Introduction

Understanding the processes controlling herbicide desorption from soil to the atmosphere is important for investigating the environmental fate of these compounds after field application (1).

In order to ensure uniform application and improve performance, more than 80% of the commercial herbicides contain surfactants which are essential components in their field formulations (2). However, little is known about how the presence of surfactants affects the desorption of herbicide from soil to the air. Artificial emulsifiable concentrates of herbicides prepared with known nonionic-anionic surfactants were used in this work.

Relative humidity (RH) has strong effects on soil/air partitioning of nonpolar organic compounds (3,4). The effect of RH on desorption of relatively polar chloroacetanilide and dinitroaniline herbicides from soil to the air in the presence of model surfactant mixtures is first studied in this work.

This study also aimed to develop a model to predict soil/air desorption behavior of relatively polar herbicides as a function of herbicide properties, surfactant concentration and RH.

Materials and Methods

### Herbicides

<table>
<thead>
<tr>
<th>Herbicide Family</th>
<th>Common Name (molWt.)</th>
<th>Structure substituents</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloroacetanilide</td>
<td>alachlor (358.3)</td>
<td>C12H16Cl2O2</td>
<td>$R_1 = 240$, $P = 1.10 \times 10^{-9}$, $K_H = 8.32 \times 10^{-10}$</td>
</tr>
<tr>
<td></td>
<td>benthalin (335.3)</td>
<td>C11H16Cl2O2</td>
<td>$R_1 = 240$, $P = 1.10 \times 10^{-9}$, $K_H = 8.32 \times 10^{-10}$</td>
</tr>
<tr>
<td></td>
<td>metolachlor (323.3)</td>
<td>C10H13Cl3N2O2</td>
<td>$R_1 = 240$, $P = 1.10 \times 10^{-9}$, $K_H = 8.32 \times 10^{-10}$</td>
</tr>
</tbody>
</table>

### Surfactants

<table>
<thead>
<tr>
<th>Type</th>
<th>CAS</th>
<th>CMC, mg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPEo4 - 80s</td>
<td>905-45-9</td>
<td>41-70</td>
</tr>
</tbody>
</table>

### Soils

<table>
<thead>
<tr>
<th>Type</th>
<th>CAS</th>
<th>CMC, mg/L</th>
<th>TOC</th>
<th>SSA (m2/g)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>NM soil</td>
<td>292</td>
<td>0.53%</td>
<td>41.61</td>
<td>Los/Chaco, NM</td>
<td></td>
</tr>
</tbody>
</table>

### Experimental Methods

Prepare herbicide-surfactant o/w solution

Spire herbicide mixture to soil

Air dry

Initiate desorption

Collect PUF

Desorbed sorbent

SFE extraction

GC/MS quantification

**Desorption Fraction** ($F_{\text{des}}$) = $M_{\text{solute}} - M_{\text{des}} / M_{\text{solute}}$

### Results and Discussion

#### Individual Herbicide Desorption from Two Soils in Presence of Surfactant Mixture

- **Chloroacetanilides**

  - 47% RH
  - 66% RH

- **Dinitroanilines**

  - 47% RH
  - 66% RH

Effect of Changes in Surfactant Concentration

- **CT soil**

  - (a) chloroacetanilides
  - (b) dinitroanilines

Effect of RH (%) at Different Surfactant Concentrations [S]

- (a) Chloroacetanilides
- (b) Dinitroanilines

**References & Acknowledgments**


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