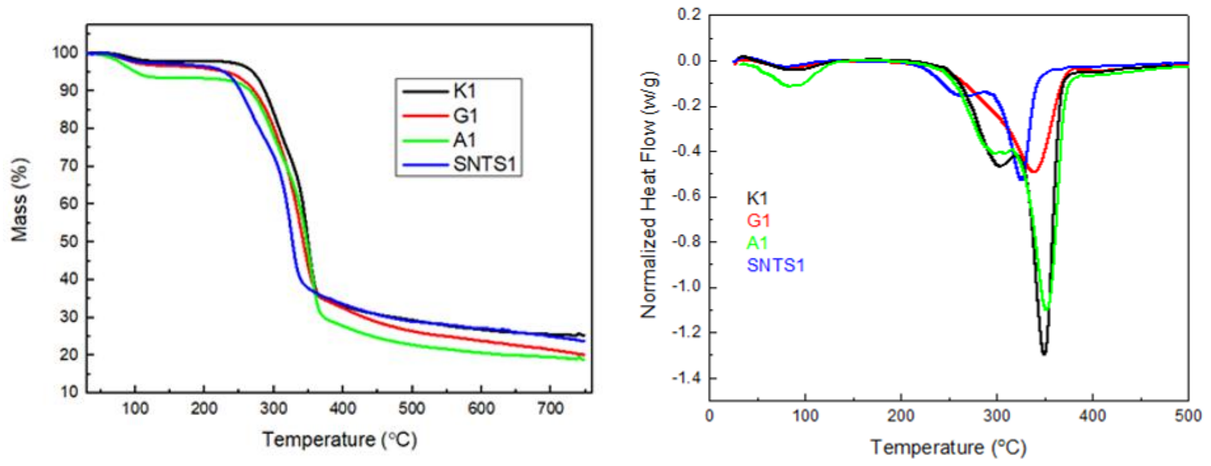
A/A	Raw material	characteristics
K1	wheat	staramaki
G1	wheat	staramaki
A1	wheat	staramaki
WS	wheat	wheat straws
ECRT1	reed	reed straws
BS	bamboo	bamboo straws
PS	paper	bio paper straws
BPS	bioplastic	biodegradable

RESULTS & DISCUSSION



A/A	Όνομα	Κρυσταλλικότητα (%)	R^2
1	K1	77.1	0.99916
2	G1	70.3	0.99744
3	A1	72.6	0.99865
4	SNTS1	66.9	0.98919
5	ECRT1	73.7	0.99871
6	BMBS1	51.4	0.99227
7	MTPX1	68.9	0.99740
8	BDGR1	88.5	0.99631





CONCLUSION

- K1 showed the highest crystallinity (77.1%) and best structural order.
- SEM: minimal surface damage after immersion.
- TGA: highest thermal stability, suitable for hot beverages.