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MADE AVAILABLE AGRICULTURAL AND HOUSEHOLD WASTES CAN INCREASE CLEANLINESS IN RURAL AREA

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In some areas of the world, soap is too expensive for many people to afford. For these people an alternative exists. They can make their own soap. In general, soap is made by the reaction of triglycerides and caustic soda. However, caustic soda, too, may be difficult to find or too expensive. The aim of this project is to develop a process for making soap from readily available agricultural and household waste materials, and other inexpensive chemicals. This process, which could be easily adapted to a kitchen or even a fireplace. The most difficult challenge not yet addressed completely is the isolation of strong enough bases from ashes to provide an efficient conversion of fat to soap.

Soaps are made from animal fats or vegetable oils by saponification with strong base. The simple soaps can be isolated as cakes or bars, or it can be used as a lather solution. Many reaction conditions were studied to develop a recommended process that can be done using heating and reaction conditions that can be performed in a kitchen or a fireplace. The soaps from this project were characterized primarily using infrared spectrometry and several other analytical techniques as well as tests to show their effectiveness.

**Materials**

- Fat
- Potassium hydroxide
- Sodium hydroxide
- Water
- Lye solution
- Fats & oils
- Ashes
- Oval glass container
- Saucepan
- Strong plastic or wooden spoon
- Large enamel or stainless steel saucepan
- Rubber gloves and eye protection
- Soap mould
- Test tubes
- Phenolphthalein indicator
- Atomic absorption spectrophotometer

**Preparation of Fats & Oils**

Cut the fat from meat and wash it with clean cold water. Cut it in small pieces and place it in the oven for several hours at 100°C and let them cool. Place the peels in the open combustion pan and heat until ignited. When heating, make sure to mix them to ensure uniform combustion. Heat until the ashes turn to a light gray color. This process may take 4-5 hours.

Add the potassium hydroxide. Heat the lye solution to 50°C on a stove. Melt the fat in a saucepan and bring it to 50°C on the stove. Then add the lye solution to the fat, stirring clockwise. Maintain the temperature about 45°C. After heating, the soap solution becomes thicker. Filter the oil to remove particles from the solution using the pressing operation and save the oil.

**Preparation of Soap**

Melt the fat in the meat and add ash. Heat the fat until the fat is melted. Add water. Mix well. Heat the mixture to a temperature of 45°C. After heating, the soap solution becomes thicker. Filter the oil to remove particles from the solution using the pressing operation and save the oil.

**Table 1. Titration Results**

<table>
<thead>
<tr>
<th>Tube</th>
<th>Initial HCl (ml)</th>
<th>Final HCl (ml)</th>
<th>Total (ml)</th>
<th>Weight of NaOH (g)</th>
<th>Moles of HCl</th>
<th>Moles of NaOH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.02g</td>
<td>0.00g</td>
<td>0.00g</td>
</tr>
<tr>
<td>2</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.02g</td>
<td>0.00g</td>
<td>0.00g</td>
</tr>
<tr>
<td>3</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.02g</td>
<td>0.00g</td>
<td>0.00g</td>
</tr>
<tr>
<td>4</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.02g</td>
<td>0.00g</td>
<td>0.00g</td>
</tr>
</tbody>
</table>

**Discussion**

The soap made from wood ash & bacon fat was the hardest soap. The other soaps have higher pH. The foam formation was observed in soap made from ash from truffle alkali.

**Acknowledgments**

The soap produced using 0.1M sodium hydroxide solution as the lye and the ash from truffle tract could be made for domestic use. Soaps were made in this project could be safe on human skin. The infrared spectra show that the soaps made in this project could be safe on human skin. The infrared spectra show that the soaps made in this project could be safe on human skin. The infrared spectra show that the soaps made in this project could be safe on human skin. The infrared spectra show that the soaps made in this project could be safe on human skin. The infrared spectra show that the soaps made in this project could be safe on human skin. The infrared spectra show that the soaps made in this project could be safe on human skin. The infrared spectra show that the soaps made in this project could be safe on human skin. The infrared spectra show that the soaps made in this project could be safe on human skin. The infrared spectra show that the soaps made in this project could be safe on human skin.

**Soap Recipe**

Ingredients:

- 100g of molten fat
- 0.1M of sodium hydroxide solution
- 0.1M of potassium hydroxide solution

Add the sodium hydroxide to the fat, stirring slowly until dissolved. Heat the solution to 50°C in a saucepan. Melt the fat in the fat, stirring slowly. Maintain the temperature at 45°C to 50°C and stir for 45 minutes until the soap shows a trace. Pour it into a clean mould and leave to set for 2 days. Then release it from the mould and leave it to cure for 2 to 3 weeks.

**Table 2. Data for Soap Samples**

<table>
<thead>
<tr>
<th>Soap Sample</th>
<th>pH of Test Tube</th>
<th>Lather</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dove soap (control)</td>
<td>4.5</td>
<td>Strong</td>
</tr>
<tr>
<td>Soap made from corn oil</td>
<td>4.5</td>
<td>Strong</td>
</tr>
<tr>
<td>Soap made from bacon fat</td>
<td>4.5</td>
<td>Strong</td>
</tr>
<tr>
<td>Soap made from cotton seeds oil</td>
<td>4.5</td>
<td>Strong</td>
</tr>
<tr>
<td>Soap made from shortening</td>
<td>4.5</td>
<td>Strong</td>
</tr>
<tr>
<td>Soap made from banana ash solution</td>
<td>4.5</td>
<td>Strong</td>
</tr>
<tr>
<td>Soap made from ash</td>
<td>4.5</td>
<td>Strong</td>
</tr>
</tbody>
</table>

**Test Tubes for Foam Test**

1. 2% solution
2. 1% solution
3. 0.5% solution
4. 0.1% solution

**Infrared Spectrum of Soap Made from Cottonseed Oil**

The results in Table 2 shows:

- The pH of soap made from 100g of bacon, bacon fat, and cotton oil (pH 12) is the highest. This is due to the presence of potassium ions in the ashes. In this reduced the carbonate solubility and hence could reduce soap formation. Also, it could be the result of the reaction of the soap with alcohols. What makes soap as a control, the result gives the possibility of that soap's composition.

The soap made from wood ash & bacon fat was the hardest soap. The other soaps have higher pH. The foam formation was observed in soap made from ash from truffle alkali.

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