Abstract Submitted
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**Yield Stress Effects on Mucus Plug Rupture**[1] YINGYING HU, SHIYAO BIAN, Department of Biomedical Engineering, University of Michigan, JOHN C. GROTBERG, University of Illinois at Chicago, SHUICHI TAKAYAMA, JAMES B. GROTBERG, Department of Biomedical Engineering, University of Michigan — Mucus plugs can obstruct airways, resulting in lost gas exchange and inflammation. Yield stress, one of the significant rheological properties of mucus, plays a significant role in plug rupture. We use carbopol 940 gels as mucus simulants to study dynamics of mucus plug rupture in experiments. Yield stress increases with gel concentration increasing (0.1%∼0.3%). The yield stress of the 0.2% gel is about 530 dyn/cm$^2$, which can simulate normal mucus. A 2D PDMS channel is used to simulate a collapsed airway of the $12^{th}$ generation in a human lung. Plug rupture is driven by a pressure drop of $1.6\times10^4$ ∼$2.0\times10^4$ dyn/cm$^2$. Initial plug length varies from half to two times the half channel width. A micro-PIV technique is used to acquire velocity fields during rupture, from which wall shear stress is derived. Plug shortening velocity increases with the pressure drop, but decreases with yield stress or the initial plug length. Wall shear stress increases with yield stress, which indicates more potential damage may occur to epithelial cells when pathologic mucus has a high yield stress. Near the rupture moment, a wall shear stress peak appears at the front of the film deposited by the plug during rupture.

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