



Antibody assembly on chitosan nanofibers

The Challenge: Polymer-based fibers are attractive platforms to perform functions in field applications. An important consideration is that standard methods are available to assemble individual fibers over a hierarchy of lengths to generate one-dimensional (1D) yarns and ropes, two-dimensional (2D) fabrics, and even three-dimensional (3D) structures. Individual fibers or fiber assemblies can also be functionalized to extend their capabilities. The most familiar “functionalization” is dyeing to impart color to a fiber and different colored fibers can be woven to generate fabrics with a nearly infinite combination of colors and patterns. Currently, there is considerable interest in functionalizing fiber assemblies to confer novel properties such as stain resistance, antimicrobial properties, catalytic activities, and electronic capabilities. Our goal is to biofunctionalize fibers by assembling proteins that impart distinct biological activities to individual fibers.

UMBI Solution: UMBI researchers have created bio-functional fibers by reversibly attaching proteins to fibers of the aminopolysaccharide chitosan. Chitosan is uniquely positioned to emerge as an important platform for biofunctionalized fiber assemblies because it can form fibers and can participate in simple protein assembly mechanisms (e.g., nickel-mediated assembly) where the proteins confer specific biological functionalities. Chitosan fibers can be further assembled from the bottom-up into hierarchical structures with multiplexed and patterned functionalities. To demonstrate this point, UMBI inventors have generated antibody-presenting chitosan fibers, assembled these fibers with two different specificities into simple 1D and 2D structures, and demonstrated that individual fibers in these fiber assemblies could capture their respective antigens from mixtures. Chitosan fiber assemblies have the potential to provide a convenient means to enlist biological activities (e.g., recognition and catalysis) in field applications. For example, multiple fibers can be assembled for single-use, multiplexed, point-of-care diagnostics. Additionally, multiple weaving protein-functionalized fibers can be weaved into clothing to provide detection and protection capabilities.

Commercial Applications:

- Platform for point of care diagnostics based on antibody-presenting chitosan fibers.
- Clothing containing protein-functionalized fibers to provide biological detection and protection capabilities.
- Platform for High Throughput Screening.

Advantages:

Provides a rapid, sensitive and multiplexed platform for point-of-care or field-use diagnostics.

Stage of Development: 1D and 2D biofunctionalized chitosan fibers have been developed in the laboratory. Commercial development and production are required.

Patent Status: PCT patent application is pending

Licensing Potential: UMBI is seeking exclusive or non-exclusive licensees for this technology. The UMBI inventors would welcome the opportunity to collaborate with any licensee to further refine or develop the invention or extend its capabilities.

Lead Inventor & UMBI Reference: Shi, 07-031

Relevant Publications:

1. Xiao-Wen Shi, Yi Liu, Angela T. Lewandowski, Li-Qun Wu, Hsuan-Chen Wu, Reza Ghodssi, Gary W. Rubloff, William E. Bentley, Gregory F. Payne. 2008. Chitosan Biotinylation and Electrodeposition for Selective Protein Assembly. *Macromol Biosci.* 13;8(5):451-7.
2. Shi XW, Wu HC, Liu Y, Tsao CY, Wang K, Kobatake E, Bentley WE, Payne GF. 2008. Chitosan fibers: versatile platform for nickel-mediated protein assembly. *Biomacromolecules* 9, 1417-23.
3. Wei D, Qian W, Shi Y, Ding S, Xia Y. 2008. Effects of cooling treatment and glutaraldehyde on the morphology of Au nanostructures synthesized from chitosan. *Carbohydr Res.* 25;343(3):512-20.

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