Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Capillary thinning and breakup of saliva threads and rheological aging of mucin solutions CAROLINE WAGNER, LYDIA BOUROUIBA, GARETH MCKINLEY, Massachusetts Institute of Technology — The elasticity of saliva, which is essential for many of its primary functions such as lubrication, arises largely as a result of the presence of MUC5B mucins. These are large glycoproteins composed of numerous repeated polymeric subunits forming a weakly crosslinked network. It has been noted for nearly a century that once removed from the mouth, saliva quickly loses its elasticity, which can be quantified by a decrease in its capillary breakup time. We model saliva as a dilute finitely extensible nonlinear elastic (FENE-P) fluid with polymer chains composed of dispersed Hookean dumbbells of maximum extensibility b related to the number of MUC5B subunits. We show that under conditions of simple elongational flow, an analytic prediction of the time evolution of the radius and the filament breakup time can be derived. Furthermore, our model shows that decreasing the maximum extensibility b leads to a decrease in the breakup time, which suggests that the aging process of saliva outside the mouth involves a shortening of the MUC5B mucin chains into smaller groupings. Finally, we compare the analytic breakup times from the model with experimental results obtained using a capillary breakup extensional rheometer and human whole saliva.

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Date submitted: 14 Jul 2014 Electronic form version 1.4