**Diffusive and Electro-osmotic Swelling of Neutral and Ion-Containing Poly(ethylene glycol) Hydrogels**

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ABSTRACT This study presents a comprehensive analysis of the swelling behavior of polyethylene glycol (PEG)-based hydrogels of different molecular weights under various conditions. We report the diffusion coefficients calculated from swelling data and provide a detailed examination of the polymer's viscoelastic properties. The manuscript compares the swelling kinetics of PEG hydrogels across molecular weights ranging from 700 g/mol to 10,000 g/mol, revealing distinct patterns of water uptake and diffusion. Rheological measurements complement these findings by illustrating the dependency of the storage and loss moduli on the percentage of swelling, which provides insights into the network structure and cross-linking density. Furthermore, the relationship between diffusion coefficients and molecular weights is explored, elucidating the impact of polymer chain lengths on the swelling process. The integration of experimental data with numerical models contributes to a deeper understanding of hydrogel behavior, potentially guiding the design of PEG-based systems for biomedical or soft robotics applications.