

# PERSONAL MEDICATION DISPOSAL SYSTEM

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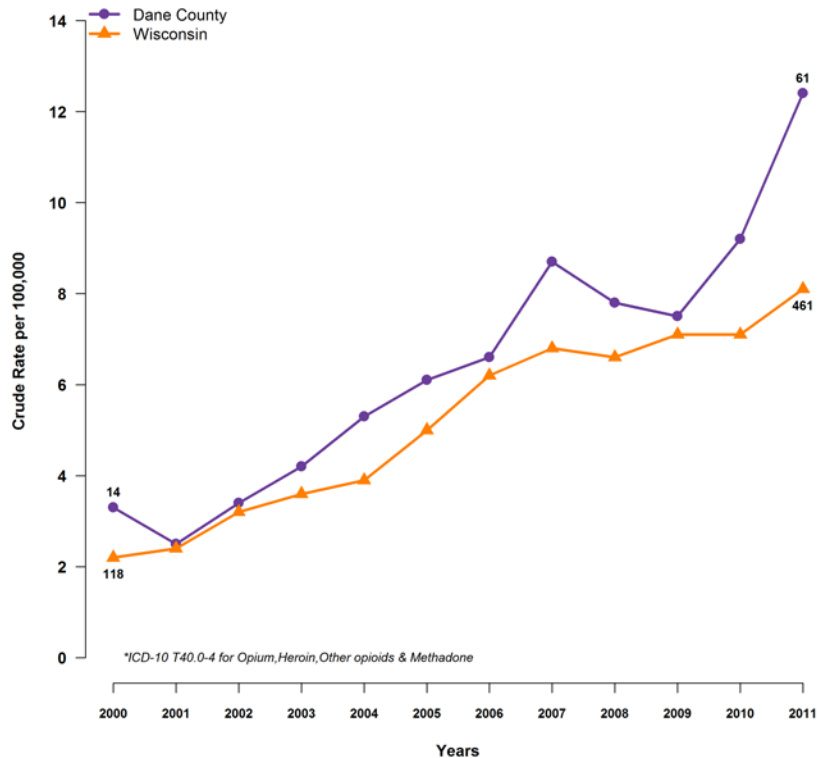
# AGENDA

- Problem Statement
- Background Material
- Current Methods
- Design Specifications
- Design Ideas
- Design Matrix
- Final Design
- Future Work
- Acknowledgements



# PROBLEM STATEMENT

Opiate\* Related Deaths 2000-2011 (All Intents)



- Households house expired prescription medications
- Disposal is inconvenient
- Most leave in cabinet or flush down toilet
- Leads to unintentional overdose or addiction
- **Goal:** Create a disposal system from opiates that is easy and can be used at home



# BACKGROUND

Drug Name	Drug Class	Number of Prescriptions	Percent of All Prescriptions
<u>Hydrocodone/Acetaminophen</u>	<u>Opioid</u>	111,831	19.0
<u>Dextroamphetamine/ Amphetamine</u>	Stimulant	55,432	9.4
<u>Oxycodone HCL</u>	<u>Opioid</u>	52,888	9.0
<u>Lorazepam</u>	Sedative	45,132	7.7
<u>Clonazepam</u>	Sedative	40,045	6.8
<u>Zolpidem Tartrate</u>	Tranquilizer	32,441	5.5
<u>Alprazolam</u>	Sedative	29,126	4.9
Methylphenidate HCL	Stimulant	27,696	4.7
<u>Oxycodone HCL/Acetaminophen</u>	<u>Opioid</u>	26,305	4.5
Morphine Sulfate	<u>Opioid</u>	21,600	3.7

Source: Wisconsin Prescription Drug Monitoring Program (PDMP)



# CURRENT METHODS

Medsaway



Image sampled from Apothecary Products

Cactus smartsink



Image sampled from Apothecary Products

Med drop boxes



Image sample from City of Racine homepage

Incinerator



Image Sampled from Heme Medi Dianafit homepage



# DESIGN SPECIFICATIONS

- Render medication inert and inaccessible
- Convenient for at-home, personal use
- Eco-friendly & safe reaction products
- Affordable and safe for use by users



# DESIGN IDEAS

## Hydrogel Powder

- One or more chemical disposal agents
- Sequester & solidify active agents after exposure to water
- Hydrophilic & hydrophobic components
  - Ex: Sodium alginate +  $\text{CaSO}_4$
- Antagonistic additions possible



# DESIGN IDEAS

## UV Light

- Potential to degrade drugs by excitation of certain bond
- Exposure to light may cause loss of potency [1]
- Hydrocodone does not absorb wavelengths  $>290$  nm [2]
- 1998 FDA must do mandatory photo-stability test on pharmaceuticals [3]



Image from allure.com





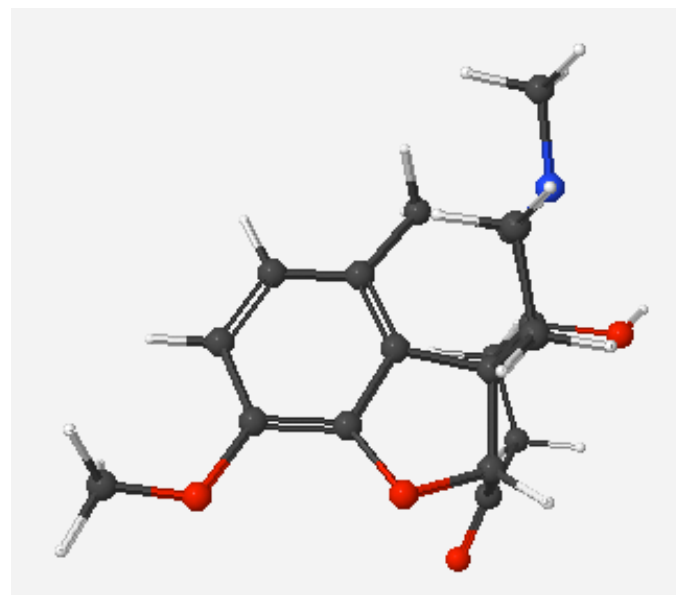
# DESIGN IDEAS

Ultrasonic Wave Generator



Dolfi Ultrasonic Wave Generator

Bond Vibration Frequency



Molecule of Oxycodone  
from WebMO



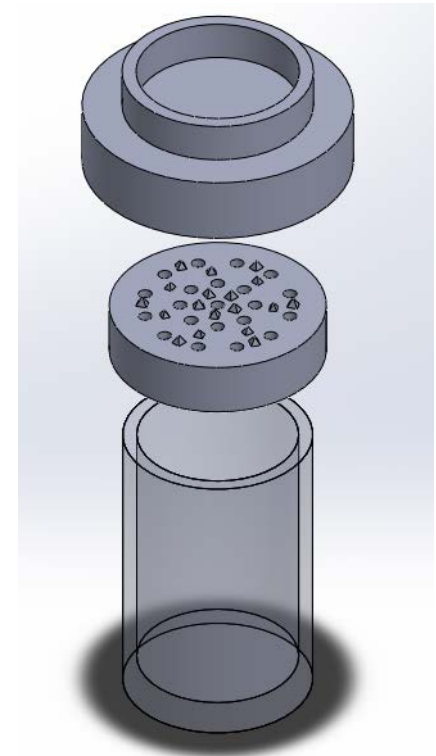
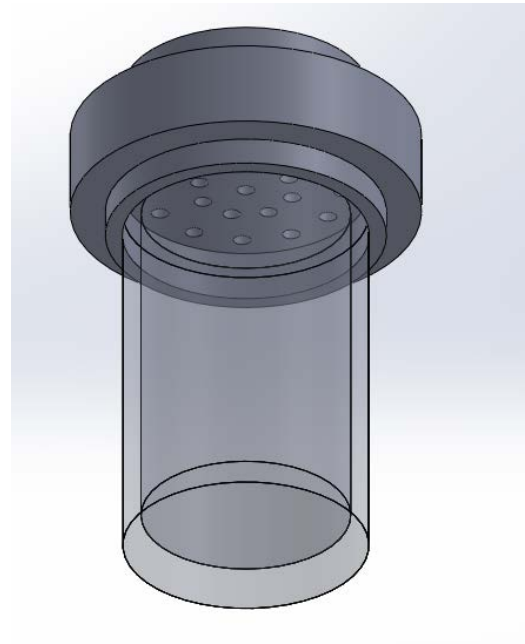
# DESIGN MATRIX

Design Matrix (Weight)	Hydrogel Powder		UV Light		Bond Vibrational Frequency	
Inaccessibility (25)	(4/5)	20	(4/5)	20	<b>(5/5)</b>	<b>25</b>
Safety (25)	(4/5)	20	<b>(5/5)</b>	<b>25</b>	(3/5)	15
Cost (20)	<b>(5/5)</b>	<b>20</b>	(3/5)	12	(2/5)	8
Ease of Use (15)	<b>(5/5)</b>	<b>15</b>	(4/5)	12	<b>(5/5)</b>	<b>15</b>
Marketability (10)	<b>(5/5)</b>	<b>10</b>	(4/5)	8	(4/5)	8
Manufacturability (5)	<b>(5/5)</b>	<b>5</b>	(4/5)	4	(2/5)	2
Total (100)	<b>90</b>		81		73	



# FINAL DESIGN

- “Modified Pill Bottle” complete with:
  - Pill Grinder Cap
  - Containment Chamber
  - Polymer Packets



# FUTURE WORK

- Experimentation & Testing
- Fabrication
  - 3-D Printing
  - Machine Shop
- Modify dimensions for other drugs/forms
- Different materials



# REFERENCES

- [1] (2004). *Photostability of Drugs and Drug Formulations (Second ed.)*. Available: <https://books-google-com.ezproxy.library.wisc.edu/books?hl=en&lr=&id=AFtAqwtrwucC&oi=fnd&pg=PA1&dq=Photoactivated+drugs+and+drug+formulations&ots=jRkSm-y7Nf&sig=Asu5BrJjuOUCFhRq4SHJ36Vh4uA#v=onepage&q=Photoactivated%20drugs%20and%20drug%20formulations&f=false>
- [2] H. H. Tønnesen. (2008), Photoreactivity of drugs. *Solar Radiation and Human Health*, 102-112. Available: [http://www.dnva.no/geomed/solarpdf/Nr\\_8\\_Hjorth\\_Tonnesen.pdf](http://www.dnva.no/geomed/solarpdf/Nr_8_Hjorth_Tonnesen.pdf)
- [3] PubChem. (2/19/2015). *Dihydrocodeinone*. Available: <http://pubchem.ncbi.nlm.nih.gov/summary/summary.cgi?sid=10224>

