355f - Robust (Dopamine)$_n$-Polycarboxybetaine Coatings for Blood-Contacting Devices Reduce Non-Specific Protein Adsorption and Improve Anticoagulation

Tuesday, October 29, 2024
2:10 PM - 2:30 PM
Room 23A (Upper Level, San Diego Convention Center)

Abstract

Polydopamine coating technology is a versatile and widely applicable surface modification method, inspired by the strong adhesion capabilities of mussels to rocks, attributing to the presence of abundant dopamine units in mussel adhesive proteins. Since 2007, this method has drawn significant attention due to its simplicity, multifunctionality, and broad applicability. Zwitterionic materials are a class of materials that contain both cationic and anionic groups but are still in neutral status and are known for their extraordinary anti-fouling properties. Therefore, a polymer, taking advantage of both moieties as described above, can be easily coated onto any substrate for anti-fouling purposes. In this work, we successfully combine features of both moieties and synthesize (dopamine)$_{1-4}$-polycarboxybetaine (DOPA$_{1-4}$-PCB, 10-40kDa) polymer, which can be easily utilized to modify any hydrophobic or hydrophilic surfaces. By performing an ELISA test with human fibrinogen on different polymer groups, it is found that anti-fouling performance depends on the molecular weight of PCB and the amount of dopamine moieties. Therefore, a polymer with an optimized structure with balanced two parameters will lead to excellent durability and antifouling properties.

With an optimized polymer, we coated the artificial lung devices attached to rabbits to avoid thrombosis and expand the lifespan of this ECMO circuit. The device failure time of the heparin+uncoated group was 3.31 hr, while the heparin+PCB-coated was 13.0 hr. The average resistance (mmHg/mL/min) of the heparin group was 1125, while the heparin+PCB-coated group was significantly lower at 385. In conclusion, these results demonstrate that the PCB coating significantly improves the anticoagulation of the ECMO circuit.

Presenting Author

T **Chenjue Tang**
Cornell University

Authors

L Di Liu
Cornell University

S Suji Shin
Carnegie Mellon University

W Zuoming Wang
Cornell University

S Mason Salonic
Cornell University

Z Lanyu Zheng
Cornell University

S Caitlin Sigda
Cornell University

C Keith Cook
Carnegie Mellon University

J Shaoyi Jiang
Cornell University

View Related

355 - Medical Devices
***Bernard Van Wie**, Washington State University and **William Pitt**, Brigham Young University*
Tuesday, October 29, 2024
12:30 PM - 3:00 PM
Room 23A (Upper Level, San Diego Convention Center)

TF - Chemical Engineers In Medicine

Topical Conference: Chemical Engineers in Medicine

Similar

AIChE
120 Wall Street, FL 23
New York, NY 10005-4020