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Evaluation of an Activated Carbon Based Drug Disposal System for Deactivation of Psychoactive Medications

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PURPOSE

Proper disposal of expired, unwanted, or unused medications in households will help reduce harm from accidental exposure or intentional misuse. For a safe and secure disposal, FDA suggests that consumers transfer their unneeded medicines to take-back programs or to DEA-authorized collectors. As an alternative, FDA recommends mixing medicines with an unpalatable substance such as dirt or used coffee grounds and then discarding it in household trash. Other than the risk of these medications to be found and used by others, they can end up contaminating food and water supplies. Therefore, a safe and secure drug disposal system seems to be beneficial for household use. An activated carbon based drug deactivation system offers safe disposal of unused medications. Activated carbon is considered to be a universal adsorbent and exerts strong physical adsorption forces due to its highly porous structure. Deterra® is a convenient and easy system in that consumers can simply dispose their unwanted medications by putting them in a pouch containing activated carbon, adding water and closing the bag.

OBJECTIVE

The purpose of this study was to evaluate an activated carbon drug deactivation system for its efficiency in deactivating a number of psychoactive medications.

METHODS

Medications included in this study were zolpidem tartrate 5 mg tablet, tramadol 50 mg tablet, quetiapine 100 mg tablet, and ketamine 500mg/10mL injection.

Deactivation Study: Medications [10 zolpidem tablets, 10 tramadol tablets, 10 quetiapine tablets, or 10 mL of ketamine injection solution] were placed in separate re-sealable plastic pouches (15 cm x 10 cm), which contain 15 grams of granulated activated carbon enclosed by a thin layer of a water-soluble polymer. Warm (~43˚ C) tap water (50 mL) was added, and pouches were shaken, sealed, and then stored undisturbed at room temperature. Samples taken from the pouches were at different time points: 8h, 1, 2, 4, 7, 14, 21, and 28 days. They were then centrifuged, filtered, and further analyzed by HPLC-UV to evaluate drug deactivation.

Desorption Study: After 28 days, contents of each pouch were transferred into a bottle, and 200mL of deionized water was added. The bottles were shaken for 1 hour (30 cycles per min) and then stored at room temperature for 23 hours. Following the water washout study, the water content was replaced with 30% ethanol, and the same procedure was repeated. Samples were taken from the water and ethanol washouts and then later analyzed to investigate the amount of drug leached out of the activated carbon.

Figure 1. Schematic diagram of deactivation study

RESULTS

Results of the deactivation study showed that on average, more than 91.0% of drugs were deactivated by 8 hours. All drugs reached close to 100% deactivation by the end of 28-day period (Fig 2). Desorption study demonstrated that for all medications 0.0% of drug was leached into the water. Results of ethanol washout studies showed that the percentage of drug leached for zolpidem, quetiapine, tramadol, and ketamine was 0.2%, 1.2%, 4.8%, and 6.5% respectively.

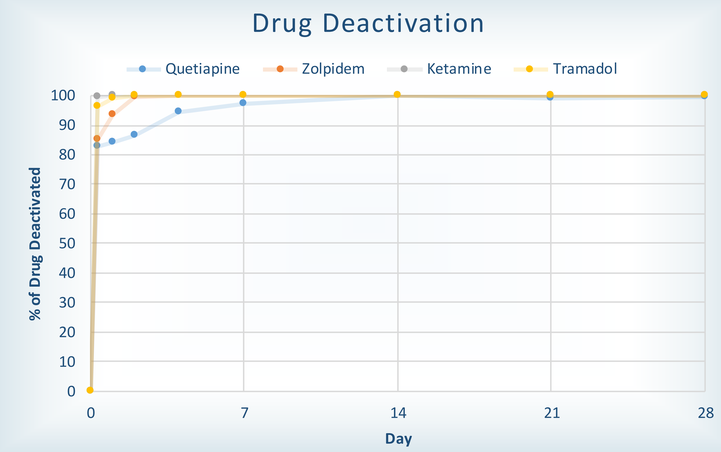

Figure 2. Deactivation profile of all medications during 28 days

CONCLUSION

Activated carbon was successfully able to deactivate the psychoactive medications tested. The deactivation was rapid, and the amount of drug that was leached by water and ethanol for most medications, was insignificant suggesting activated carbon based drug deactivation system provides a convenient, secure, and effective disposal method for unused medication that can be used in households.

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