

Abstract Submitted
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Modeling Cell Desiccation with Glass Formation¹ CHRIS VOGL, MICHAEL MIKSIS, STEPHEN DAVIS, Northwestern University, DAVID SALAC, University at Buffalo SUNY — Lyopreservation is a preservation technique that seeks to store cells at room temperature. The storage process involves desiccating cells filled with special glass-forming sugars. However, care must be taken during the desiccation process to avoid both damaging membrane stress and to ensure the complete formation of glass throughout the cell. A lipid vesicle model is used here to study this process. The vesicle is represented as a moving interface (tracked by a level set method) with bending rigidity and incompressibility conditions. The vesicle is placed in a fluid containing a spatially varying sugar concentration field. As physical cells are impermeable to the sugar, the vesicle's impermeability is enforced with an immersed interface method. This results in a concentration jump across the vesicle's membrane, which in turn determines the flow of fluid through the membrane. Various desiccation techniques are simulated with this model. The effectiveness of each technique at minimizing membrane stress while ensuring glass formation will be discussed.

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