Detergents and Sanitizers

Detergents
Classification of surface active agents:

1. Highly alkaline detergents:
2. Moderately alkaline detergents:
3. Inorganic acids:
4. Organic acids:
5. Surface active agents:
   a. Anionic compounds
   b. Cationic compounds
   c. Non-ionic compounds

Detergents

Surface active compounds which have

- a polar head (hydrophilic)
- a non-polar tail (hydrophobic)
**Anionic Surface-Active Compounds**

- \( R\cdot OH + H_2SO_4 \rightarrow R\cdot OSO_2OH + H_2O \)  
  (sulfuric acid ester)

- \( R\cdot OSO_2OH + NaOH \rightarrow R\cdot OSO_2Na + H_2O \)

- \( R\cdot OSO_2Na \rightarrow R\cdot OSO_2^- + Na^+ \)
Cationic surface-active compounds

\[
\begin{array}{c}
\left[ \begin{array}{c}
a \\
R \quad N \\
c 
\end{array} \right]^+ \\
\quad \\
x 
\end{array}
\]

Cationic surface-active compounds

Alkyl ammonium hydrochloride

Alkyl trimethyl ammonium chloride

Alkyl dimethyl benzyl ammonium chloride

Alkyl Pyridinium halides
Non-ionic surface-active compounds

1- Polyethers
2- Polyglycerol esters
3- Polyoxyethylene glycol stearates

Functions of Detergents

• 1- Chelating
• 2- Saponifying
• 3- Wetting
• 4- Peptizing
• 5- Emulsifying
• 6- Dispersion
• 7- Rinsing
• 8- Corrosion
Relative effectiveness of some Detergents in meeting all of the various functions:

<table>
<thead>
<tr>
<th>Properties of Detergents</th>
<th>Degrees of Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extreme = 4</td>
<td>High = 3</td>
</tr>
<tr>
<td>Medium = 2</td>
<td>Low = 1</td>
</tr>
<tr>
<td>Non = 0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>STRONG ALKALIS</th>
<th>MILD ALKALIS</th>
<th>POLY-PHOSPHATE</th>
<th>MILD ACIDS</th>
<th>STRONG ACIDS</th>
<th>SURFACTANTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chelating</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Saponifying</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Wetting</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Peptizing</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Emulsifying</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Dispersion</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Rinsing</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Corrosion</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

Choice of detergent

<table>
<thead>
<tr>
<th>Soil</th>
<th>solubility</th>
<th>ease of removal</th>
<th>change on heating</th>
<th>best detergent</th>
</tr>
</thead>
<tbody>
<tr>
<td>protein</td>
<td>water</td>
<td>difficult</td>
<td>denatures, more tenacious</td>
<td>chlorinated alkaline</td>
</tr>
<tr>
<td>fats / oils</td>
<td>water</td>
<td>difficult</td>
<td>polymerization more difficult to clean</td>
<td>alkaline</td>
</tr>
<tr>
<td>carbohydrates</td>
<td>water</td>
<td>easy</td>
<td>caramelization, more difficult to clean</td>
<td>alkaline</td>
</tr>
<tr>
<td>mineral salts</td>
<td>variable water insolvibility</td>
<td>variable</td>
<td>generally easy</td>
<td>acid</td>
</tr>
</tbody>
</table>
Sanitizers

Classification of sanitizers

- **Sanitizers**
  - Oxidizing
    - Chlorine compounds
    - Iodine Compounds
    - Ozone
    - Acids
  - Non-Oxidizing
    - Quaternary ammonium compounds
The ideal chemical sanitizer should:

1. be approved for food contact surface application
2. have a wide range or scope of activity.
3. destroy microorganisms rapidly.
4. be stable under all types of conditions.
5. be tolerant of a broad range of environmental conditions.
6. be readily solubilized and possess some detergency.
7. be low in toxicity and corrosivity.
8. be inexpensive.

**Factors affecting efficacy**

- Contact time
- Temperature
- Concentration
- pH
- Nature of “soil”
- Compatibility with detergents
Specific sanitizer safety problems include:

1. Strong acids and alkalis are highly corrosive to skin, and should not be sprayed in plants.
2. Sodium hydroxide reacts with aluminum to form hydrogen gas. Hydrogen gas is explosive at a 4% concentration level.
3. Chlorine gas is a deadly poison. Gas cylinders must be handled carefully, stored securely, and kept away from heat.
4. Liquid chlorine solutions are highly corrosive.
5. Mixing a chlorine sanitizer with acid generates chlorine gas.
6. Mixing sodium hypochlorites with quaternary ammonium compounds generates heat and nitrogen chloride (explosive).
Thank you