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FULL PAPER ABSTRACTS

EFFECT OF THE SCALE FACTOR OF FREE VOLUME THEORY ON THE DIFFUSION PROPERTIES OF POLYETHYLENE GLYCOL HYDROGEL

Pooja Vardhini Natesan, Shib Sundar Banerjee and Ramakrishnan Swaminathan
Department of Applied Mechanics, Indian Institute of Technology Madras, Chennai, India

Corresponding Author: Pooja Vardhini Natesan
Address: Non-Invasive Imaging and Diagnostics Laboratory, Biomedical Engineering Group, Department of Applied Mechanics, Indian Institute of Technology Madras, Chennai - 600036, Tamil Nadu, India
Email: am19d750@smail.iitm.ac.in

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ABSTRACT

Free volume theory (FVT) based approach has been frequently utilized by the researchers to characterize the diffusion-mediated hydrogel drug delivery systems. The scale factor is a crucial parameter in the FVT premise which governs the diffusion dynamics of the solute by means of the available free volume. In this study, the influence of the scale factor (Y) of FVT on the diffusion characteristics of polyethylene glycol (PEG) hydrogel has been explored for wound healing applications. A computational model has been implemented to simulate the diffusion of two antimicrobial plant metabolites namely, Cinnamaldehyde and Curcumin and two synthetic antimicrobial drugs namely, Amphotericin B and Vancomycin through PEG 20000 hydrogel matrix. A reduction in the diffusion coefficient and diffusivity ratio of about 36% has been observed with an increase in the scale factor from 0.5 to 2, while the diffusion time is found to be extended by more than 50%. This shows that the theoretical assumption of a constant Y value of 1 may not be suitable for practical cases as the scale factor significantly influences the diffusion kinetics. The outcomes of the present study will contribute to the physical understanding of the FVT scale factor and its impact on the diffusion characteristics of hydrogels which in turn will aid in the appropriate selection of the model parameters during the in silico validation of tuned drug delivery systems.

Keywords: Hydrogel, Diffusion, Free Volume Theory, Scale Factor, Antimicrobial Agents, Wound Healing