489c Controlled Transdermal Nicotine Delivery with Aligned Carbon Nanotube Membrane

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Carbon-nanotube (CNT) polymer films can be used for various purposes, such as drug delivery, chiral separation, and waste water treatment. Controlled gating on the CNT membrane can be achieved by functionalizing the CNT tips with long chained alkane groups. In this study, the gating effect of octadecyl amine functionalization on CNT polystyrene membrane was evaluated with nicotine flux. A drug permeation from a nicotine solution (10 mg/ml) in isotonic phosphate buffer pH 7.4 across CNT membrane with or without octadecyl amine groups was studied in a diffusion cell. The isotonic phosphate buffer pH 7.4 receiver solution samples were collected at various time intervals and stored at 4ºC until analysis for nicotine content by high pressure liquid chromatography (HPLC). The fluxes of nicotine through CNT membrane and octadecyl amine functionalized CNT membrane were 17 µmol/cm2/h and 2.7 µmol/cm2/h, respectively. The flux reduction through octadecyl amine CNT membrane by a factor of 6.2 corresponded with the reduced cross-section porous surface area by a factor of 7.5, due to the addition of long chain alkane groups to the CNT tips. The nicotine flux through octadecyl amine CNT membrane was in the preferred transdermal nicotine delivery range of 0.08-4 µmol/cm2/h. This aligned membrane structure has been incorporated into a working skin patch geometry with conventional materials. Overall nicotine flux through the skin patch was in the therapeutically useful flux of 0.90 µmol/cm2-h.