Development of a disposal system for deactivation of transdermal patches of fentanyl

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Objective

The objective of this study was to test a carbon fabric containing disposal system for its efficiency in deactivation of transdermal patches of fentanyl

Rationale

There has been an increasing concern regarding misuse/ abuse of controlled drug substances. Fentanyl is a potent opioid analgesic and a Schedule II Controlled Substance. Transdermal patches of fentanyl- Duragesic® are being used in the treatment of moderate to severe chronic pain. Duragesic patches are intended to be applied on to intact skin of patients for a maximum time period of 72 h. However, even after use, the patches retain significant amount of fentanyl resulting in a potential for drug misuse. It is therefore suggested that Duragesic patches be flushed down the drain after use which would minimize the drug abuse potential. However, this method of disposal may be a concern for environmental contamination with drugs. Hence, in our study we are investigating the feasibility of using an alternative carbon fabric containing disposal system of fentanyl for safe, effective and environmentally friendly drug disposal

Methods

Deactivation studies were carried out using marketed fentanyl transdermal patches- Duragesic® 12.5 µg/h in strength. The disposal system was composed of a carbon fabric material which could be enclosed between an adhesive tape and a liner. Deactivation was carried out by removing the liner of the disposal system, placing the Duragesic patches on wetted carbon fabric and sealing the system with the adhesive tape. Deactivation times of 8, 24, 48 and 96 h were tested after which the disposal system was either cut into small strips (condition 1) or torn open and the patch was removed out forcefully from the system (condition 2). A method was developed for complete extraction of fentanyl from the deactivated patches and deactivation was followed by a two step extraction process; first with water for 24 h and then with 30% ethanol for 24 h. The amount of fentanyl remaining in the system after deactivation was quantified using a stability indicating HPLC assay.

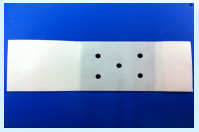

Figure 1: Image of the carbon fabric containing drug disposal system (MedsAway™ Disposal System) for deactivation of transdermal patches

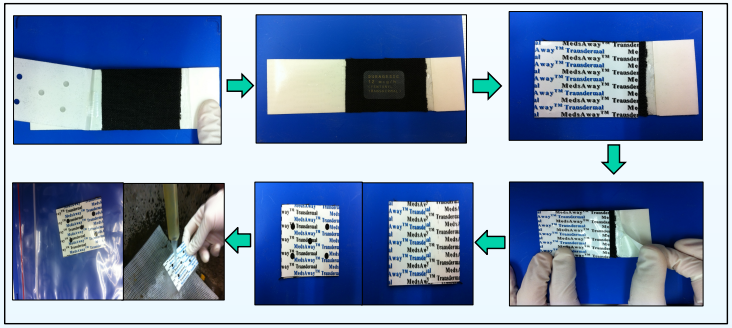

Figure 2: Pictorial description of protocol followed for potential deactivation of transdermal patches of fentanyl

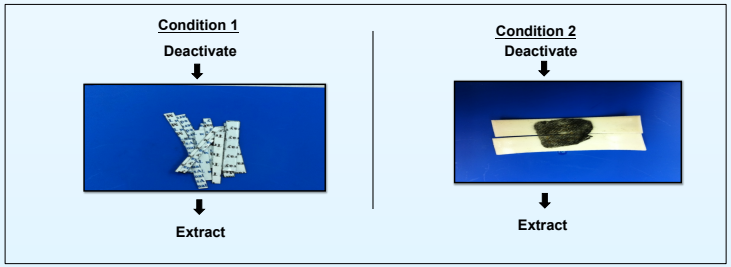

Figure 3: Pictorial description of the conditions tested to determine the deactivation efficiency of the carbon fabric containing disposal system

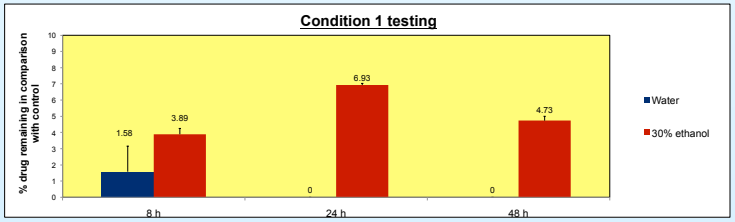

Figure 4: Results from condition 1 testing indicated that deactivation in the range of 93-96% was observed at all time points. Based on these results, deactivation period of 8 h seems to be optimum to ensure > 90% deactivation

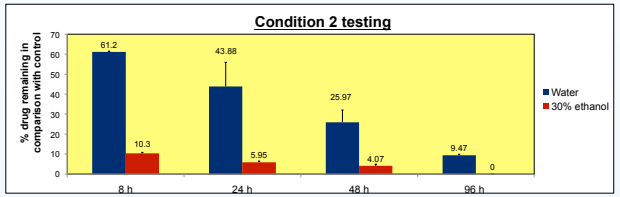

Figure 5: Condition 2 testing indicated deactivation of > 90% fentanyl wasobserved at the 96 h time point

Effect of thickness of carbon fabric in the disposal system on deactivation of fentanyl

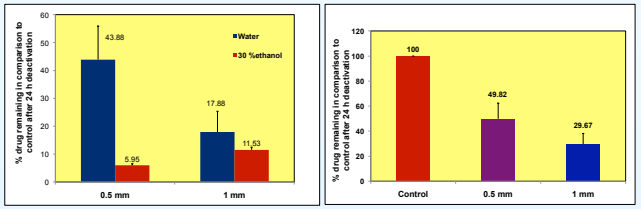

Figure 6: Increasing thickness of the carbon fabric material in the disposal system resulted in increased deactivation of fentanyl

Summary

- A carbon fabric containing disposal system was tested for deactivation of transdermal patches of fentanyl. The deactivation efficiency of the system was tested using two protocols (Condition 1 and Condition 2)
- Condition 1 test results demonstrate a rapid benefit via encapsulation with the deactivation layer. Even when destroying the system by cutting it into strips, by 8 hours only 1.6% of the fentanyl was recoverable in the aqueous extraction, and only 3.9% was recovered in the ethanol extraction.
- Condition 2 testing indicated that deactivation of > 90% fentanyl can be achieved in 96 h time period. In this case, increased deactivation efficiency was observed with an increase in deactivation period
- Increased deactivation efficiency was observed on increasing the thickness of the carbon fabric material in the disposal system

Conclusion

•The carbon fabric disposal system was effective at deactivation of transdermal patches of fentanyl. This disposal method resulted in > 90% deactivation of fentanyl content in Duragesic patches.

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