Structurally Tunable PDMS Xerogels via Microemulsion Templating for Controlled Solvent Delivery

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The conservation of modern and contemporary artworks presents unique challenges due to the fragility of materials and the complexity of surface layers. Conventional cleaning methods, often based on mechanical action or non-selective solvents, risk damaging the artwork and the environment. This research focuses on the development of novel chemical organogels and sponges with tunable mechanical and structural properties, designed to enable selective and controlled removal of surface contaminants.

Macroporous polydimethylsiloxane (PDMS) xerogels were synthesized by polymerizing the continuous phase of water-in-oil microemulsions, where aqueous droplets serve as porosity templates [1]. Material morphology and structure were characterized by Scanning Electron Microscopy (SEM) and X-ray Microtomography (XMT), while Dynamic Light Scattering (DLS) was used to assess nanodroplet size distribution.

Swelling and release tests with solvents of varying polarity were performed to evaluate absorption and retention behavior. These results, analyzed using mathematical models [2], revealed correlations between solvent properties and transport dynamics within the porous matrix.

References

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