The interaction of pulsatile flow in the presence of wall waviness with application to separation in space habitation environments

AARON THOMAS, GATWECH THICH, DEMIAN GUTHMILLER, University of Idaho, RANGA NARAYANAN, University of Florida — Oscillatory flows in tubes are a novel way to increase the separation of two dilute species present in a carrier while providing a high throughput or mass transfer. We can then mechanically separate, for example, trace contaminants from air in long-term manned space missions without a re-supply or a regeneration of materials. The separation is connected to dispersion wherein low diffusing species is axially dispersed down a tube to a great amount than a fast diffusing species. One of the ways to change the rate at which a species transports is to alter the flow by modifying the geometrical configuration of the tube. This study analyzes the effect of a wavy-walled boundary on the mass transfer and separation of two dilute species. The main goal is to understand the physics so that a system can be designed to give the greatest separation along with a high mass transfer. The results show that the wavy-wall decreases the overall mass transfer as oscillation frequencies increase in comparison to a flat wall but increases the separation.

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