pH Extremes: An Ineffective Method of Opioid Destruction

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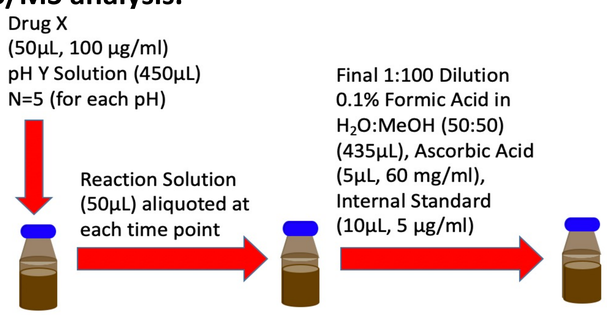
Background and Hypothesis:

- The non-medical use of prescription opioids is a public health crisis resulting in unprecedented rates of accidental deaths (> 100,000 per year) and opioid-related treatment admissions[1-6].
- Significantly more opioids are prescribed than consumed and no clear at home disposal method is available (trash vs. flushing down the toilet)[7-9].
- Unconsumed opioids are a reservoir fueling the opioid epidemic[10].
- Our aim is to study how to destroy the most commonly prescribed opioids, hydrocodone and oxycodone, in a safe, quick, easy-to-enact, and environmentally appropriate way.
- We hypothesized that extremes of pH would be effective in destroying the structure of opioids.

Sample Preparation Method:

- Solutions at pH 0, 4, 7, 10, and 14 were prepared in sterile water adjusted with hydrochloric acid (0.01 – 1 N) and sodium hydroxide (0.01 N – 1 N).
- Hydrocodone (50 µL, 100 µg/mL) was added to 450 µL of each pH solution (n=5 for each pH).
- Oxycodone (50 µL, 100 µg/mL) was added to 450 µL of each pH solution (n=5 for each pH).
- Blank samples were prepared at each pH for each analyte (no analytes added).
- Reaction solutions incubated at room temperature in absence of light, for one week.
- Time Points: 5 min, 1 h, 2 h, 24 h, 96 h, and 168 h.
- Final drug concentration 100 ng/mL compatible for LC-MS/MS analysis.



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Instrument Method:

- Analysis performed on Agilent 1100 Series HPLC system coupled to AB SCIEX API 5000 tandem mass spectrometer with an electrospray ionization source.
- Analytical column was an Agilent InfinityLab Poroshell 120 EC-C18 column (2.7 µm, 4.6 × 50 mm), held at 60 °C. Flow rate was 1 mL/min, with a 5µL injection volume.

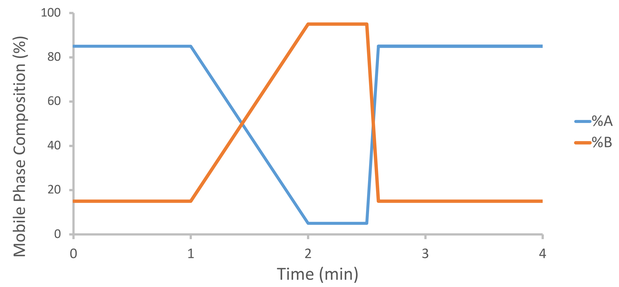

Figure 1. Mobile phase percentage composition for the HPLC gradient. Mobile phase solutions are (A) 0.1% formic acid in water, and (B) 0.1% formic acid in ACN.

Analyte	Precursor (m/z)	Product 1 (m/z)	Product 2 (m/z)
D6-Hydrocodone	306.2	202.4	
D6-Oxycodone	322.2	262.3	
Hydrocodone	300.2	199.1	141.0
Oxycodone	316.2	256.2	241.2

Table 1. MS/MS transitions for hydrocodone, oxycodone, and internal standards.

Results:

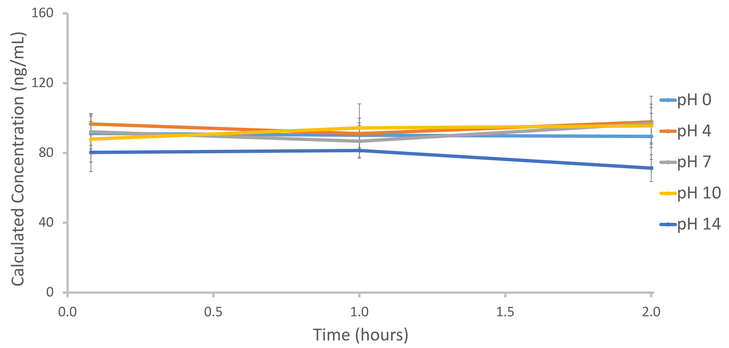

Figure 2 (a): Hydrocodone mean calculated concentrations across initial 2-hours.

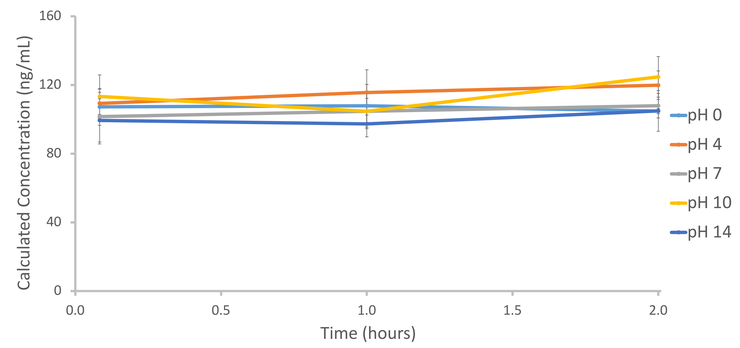

Figure 3 (a): Oxycodone mean calculated concentrations across initial 2-hours.

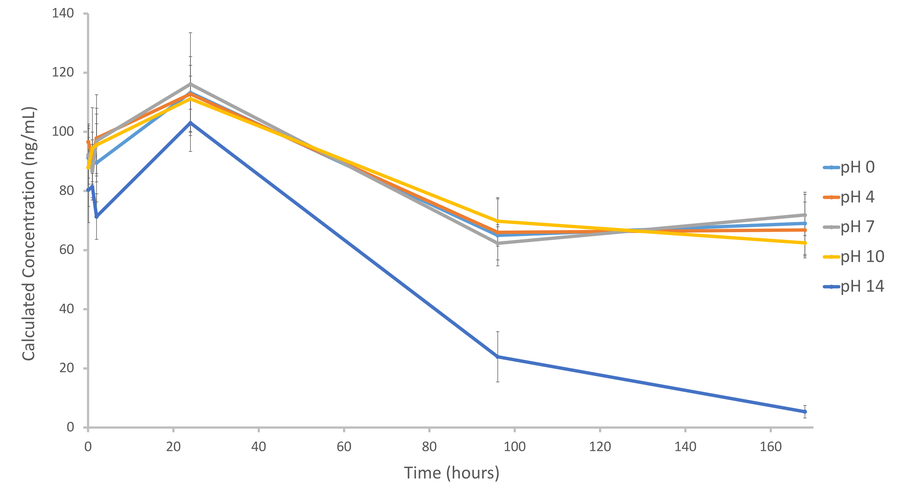

Figure 2 (b). Hydrocodone mean calculated concentrations across a 168-hour (7-day) time course. At 96 hours, the average hydrocodone concentration for pH values 0 - 10 decreased -28% from baseline, whereas pH 14 showed an average -70% reduction. At 7 days, there was almost complete degradation of hydrocodone at pH 14. Complete degradation of hydrocodone was only observed at pH 14.

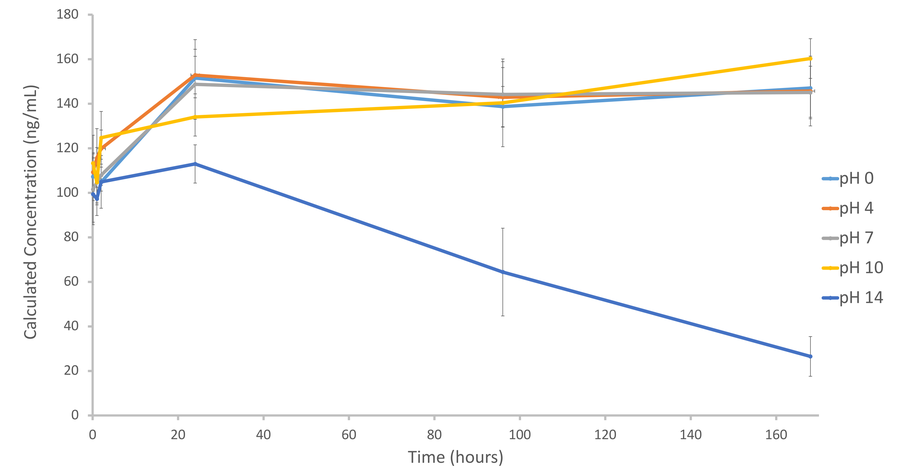

Figure 3 (b). Oxycodone mean calculated concentrations across a 168-hour (7-day) time course. At 96 hours and 168 hours, pH 0 - 10 remained at the higher signal intensity within the uncertainty parameters of 2 × standard error of the mean and did not show any degradation. At pH 14, oxycodone showed an average -35% reduction at 96 hours and a -73% reduction at 7 days. Significant reductions in concentration for oxycodone were only observed at pH14.

Summary & Conclusions:

- While pH 14 was the most effective, extremes of pH did not destroy the chemical structures of pure oxycodone or hydrocodone in a short time period. Commercially available pharmaceuticals (tablets) would be even more difficult to destroy.
- pH alone is an ineffective method for at home opioid destruction and disposal.

Disclosures: No financial disclosures or conflicts of interest.