Fabrication and Characterization of Hydrophilic Electrospun Fibers that Incorporate Probiotics against Bacterial Vaginosis Infection

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Bacterial vaginosis (BV) is a prominent dysbiotic condition resulting from the disruption of diverse vaginal microbial communities. It significantly impacts reproductive health, by increasing susceptibility to adverse pregnancy outcomes, postsurgical infections, and sexually transmitted infections (STIs). While standard treatments comprised of orally- and topically-applied antibiotics are initially efficacious, long-term challenges include frequent relapse, recurrent infection, and drug-resistance. Indigenous *Lactobacilli* have been utilized to counteract infection by the predominant BV-associated bacteria, *Gardnerella vaginalis* (*G. v.*). The goal of this work is to assess the feasibility of hydrophilic electrospun fibers to viably incorporate *Lactobacilli* and provide therapeutic efficacy against *G. v.* in a co-culture model.

Poly(ethylene oxide) and polyvinyl alcohol EFs were synthesized to incorporate *L. acidophilus*. Fresh and lyophilized *L. acidophilus* were electrospun in water, MRS media, and MRS with glycerol. Fiber morphology was examined with scanning electron microscopy (SEM). *L. acidophilus* viability and stability were evaluated at -20°, 4°, and 25°C by counting colony forming units (CFUs). Antimicrobial activity was assessed by co-culturing *L. acidophilus* fibers with *G. v.*

Figure 1 depicts the fiber microstructure, demonstrating high loading of *L. acidophilus* ($5x10^7$ CFU/mg) in EFs. Up to 33% of *Lactobacilli* remained viable post-electrospinning, and EFs stored in 4°C and -20°C retained the highest viability (2.1 x 10^6 CFU/mg EF) 30 d post-spin, while only EFs electrospun in MRS retained high viability at 25°C. Moreover, ~20 mg *L. acidophilus* fiber effectively inhibited *G. v.* ($1x10^8$ CFU/ml) in soluble co-culture conditions. This study demonstrates the potential of EFs to viably incorporate *L. acidophilus*, and to provide protection against *G. v*. *in vitro*. In addition, conditions for post-electrospin and long-term viability and stability are identified.

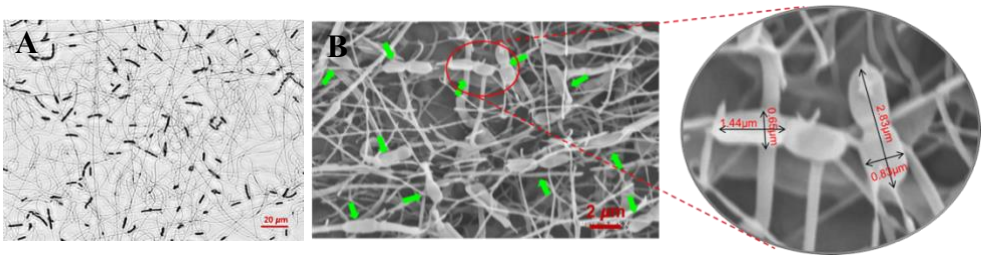
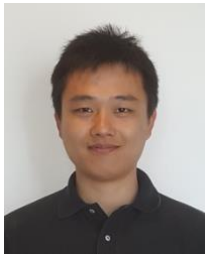


Figure 1. (A) Phase contrast and (B) SEM images of *L. acidophilus* PEO fiber. Scale bars = 20 µm and 2 µm, respectively.



Biography: Dr. Zhang is a postdoctoral associate in Dr. Steinbach-Rankins' lab. He received his Ph.D. in Biology from Tennessee State University. His research interest is to develop a multipurpose drug/biologic delivery platform.