

pH Extremes: An Ineffective Method of Opioid Destruction

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Non-medical use of prescription opioids (e.g., abuse, misuse, addiction) is one of the most serious public health problems in the United States, resulting in unprecedented rates of accidental deaths and opioid-related treatment admissions. Multiple studies have documented strong relationships among the increase in pain assessment, opioid sales volume, opioid consumption, and opioid associated morbidity and mortality. Unfortunately, a significant number of prescribed opioids are neither consumed nor discarded, and the left-over opioids have become a primary source ("gateway drug") for teenage and young adult drug misuse and addiction. Our aim is to study the stability of two of the most commonly prescribed opioids, hydrocodone and oxycodone, under different conditions in order to provide an effective, easy-to-enact and environmentally safe disposal method to be performed at home by patients. Pure reference standard solutions of hydrocodone and oxycodone were spiked in aqueous solutions at pH 0, 4, 7, 10 and 14. pH solutions were adjusted using hydrochloric acid (0.01 – 1 N) and sodium hydroxide (0.01 – 1 N). Five independent replicates were collected at 5 minutes, 1, 2, 24 hours, 4 and 7 days. Samples were diluted using 0.1% formic acid in pure water: methanol (50:50 v/v) containing 600 µg/mL of ascorbic acid. This resulted in a final drug concentration of 100 ng/mL and achieved pH levels compatible with liquid chromatography tandem mass spectrometry analysis. Calibration standards were

prepared at varying concentrations within the working range of the respective compound (1.95-500 ng/mL). Analysis was performed on Agilent 1100 Series HPLC system coupled to an AB SCIEX API 5000 tandem mass spectrometer with an electrospray ionization source. The analytical column was an Agilent InfinityLab Poroshell 120 EC-C18 column (2.7 μm , 4.6 x 50 mm), held at 60 ° C. The flow rate was 1 mL/min with a 5 μL injection volume, and the mass spectrometer was run in the positive multiple reaction monitoring mode. The disappearance of oxycodone and hydrocodone compared to baseline was monitored. As tandem mass spectrometry is highly selective, signal reduction is an indicator for the destruction of the opioid structure. No significant variation in the calculated concentrations was observed up to 4 days neither for hydrocodone nor for oxycodone. After 7 days, hydrocodone and oxycodone were stable at pH 0, 4, 7 and 10 while concentrations dropped close to 10% at pH 14. Very little literature is available on the stability of hydrocodone and oxycodone under different conditions. This is the first data to prove that even extreme pH solutions do not alter the chemical structure of these compounds over a short period of time demonstrating that pH alone is not a suitable method to dispose of "left-over" opioids. The experiments were performed using pure standards making the compounds readily available in the solution, unlike the commercial pharmaceuticals, which may be more difficult to destroy.