Damaging UV Light; the Effect of Containers on the Photo-degradation of Naproxen

Community College of Aurora
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Potential Focus

- Cheap alternatives to protect photosensitive products
  - Shelf life
  - How careful do we need to be?
  - How much exposure is too much exposure
- Future space travel
  - Mars
  - Moon
  - Long space flights
UV exposure in the stratosphere

- The Stratosphere is a mars like environment
- Exposure to UVB/UVA rays
- Exposure to cosmic rays
Mission Overview

- Our mission objective is to find the range in which our Naproxen solution will photodegrade, by using different colored 3-D printer containers.
- We expect to prove that there are cheap methods to house medicine that will protect them from the effects of UV light.
- When photosensitive products are exposed to UV light they will photodegrade into new substances. They could even cause a reaction that makes the product toxic. We shall examine naproxen, which is known to photodegrade.
Why Naproxen?

- Anti-inflammatory drug
  - Useful drug
- Photosensitive drug
  - Likely produce a product formation
- From a solid form to a liquid form
  - Lower activation energy

Naproxen has been observed to absorb UV light wavelengths (210-310nm)
What we measured

- UV Irradiance (In mW/cm²)
  - Using six ML8511 UV sensors

- External/Internal
  Temperature
  - Using two TMP36 sensors
How we did it

- 5 3-D printer colored containers
- 5 encapsulated Naproxen samples
- 6 UV sensors
- 1 Heater circuit
Design - Containers

- Each of the containers were 3D printed
  - Each a different colored container
  - Made from T-Glasse (PETT), a semi-transparent printer filament.

- Each container was designed to hold a Naproxen sample an UV sensor
  - Completely cover the UV sensor and sample
Why T-Glase?

- Clear
- High strength
- Color options
Design - Top
Mass Spectroscopy

- Used to determine the chemical composition of our samples
What Photo-degradation of Naproxen looks like

Area Percent Report

Data File: C:\HPCHEM\1\DATA\EVADEMO.D
Acq On: 22 Apr 2016 15:32
Sample:
Misc:
MS Integration Params: events.e
Method: C:\HPCHEM\1\METHODS\CCA.M (Chemstation Integrator)
Title:
Signal: TIC

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Sum of corrected areas: 5811822872

EVADEMO.D CCA.M Fri Apr 22 16:00:00 2016
Results - Mass Spectroscopy of Samples
Results - Temperature

Red - Internal
Black - External
Results - UV Sensor Data

UV Sensor Converted Data

Irradiance (mW/cm^2)

Time (minutes)
UV Sensor Converted Data

Irradiance (mW/cm^2)

Time (minutes)
Results - Converted UV Sensor Data

UV Sensor Converted Data

Irradiance (mW/cm²)

Time (minutes)
So how effective were the boxes?
Conclusion

- Different Colors have different reflective abilities of UV light

- Not enough UV exposure for photo-degradation
  - Balloon did not fly high enough or long enough