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Activated Carbon Based Disposal of Fentanyl Transdermal Patches

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PURPOSE

INTRODUCTION:

- About 40% of prescribed medications remain unused and about 67% of patients retain the unused medications at home.
- Proper disposal of these unused or expired medications is critical to prevent abuse and to minimize environmental hazard. A drug disposal pouch was designed which contains granular activated carbon packaged within a water soluble film reservoir.
- The objective of this project was to investigate the effectiveness of the activated carbon disposal system on transdermal patches containing fentanyl, an opioid analgesic which is a controlled substance that has a high abuse potential.

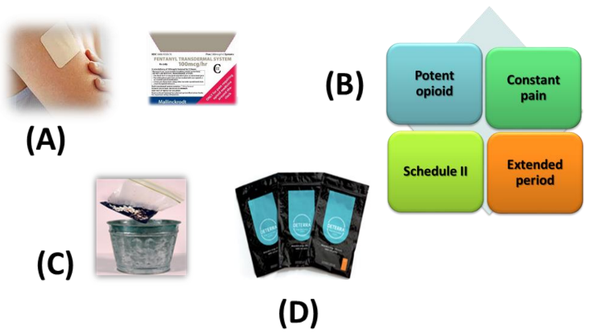


Figure.1: A) Fentanyl prescription medication.
B) Characteristics of the fentanyl patch.
C) Traditional drug disposal methods. D) Drug Deactivation system.

METHODS

1) HPLC method development and validation for fentanyl was performed using following parameters:

PARAMETERS	CONDITIONS
Column (Size and Particle size)	Gemini NX C18; 250*4.6 mm, 5µm
Pump mode	Isocratic
Mobile phase	ACN : Water (0.2%v/v formic acid containing 10mM sodium-1- decane sulfonate) (60%: 40% V/V)
Run time	10 min
Retention time	3.6 min
Injection volume	20 µl
Detection wavelength	192 nm

Table.1: HPLC parameters for detection of fentanyl by reverse phase chromatography.

METHODS

2) Adsorption study for deactivation of fentanyl:

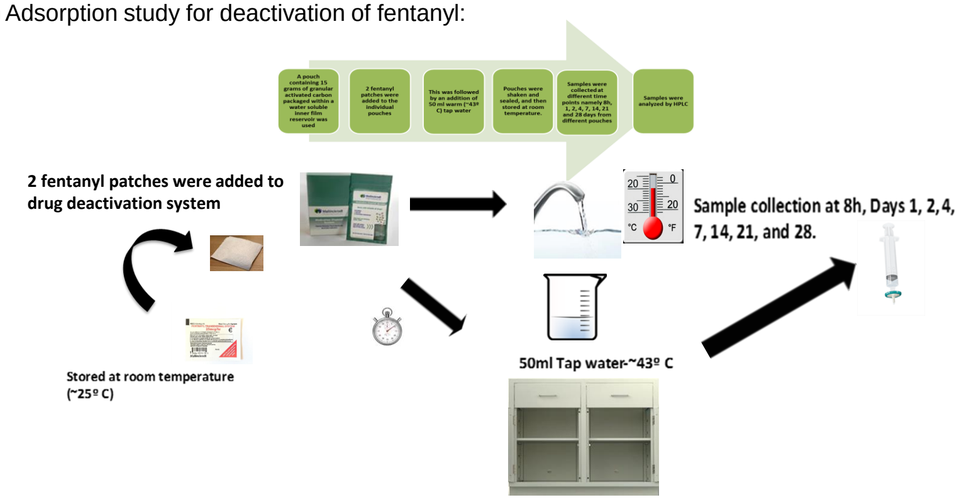


Figure.2 : Protocol- Rate and extent of adsorption for fentanyl patch.

3) Desorption study for washout from water and ethanol:

4) Release jar study (Residual fentanyl patch)

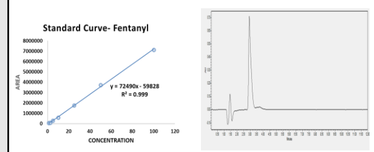
Figure.3: Release jar study to measure the amount of fentanyl remaining in the patch after being exposed to activated carbon.

RESULTS

- Deactivation or adsorption was observed to start immediately after addition of fentanyl patches into the disposal pouches. Within 8 h, 38.55% of fentanyl was released from the transdermal patch and immediately adsorbed/deactivated by the activated carbon.
- The remaining 61.45% was released during the glass jar release study. After 24 h, 100% deactivation was achieved in the pouch and this was confirmed with the observation that no drug released during the glass jar release study. It was also observed that fentanyl was released at a faster rate in presence of carbon.

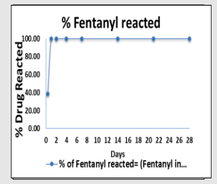
RESULTS

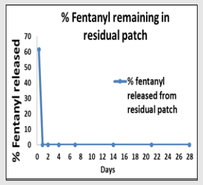
Figure 4: A) Standard curve plot of Fentanyl on three different days.
B) Chromatogram representation of Fentanyl at ~3.6 minutes for 10 µg/mL.
c) **Table.2: Interday accuracy and precision**

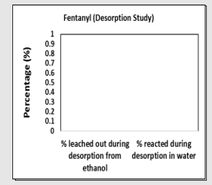


Concentration (µg/ml)	Average	SD	Accuracy (%)	Precision (%)
10	8.93	1.05	89.27	11.71
25	24.32	1.09	97.30	4.48
50	51.47	0.97	102.94	1.89

Figure.5: A) % deactivation of fentanyl with activated carbon over a period of 28 days. B) Amount of fentanyl released from the patch during the release jar study. Desorption study of fentanyl: C) Washout in water and ethanol.







CONCLUSIONS

- The deactivation pouch successfully adsorbed fentanyl within 24 hours and did not release adsorbed drug upon exposure to large volumes of water and ethanol.
- Moreover, the release of fentanyl from the matrix system was faster in presence of activated carbon.

*This submission is an encore presentation and will be presented at “Controlled Release Society” annual meeting (July 17-20, 2016).

Acknowledgments and Reference

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Reference

1. Herwadkar A, Singh N, Anderson C, Korey A, Fowler W, Banga AK. Development of disposal systems for deactivation of unused/residual/expired medications. Pharm Res. 2015 Aug 12.