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MAKING SOAP FROM READILY AVAILABLE AGRICULTURAL AND HOUSEHOLD WASTES CAN INCREASE CLEanness IN RURAL AREA

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In rural parts of wealthy counties and in many poor countries, soap is expensive and/or not readily available. To address this need, this project was initiated. The goal was to develop a process for making soap that could be shared with impoverished people, so that they could make their own soap. Although the tools used were typical chemical laboratory equipment, the process 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.

PREPARATION OF FATS

Cut the fat from meat and wash it with cold clean water. Cut it in small pieces and place it in a cooking pan with water to fill the pan. Heat the water, evaporate the water, then heat and continue heating slowly until the fat melts out. Pour the oil into a container and save it at room temperature for several weeks before using it to make soap. Another method is fry the bacon in the frying pan and pour the oil after it has cooled to a safe temperature into a glass or metal container. A similar process can be used for any fat.

Alkali extraction; for extracting high concentration of base, make sure the particle size is small about 0.16cm, dissolve 150g of ashes in 250 milliliters of rainwater or distilled water or rain water, animal fats or vegetable oil, sodium hydroxide (NaOH) or potassium hydroxide (KOH). The soaps from this project were characterized primarily using infrared spectroscopy and several other analytical techniques as well as tests to show their effectiveness.

**General Reaction**

When fats or oils are treated with strong bases such as sodium hydroxide (NaOH) or potassium hydroxide (KOH), they undergo saponification to form glycerol and soap (the salt of the long chain fatty acid) (etabelli in 2000).

\[
\begin{align*}
\text{C}_n\text{H}_{2n+1}\text{COO}^- + \text{NaOH}\rightarrow \text{C}_n\text{H}_{2n+1}\text{COONa}^- + \text{H}_2\text{O} \\
\text{C}_n\text{H}_{2n+1}\text{COO}^- + \text{KOH}\rightarrow \text{C}_n\text{H}_{2n+1}\text{COOK}^- + \text{H}_2\text{O}
\end{align*}
\]

**Table 1. Titration Results**

<table>
<thead>
<tr>
<th>Initial HCl</th>
<th>Final HCl</th>
<th>Total</th>
<th>Weight of NaOH</th>
<th>Weight of KOH</th>
<th>Moles of NaOH</th>
<th>Moles of KOH</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00ml</td>
<td>0.00ml</td>
<td>0.00g</td>
<td>0.00g</td>
<td>0.00g</td>
<td>0.00mol</td>
<td>0.00mol</td>
</tr>
</tbody>
</table>

**Table 2. Data for Soap Samples**

<table>
<thead>
<tr>
<th>Foaming Test</th>
<th>pH of Test Tube</th>
<th>Lather</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Very strong</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Strong</td>
<td></td>
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<tr>
<td>7</td>
<td>Strong</td>
<td></td>
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<tr>
<td>8</td>
<td>Strong</td>
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<td>9</td>
<td>Strong</td>
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<td>Strong</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Strong</td>
<td></td>
</tr>
</tbody>
</table>

**Table 1** shows the titrations of 15g of banana ashes and wood ashes dissolved in 100ml of distilled water and titrated against 0.1M HCl by using three drops of phenolphthalein. The 0.02g NaOH and 0.03g KOH in wood ashes based on calculation assuming all the base comes from NaOH and KOH in the same ash are based on ICPCP data for NaOH and KOH.

**Table 2** shows the end point of soaps made from different fats and oils. The pH of soaps made from 100g of beef, bacon fat and corn oil with 12g of NaOH have same pH as Dove soap from Rite Aid Drug Store. The other soaps have higher pH or foam formed on soaps made from ash as: 

**Soap Recipe**

Ingredients For a Traditional Animal Fat Soap For a simple example if you want to make a 1 bar of soap

100g of fat

12g of sodium hydroxide (NaOH) or 1g of potassium hydroxide (KOH) 0.1 ml of distilled water or rain water

**Preparation of the basis**

Heat the lye solution on a stove. Melt the fat in a saucepan and bring it to 50°C on the stove. Blend the lye solution into the fat, stirring constantly. Maintain the temperature at 45°C to 50°C and stir for 5 minutes until the soap shows tracing. Then pour it into a clean mold and leave it to set for 2 days. Then release it from the mold and leave it to cure for 5 weeks.

**S: AP RECIPE**

Materials Add the a. h in the water, min careful until dissolved. 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. Blend the lye solution into the fat, stirring constantly. Maintain the temperature at 45°C to 50°C and stir for 5 minutes until the soap shows tracing. Then pour it into a clean mold and leave it to set for 2 days. Then release it from the mold and leave it to cure for 5 weeks.

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

Absorbance typical of alkali metal carbonate ylates.

**Conclusion**

The soap used in Tanzania is not effective as soap made from pure sodium hydroxide. The soap made from pure sodium hydroxide with animal fat extracted in the kitchen, corn oil, and very strong NaOH, too, may be difficult to find or too expensive. The soap produced used 0.1 sodium hydroxide (NaOH) solution was hard and gave the most foam in our foam test. The ash alkali soap had a harder consistency. The difference in lather and soap effectiveness between the pure sodium hydroxide; lye and the ash-based trialkali soap could be accounted for the presence of other metallic ions in the ashes.

The foam ability of the pure sodium hydroxide soap was very different from that of the ash-based trialkali soap (Table 2). This could be caused by the presence of calcium ions in the ash which reduced the carbonate solubility and hence could reduce soap foam formation. Also, it could be the result of low concentration of ash or trialkali, which was not as effective as the pure sodium hydroxide soap. The results in Table 2 shows the pH and the foam formation in different soaps made from different fats and vegetable oils. By using Dove as a control, the results give the possibility of that, soaps made in this project could be safe on human skin. The infrared spectra show absorptions typical of alkali metal carbonates.

**References**


**Acknowledgments**

Thanks to Dr. Kenneth Frost for being such a terrific mentor of my project, Chad Schwietert for laboratory chemical supplies, photos, and equipment, and Dr. Sibdas Ghosh, chair of Science and Mathematics of Dominican University of California.