Development of a Novel 3D Printed 2-Stage Hollow Fiber Filter to Reduce Pain on Injection of a Propofol Emulsion

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Propofol is the most common anesthetic agent used in the United States, but 60% of the time patients feel pain on injection (Jalota et al. 2011). This pain is hypothesized to be from the free propofol in the aqueous phase (Doenicke et al. 1996). The aim of this study was to develop an adsorptive material filter that could reduce the free propofol. Hollow fiber membranes were selected as the adsorptive material. After different substances were compared to propofol, toluene was selected as a substitute for propofol, which is difficult to obtain without a prescription. Toluene was dissolved in water and a test dust added to create a two-phase mixture to simulate an injectable propofol emulsion. A two-stage hollow fiber membrane filter was designed to reduce the free toluene. After filtration, free toluene was measured using dialysis tubing and a spectrophotometer. A 24-33% reduction of free toluene was observed. Propofol may be more readily adsorbed due to its reduced solubility in water compared to toluene, which may lead to more effective hydrophobic binding and a greater reduction. The results were successful in proving the feasibility of the reduction of free propofol using a two-stage hollow fiber membrane filter.