

An aqueous bio-lubricant with ultra-low friction coefficients to tackle xerostomia (dry mouth condition)

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Summary

Xerostomia is a dry mouth syndrome where the lubrication property of natural saliva is lost. The impact of complications associated with xerostomia on people suffering from that is significant. Therefore, a bio-lubricant capable of excelling the lubricity of saliva can transform the quality of life of millions of individuals, particularly elderly population where this condition is most prevalent. In this paper, a food-grade bio-lubricant is presented comprising of positively-charged proteinaceous microgels doped into a network of negatively-charged carbohydrate-based nanofibrils. The lubricant was developed by addition of laboratory-synthesized lactoferrin microgels (LFMs) into a network of κ -carrageenan hydrogel (κ CH) and exhibits a lubricity superior to that of real human saliva [1].

Keywords: oral tribology, superlubricity, biomimetic, microgel, hydrogel

Results, discussion and conclusion

The transmission electron microscopy (TEM) and ζ -potential measurements demonstrated electrostatic interactions between LFMs and κ CH. The surface adsorption properties of the LFMs, κ CH, and LFM-doped κ CH were investigated using a quartz crystal microbalance with dissipation monitoring (QCM-D) and finally the lubrication behaviour of the lubricants was studied using a Mini Traction Machine (MTM) and bespoke rheo-tribometry technique using 3D tongue-like soft textured surfaces [2]. Using TEM and ζ -potential we show that a critical ratio of κ CH/LFMs exists where LFMs were fully covered by κ CH. The surface adsorption (examined by QCM-D) was governed by the interactions between surfaces and LFMs. The LFM-doped κ CH showed enhanced surface adsorption properties as compared to the individual components (Figure 1).

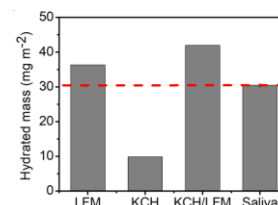


Figure 1. Surface adsorption results measured using QCM-D

Tribotesting surfaces were carried out on polydimethylsiloxane (Figure 2a) as well as on tongue-emulated surfaces (Figure 2b). These surfaces were recently developed by authors [2]. These tests confirmed that the novel microgel-doped hydrogel, developed in this work [1], excels real human saliva in lubricating orally-relevant surfaces and hence has substantial potential to be used in treating xerostomia.

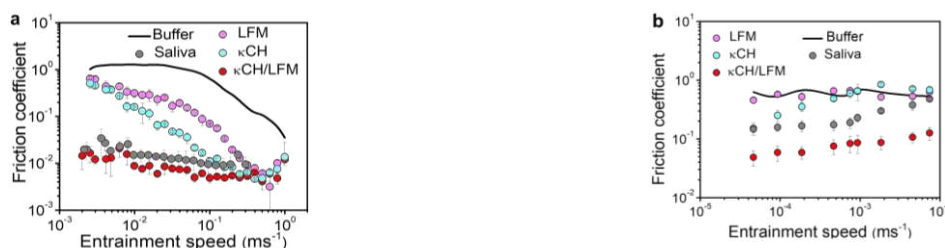


Figure 2. The friction coefficient results for LFM, κ CH, LFM-doped κ CH and real human saliva on elastomeric surfaces using a) MTM and b) a modified rheo-tribometer and tongue mimicked surfaces.

References:

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