Surfactant Effects in Irradiated, Hanging-Droplet, Aqueous-Phase Glyoxal/Ammonium Sulfate Aerosol Mimic System

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Introduction

- Secondary organic aerosol (SOA) are formed via in situ interactions with volatile organic compounds (VOCs)
- Our work has shown that when exposed to UV light Methyl/glyoxal (MG) surface tension changes as a function of time
- The main goal was to analyze the effects of irradiation on Glyoxal (G) and Ammonium Sulfate (AS) and see if there was any concentration dependencies.
- In addition, surface tension effects as a function of bulk organic concentration will be investigated in the presence of extra surfactants.

Methods

- Surface tension of hanging droplet, 24 h aged AS/G mimic solution were measured
- 2x2x3 full factorial design was used
  - Lights (on/off)
  - Addition of Surfactants (none/ SDS)
  - Concentration of Glyoxal (10mM, 30mM, & 50mM)

Results & Discussion

Carbonyl Volatile Organic Compounds

Carbonyl-containing VOCs (CVOCs) such as Glyoxal (G) and Methylglyoxal (MG) are SOA precursors.

Figure 1: Graphical representation of dark chemistry occurring with the mixture of G and AS. It produces pyrazine and imidazole which are known to absorb UV radiation. Currently, not much is known of the product when exposed to UV³

Figure 2: The chemical structure of Sodium dodecyl sulfate. It contain both a strong polar and no polar region making it surface active surfactant

Table 1: ANOVA analysis on the data. In both testing condition time was found to be a significant as it is less than α of 0.05. While exposure was found only to be significant in the absence of SDS.

<table>
<thead>
<tr>
<th>Exposure</th>
<th>0.002</th>
<th>0.563</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>.016</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Glyoxal Conc.</td>
<td>0.135</td>
<td>0.216</td>
</tr>
</tbody>
</table>

Figure 3: Schematic of Profile Analysis Tensiometer (PAT) experimental set up²

Figure 4: An example of hanging droplet in the PAT

Figure 5: (A) time resolved (B) concentration table showing how surface tension changes both in irradiated and non-irradiated conditions as a function of time and concentration.