NOVEL BIODEGRADABLE POLYMERS MODIFIED BY HUMIC ACIDS

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Humic acids (HAs), extracted from Ukrainian lignite, are used as hybrid modifiers for biodegradable polymers (BPs). Optimal HA content is 10 wt %, ensuring strong antibacterial properties and maintaining high performance characteristics of films.

Key Concepts:

Modern biodegradable polymer materials (BPMs), though eco-friendly, often lack the performance of synthetic polymers. Hybrid modification, combining organic and inorganic components, improves their structure and expands applicability.

Gelatin-Based HBPs and HAs:

IR spectroscopy confirms hydrogen bonding between gelatin and HAs. At 10 % HA, notable shifts in IR spectra indicate structural rearrangements. Thermal (DSC) analysis shows that higher HA content alters hydrogel structure by reducing crystallization water and enhancing hydrogen bonding. XRD analysis confirms structural changes: HA increases α-helix content at 15 %, but causes amorphization at 45 %.

Mechanism of Modification:

In gelatin-HA systems, HA interacts with water, reducing gelatin-water coordination and altering structure. For PVA-HA and HPMC-HA systems, hybrid modification occurs through supramolecular interactions and cross-linking with HA functional groups.

Conclusion:

This is the first proposed use of lignite-derived HAs for modifying BPs. The impact of HAs on HBP properties varies by source (HA3 > HA2 > HA1), driven by differences in structural interactions.