**Preparation of a Hand Cream**

**BACKGROUND**

Hand creams are formulated to carry out a variety of cosmetic functions. Among these are softening the skin and preventing dryness; elimination of natural waste products (oils) by emulsification; and cooling the skin by radiation, thus helping to maintain body temperature. In addition, hand creams must have certain ingredients that aid spreadability and provide body. In many cases added fragrance improves the odor, and in some special cases medications combat assorted ills.

The basic hand cream formulations all contain water to provide moisture and lanolin, which helps its absorption by the skin. The latter is a yellowish wax. Chemically, wax is made of esters of long-chain fatty acids and long-chain alcohols. Lanolin is usually obtained from sheep wool; it has the ability to absorb 25-30% of its own weight of water and to form a fine emulsion. Mineral oil, which consists of high-molecular-weight hydrocarbons, provides spreadability. In order to allow nonpolar substances, such as lanolin and mineral oil, to be uniformly dispersed in a polar medium, water, one needs strong emulsifying agents. An emulsifying agent must have nonpolar, hydrophobic portions to interact with the oil and also polar, hydrophilic portions to interact with water. A mixture of stearic acid and triethanolamine, through acid-base reaction, yields the salt that has the requirements to act as an emulsifying agent.

Besides the above five basic ingredients, some hand creams also contain alcohols, such as propylene glycol (1,2-propanediol), and esters, such as methyl stearate, to provide the desired texture of the hand cream.

In this experiment you will prepare four hand creams using the combination of ingredients as shown in Table 35.1.

1. To learn the method of preparing a hand cream.

2. To appraise the function of the ingredients in the hand cream.
Table 35.1 *Recipes to Prepare Hand Creams*

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Sample 1</th>
<th>Sample 2</th>
<th>Sample 3</th>
<th>Sample 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>12.5 mL</td>
<td>12.5 mL</td>
<td>12.5 mL</td>
<td>12.5 mL</td>
</tr>
<tr>
<td>Triethanolamine</td>
<td>0.5 mL</td>
<td>0.5 mL</td>
<td>0.5 mL</td>
<td></td>
</tr>
<tr>
<td>Propylene glycol</td>
<td>0.25 mL</td>
<td>0.25 mL</td>
<td>0.25 mL</td>
<td>0.25 mL</td>
</tr>
<tr>
<td>Stearic acid</td>
<td>2.5 g</td>
<td>2.5 g</td>
<td>2.5 g</td>
<td>2.5 g</td>
</tr>
<tr>
<td>Methyl stearate</td>
<td>0.25 g</td>
<td>0.25 g</td>
<td></td>
<td>0.25 g</td>
</tr>
<tr>
<td>Lanolin</td>
<td>2 g</td>
<td>2 g</td>
<td>2 g</td>
<td>2 g</td>
</tr>
<tr>
<td>Mineral oil</td>
<td>2.5 mL</td>
<td>2.5 mL</td>
<td>2.5 mL</td>
<td>2.5 mL</td>
</tr>
</tbody>
</table>

**PROCEDURE**

**Preparation of the Hand Creams**

For each sample in Table 35.1, assemble the ingredients in two beakers. Beaker 1 contains the polar ingredients, and beaker 2 contains the nonpolar contents.

1. To prepare sample 1, put the nonpolar ingredients in a 50-mL beaker (beaker 2) and heat it in a water bath. The water bath can be a 400-mL beaker half-filled with tap water and heated with a Bunsen burner (Figure 35.1). Carefully hold the beaker with crucible tongs in the boiling water until all ingredients melt. As an alternative, use hot plates instead of a Bunsen burner.

2. In the same water bath, heat the 100-mL beaker (beaker 1) containing the polar ingredients for about 5 min. Remove the beaker and set it on the bench top.

3. Into the 100-mL beaker containing polar ingredients, slowly pour the contents of the 50-mL beaker that holds the molten nonpolar ingredients (Figure 35.2). Stir the mixture for 5 min. until you have a smooth uniform paste.

4. Repeat the same procedure in preparing the other three samples.
Characterization of the Hand Cream Preparations

1. Test the pH of the hand creams prepared using a wide-range pH paper.

2. Rubbing a small amount of the hand cream between your fingers, test for smoothness and homogeneity. Also note the appearance. Record your observations on the Report Sheet.

3. Dispose of your hand cream preparations in the waste containers provided. **DO NOT** place them in the sink.

- Bunsen burner
- Lanolin
- Stearic acid
- Methyl stearate
- Mineral oil
- Triethanolamine
- Propylene glycol
- pHydron paper
EXPERIMENT 35

Pre-Lab Questions

1. Write the structural formula of propylene glycol, 1,2-propanediol. Why is it classed as an alcohol? Is it a polar molecule?

2. An emulsion agent was used in the hand cream. Explain its purpose.

3. How is the structure of the emulsion agent similar to that of a soap?

4. Some hand creams use methyl stearate in their formulation. Why is it there? What functional group is present in the molecule? Write the structure of methyl stearate. Can it be effective as an emulsifying agent?
# Report Sheet

## Characterization of the hand cream samples

<table>
<thead>
<tr>
<th>Properties</th>
<th>Sample 1</th>
<th>Sample 2</th>
<th>Sample 3</th>
<th>Sample 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoothness</td>
<td></td>
<td></td>
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<tr>
<td>Homogeneity</td>
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<tr>
<td>Appearance</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>
Post-Lab Questions

1. In comparing the properties of the hand creams you produced, ascertain the function of each of the missing ingredients in the hand cream:
   a. Mineral oil
   b. Triethanolamine
   c. Methyl stearate and propylene glycol

2. The emulsion agent, a salt, was prepared from two chemicals.
   a. Write the structure of stearic acid.
   b. Write the structure of triethanolamine.
   c. Write the structure of the salt.
   d. In the above salt, label the hydrophobic part of the salt and the hydrophilic part.

3. What evidence do you have from your preparations that suggests that the emulsifying agent is a necessary component of hand creams?

4. Was the pH of all your samples of hand cream the same? Which one differed? Explain why there was a difference.

5. Two ingredients are necessary in order for a substance to be called a hand cream. What are they and why are they included?