

**Abstract**

The result of a comparison of the in-vitro permeation performance of identical transdermal delivery adhesive matrices containing both Sufentanil and Fentanyl is presented. The permeation rate observed for Sufentanil was found to be 36% of that determined for Fentanyl. The difference found was attributed to molecular weight melting point and polymer matrix solubility parameter interactions.

**1. Purpose**

Compare in-vitro permeation performance of transdermal delivery devices containing Sufentanil and Fentanyl.

**2. Methods**

**2.1 Materials**

Fentanyl (MW=336.5) mp = 83-84°C; Mallinckrodt, Inc.  
Sufentanil (MW=386.6) mp = 96.6°C; Mallinckrodt, Inc.  
BIO-PSA® 7-4302; Dow Corning Corp.  
Kollidon® (PVP) K-30; BASF  
Duro-Tak® 87-9085; National Starch & Chemical Co.  
Scotchpak™ 1022 Release liner; 3M™  
Scotchpak™ 9732 Backing; 3M™

**2.2 Adhesive Matrix Preparation**

The two formulations produced for the direct comparison of Fentanyl vs. Sufentanil utilized identical amounts of Duro-Tak® 87-9085 acrylic pressure sensitive adhesive (PSA), PVP, BIO-PSA® 7-4302 and drug. Patches were produced by casting polymer blends on Scotchpak™ 1022 release liner, drying for 5 minutes at RT, then 5 minutes at 92°C in a convection oven. Dried matrix was laminated to the polyester side of Scotchpak™ 9732 backing and had a coat weight of 7.5±0.75mg/cm<sup>2</sup>.

**2.3 Human Cadaver Skin Permeation Study**

Stratum corneum was obtained from split thickness, cryopreserved cadaver skin by the heat separation technique. 0.5cm<sup>2</sup> circular patches (n=4) were cut from adhesive laminate, placed on stratum corneum and mounted on modified Franz cells that were magnetically stirred at ~300 rpm and maintained at 32°C. The receiving solution was 7.5ml of 0.9% NaCl + 0.01% NaN<sub>3</sub> which was replaced at each sample point. The permeation samples were analyzed by HPLC using a Phenomex® Columbus®C-8 10cm x 0.46cm, 5µm column. The mobile phase was 50:30:20 Buffer:ACN:MeOH with an injection volume of 25µl. Buffer was 10mM KH<sub>2</sub>PO<sub>4</sub>+ 4.4mM OSA (pH= 3.0). The detection wavelength was 210nm. The flow rate was 1.5ml / min.

**3. Results**

**Figure A**

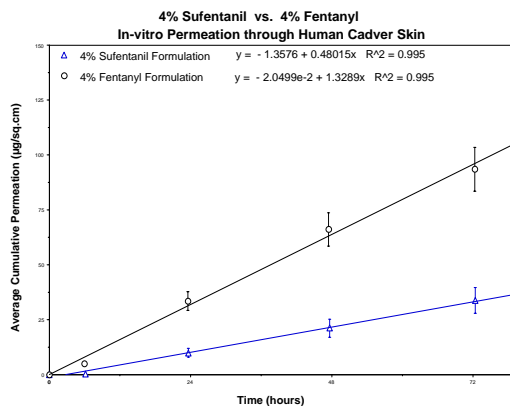


Figure A shows the permeation performance determined for both Sufentanil and Fentanyl from a matrix composed of 60% Duro-Tak® 87-9085 with 26% BIO-PSA® 7-4302 and 10% PVP.

**Figure B**

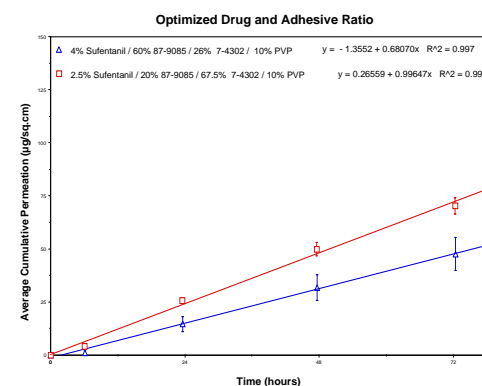


Figure B illustrates the profound affect that drug and adhesive ratio selections have upon Sufentanil permeation from the multi-polymer matrix. This observation suggests that the difference in permeation rates determined for the comparative permeation study is due to drug-polymer solubility parameter interaction in addition to physical properties such as molecular weight and melting point.

**4. Conclusion**

Although structurally similar to Fentanyl, Sufentanil permeation from this adhesive matrix is nearly three times lower than Fentanyl. The reduced Sufentanil permeation observed is attributed to higher melting point, higher molecular weight and greater solubility in the polymeric matrix.

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