INFLUENCE OF AGING AND BIODEGRADATION ON THE PROPERTIES OF LATEX COMPOSITES FILLED WITH PVA HYDROGEL AND KERATIN

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Latex-based polymer composites with biodegradable fillers represent an interesting alternative to conventional synthetic materials. These materials are increasingly explored in applications where sustainability and controlled biodegradability are crucial. The combination of poly(vinyl alcohol) (PVA) hydrogel and keratin provides a unique balance of mechanical durability and environmental compatibility. This study investigates the effects of thermo-oxidative and biological aging on the properties of latex composites filled with these biodegradable components.

Mechanical, morphological, and spectral analyses were conducted on aged samples to evaluate their stability and degradation behavior. Thermo-oxidative aging resulted in a 20 % increase in hardness and a 15 % increase in tensile strength, demonstrating improved structural integrity under prolonged exposure to heat and oxygen. Conversely, biological aging led to a 30 % reduction in tensile strength and a 25 % decrease in elasticity, highlighting the material's susceptibility to microbial decomposition (Table 1). FTIR analysis revealed spectral changes in the regions associated with protein and hydroxyl functional groups in biologically aged samples, showing peak intensity reductions of up to 18% in specific functional regions, indicating progressive molecular degradation.

Additionally, scanning electron microscopy (SEM) was utilized to examine the surface morphology of aged composites, revealing microstructural changes such as increased porosity and surface roughness after biological exposure. These findings confirm that keratin addition enhances the thermal stability of the composites while increasing their susceptibility to biological degradation, making them promising candidates for sustainable applications requiring controlled lifespan materials.

Table 1. Mechanical properties of latex composites before and after aging

Property	Before Aging	Thermo-oxidative Aging	Biological Aging
Hardness (Shore A)	55	66 (+20 %)	41 (-25 %)
Tensile Strength (MPa)	3.2	3.7 (+15 %)	2.2 (-30 %)
Elasticity (%)	120	102 (-15 %)	90 (-25 %)

These results are significant for designing biodegradable polymeric materials with controlled durability, particularly in applications such as agricultural films, biomedical scaffolds, and eco-friendly packaging, where material breakdown over time is a desired characteristic.