Production of Eco Friendly Fabric Softener

Greeshma Nair¹, Yashrajsinh Jadeja², Milan Donga³, Dhaval Vaghasiya⁴, Viraj Vora⁵

¹,²,³,⁴,⁵Department of Chemical Engineering, SAL College of Engineering
Opp. Science City, Sola Kalol Road, Ahmedabad-380060
Phone: 079-65229333;
¹greeshma.nair@sal.edu.in

ABSTRACT
A fabric softener is a liquid composition added during the manufacturing of fabric to make clothes feel better to the touch. The fabric softeners were first developed by the textile industry during the 20th century. During that time the process which was used for dyeing the cotton fibres left them feeling rough and harsh. In the early 1900s, preparations known as cotton softeners were developed to improvise the feeling of fibres post dyeing. A typical cotton softener consisted of seven parts water, three parts soap and one part olive, corn or tallow oil.

In conventional process of making fabric softener, tallow is used as one of the primary raw materials which impart all the required properties to fabric. However, the same is found to be the cause of certain skin diseases like irritant dermatitis. In order to overcome this issue and other pertaining limitations of the tallow, replacement of the tallow with other materials/chemicals is being studied upon. Thus the work done is this project aims at testing the use of alternative raw material for synthesizing the cationic and non-ionic forms of softener having the same or better properties qualitatively or quantitatively on the fabric.

Keywords: Cationic Softener, Mutton Tallow, Eco-friendly Softener

INTRODUCTION
Fabric softeners are added during the rinsing rather than the wash cycle because they can interfere with detergent’s cleansing action. In addition to fabric softening chemicals, fabric softeners may include acids or bases to maintain optimal pH for absorption, silicone-based anti-foaming agents, emulsion stabilizers, fragrances and colours.

Today as the world is developing fast, intense stress is also being laid on developing aids which not only makes our lives easy but also help in maintaining a sustainable environment around. While discussing the synthesis of fabric softeners by the conventional production method used so far it becomes important to highlight its various limitations viz. bad odour, unhygienic conditions for procurement and use in the process and the resultant effects of various skin diseases in the user of the fabric treated with the aforementioned softener.
The effluent of the process stream wherein the fabric treated with the softener is also found to be exceeding the toxicity limit which is harmful to the fish, algae and other small invertebrates; thereby harming the ecological balance. Thus going by this, the conventional method of production of the softener is under scrutiny in order to reduce the harmful effects discussed herein.

PROPOSED MODIFICATION
The proposed change in the current synthesis procedure is to replace the major problem causing raw material- Mutton Tallow with some other compound which may not only treat the problems associated to the processing but also to the after process disposal and treatment of the waste stream containing the traces of the softener used.

**Alternate Raw Material for Cationic softener**
Alternative replacements for cationic softeners are as mentioned below:

1.) Pine Oil
2.) Glycerol
3.) Castor Oil
4.) Vegetable Oil
5.) Coconut Oil

The above-mentioned alternates were selected based on their physical and chemical properties which are similar to tallow.

![Figure 1: Conventional Production Method of Fabric Softener using Mutton Tallow](image)
PROCEDURE OF MODIFIED PROCESS

1. Weigh proposed raw material and add into closed vessel.
2. Heat up the raw material at 40-45°C till it gets an oil like appearance.
3. Weigh appropriate quantity of Di-ethylene tri-amine (DETA).
4. After attaining the temperature about 40-45°C start adding Di-ethylene tri-amine in solution in closed vessel, after adding Di-ethylene tri-amine close the vessel properly from top.
5. Heat the solution at a temperature 100°C for up to 45-60 min.
6. After heating keep the solution open for one day.
7. On second day take boiled water in vessel and add it to the cold solution and start stirring it.
8. After proper mixing of solution, make the solution neutral by using acetic acid as per requirement.
9. After neutralization of solution the softener is ready to use.

10. Further, the softener is mixed with cationic starch and it is applied on cotton fabric.

The observed data after multiple trials using different samples have been recorded below.

### Table 1: Observation Data of Experimental Trials

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Weight of Raw Material</th>
<th>Price of Raw Material (in Rupees)</th>
<th>Actual Cost of Prepared Sample (in Rupees)</th>
<th>Cost of Product (1 Litre) (in Rupees)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Raw Material 1</td>
<td>Raw Material 2</td>
<td>Raw Material 3</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>300 ml Coconut Oil</td>
<td>120 ml DETA</td>
<td>1500 ml Water</td>
<td>54</td>
</tr>
<tr>
<td>2</td>
<td>90 gm Vegetable Ghee</td>
<td>25 ml DETA</td>
<td>400 ml Water</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Equal Ratio of Coconut Oil and Vegetable Ghee</td>
<td>72.5 ml DETA</td>
<td>950 ml Water</td>
<td>31.5</td>
</tr>
<tr>
<td>4</td>
<td>47 ml Castor Oil</td>
<td>14 ml DETA</td>
<td>200 ml Water</td>
<td>7.99</td>
</tr>
</tbody>
</table>

### Table 2: Characterization Data of Different Samples of Softener Prepared using different Raw materials

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Parameter</th>
<th>Tallow</th>
<th>Coconut Oil</th>
<th>Vegetable Ghee</th>
<th>Equal Ratio of Coconut Oil and Vegetable Ghee</th>
<th>Castor Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Softener Colour</td>
<td>Light Brown</td>
<td>Light Cream</td>
<td>Creamish White</td>
<td>Yellowish White</td>
<td>Milky White</td>
</tr>
<tr>
<td>2</td>
<td>Slurry Colour</td>
<td>Brown</td>
<td>Dark Cream</td>
<td>Light Cream</td>
<td>White</td>
<td>Light Cream</td>
</tr>
<tr>
<td>3</td>
<td>Concentration(% w/w)</td>
<td>20</td>
<td>22</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>Raw Material(% w/w)</td>
<td>15</td>
<td>20</td>
<td>15</td>
<td>15.35</td>
<td>17.5</td>
</tr>
<tr>
<td></td>
<td>Di-ethylene Tri-amine(%w/w)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5.7</td>
<td>2.5</td>
</tr>
<tr>
<td>6</td>
<td>Water(%w/w)</td>
<td>80</td>
<td>76</td>
<td>79</td>
<td>77.95</td>
<td>79</td>
</tr>
<tr>
<td>7</td>
<td>Acetic Acid(%w/w)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>pH</td>
<td>7.2</td>
<td>7.5</td>
<td>7.8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>Yield%</td>
<td>97</td>
<td>95.12</td>
<td>95.14</td>
<td>94</td>
<td>70</td>
</tr>
<tr>
<td>10</td>
<td>Solubility in Water</td>
<td>Completely Soluble</td>
<td>Completely Soluble</td>
<td>Insoluble</td>
<td>Partly Soluble</td>
<td>Partly Soluble</td>
</tr>
<tr>
<td>11</td>
<td>Cost (Rs/lt)</td>
<td>115</td>
<td>63</td>
<td>61.91</td>
<td>103.84</td>
<td>103.84</td>
</tr>
</tbody>
</table>

Figure 3: % Yield for Samples prepared using alternative Raw Materials

Figure 4: No. of Wash Cycles required for Samples prepared using alternative Raw Materials
CONCLUSION
From the depicted results coconut oil is found to be preferablenevelopment. Coconut oil is found to be nourishing for the skin. It is skin friendly. Processing a fabric with the coconut oil softener also saves utilities in terms of electricity cost and the amount of water used for washing. Based on the property and cost analysis of the softener prepared with different materials it is seen that coconut oil based softener is more economically feasible, hygienic and environment friendly as compared to the conventional methodology. Cost of coconut oil based softener is less compared to cationic fabric softener i.e. 115 Rs/litre.

The other solutions offered on the basis of the experimental results are the softeners formed using a 50-50 % of the vegetable ghee and coconut oil and that of the castor oil. The mixed composition containing softener prepared was also found to be a productive choice given the parameters of its properties and the cost. The issue of the partial solubility may be solved by

ACKNOWLEDGEMENT
We are pleased to know that the Department of Chemical Engineering, SAL College of Engineering is helping us to publish our research paper in the journal “IJAER”. We also extend our gratitude to the Department for the same.

DECLARATION
We also declare that the presented work is done by us. We publish our paper “Production of Eco-Friendly Fabric Softener” in the above said journal at our sole responsibility and resolve the issues if raised any time at ourselves.

REFERENCES


