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Effect of oscillatory core-flow on a shear-thinning fluid layer coating the inner surface of a tube. HIDEKI FUJIOKA, University of Michigan, DAVID HALPERN, University of Alabama, JAMES B. GROTBERG, University of Michigan — Surface tension on an air-liquid interface induces liquid flows, which may cause the lung's airways to close due to the formation of a liquid plug as a result of drainage of the liquid lining coating the airways. Flows in the liquid layer are also influenced by the air flow and the rheological properties of the fluid. In this study, we develop a computational model of a liquid-lined tube with an oscillatory core flow: a Newtonian fluid flows through a cylindrical whose inner wall is coated by a shear-thinning fluid. An oscillatory core flow rate is prescribed. The presence of the core flow enhances the initial film growth-rate when compared to no core flow case. As the liquid bulge grows, its axial displacement increases due to the oscillatory core flow. At some point, the film growth-rate decreases and eventually the minimum core radius approaches a non-zero value implying that a liquid plug has not formed. The effect of core flow frequency and amplitude and properties of the film fluid are investigated. This work is supported by NIH grant HL41126, NASA grant NAG3-2740.

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