Fabrication of a Novel Nanoporous Hybrid and Multi-Layer Membrane for a Drug Delivery System

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Micro and nanoscale structures for drug delivery have gained prominence in pharmacology. Ophthalmic diseases require repeated treatment, usually in the form of eye drops, and the treatment time ranges from a few weeks to a lifetime depending on the patient's needs. Consequently, a drug delivery system with a long-term release profile is needed. Using the electrospinning process, a hybrid multi-layer membrane was fabricated. The membrane was composed of polycaprolactone, a biodegradable polymer. The membrane structure contains a layer of microbeads that contain the drug which is sandwiched between two layers of nanofibers which do not contain the drug. The diameters of the microbeads and the nanofibers range from 1-2 micrometers and 200-700 nanometers respectively. Electrospinning is influenced by factors such as polymer solution concentration, solution flow rate, applied voltage, and tip-to-collector distance. Electrospinning relies on electrostatic forces to eject a polymer solution from a syringe to a collector. The production of microbeads and nanofibers was controlled by polymer concentration. The results indicated that microbead production was favorable at low concentrations (2% to 8%) of the polymer whereas nanofiber production was dominant in high concentrations (10% to 18%). In order to determine the efficacy of the polycaprolactone membrane for drug delivery, the system was sent to a technician for drug release testing. The results of the testing were sent back, which indicated potential of long-term drug delivery with minimal burst-release.

Awards Won:
Drug, Chemical &amp
Associated Technologies Association (DCAT): First Award of $3,000.