Modulating Mucin Hydration and Lubrication by Deglycosylation and Polyethylene Glycol Binding

Abstract:
A key property of mucin glycoproteins is their exceptional capacity to hydrate and lubricate surfaces. In vivo, mucins assemble into mucus hydrogels that cover the epithelium and protect it from dehydration and shear stress. A better understanding of the origin of these properties could lead to new treatment strategies for patients with poor mucus coverage, defective mucus production, or glycosylation as caused by Sjogren syndrome, dry eye, or in the case of certain bacterial infections. In this work, mucin coatings are used to show that mucin-associated glycans are essential for the formation of such hydrated and lubricating layers. Native mucins are compared with deglycosylated mucins by analyzing their hydration and it is shown that their lubricative potential in the boundary and mixed lubrication regime is linked to the hydration. The removal of glycans from the mucin results in a 3.5-fold decrease in hydration and an increase in friction by two orders of magnitude. This loss of function is countered by grafting polyethylene glycol (PEG) molecules to defective mucins through lectin-glycan interactions. This lectin-PEG
conjugation restores hydration and improves lubrication of the partially deglycosylated mucin coatings. Thus, local complementation of defective mucus layers could prove to be a useful new treatment strategy.

**Stichworte:**
- PORCINE GASTRIC MUCIN
- BOUNDARY LUBRICATION
- MOLECULAR-WEIGHT
- SHEAR FORCES
- SURFACES
- POLYMER
- MUCUS
- POLYELECTROLYTE
- GLYCOPROTEIN
- SUBMAXILLARY

**Dewey Dezimalklassifikation neu:**
- 500 Naturwissenschaften

**Zeitschriftentitel:**
- Adv. Mater. Interfaces

**Jahr:**
- 2015

**Heft / Issue:**
- 18

**Seiten:**
- n/a-n/a

**Nachgewiesen in:**
- Web of Science

**Reviewed:**
- ja

**Sprache:**
- en

**Volltext / DOI:**
- http://doi.org/10.1002/admi.201500308

**WWW:**

**Verlag / Institution:**
- Wiley-Blackwell

**Print-ISSN:**
- 2196-7350

**Publikationsdatum:**
- 24.09.2015

**TUM Einrichtung:**
- Professur für Biomechanik

**Format:**
- Bild/Text

**Occurences:**
- Einrichtungen > Fakultäten > Fakultät für Maschinenwesen > Institut für Mechatronik > Fachgebiet Biomechanik (Prof. Lieleg) > 2015

**entries:**