The recovered products from the industrial waste streams viz. liquid bromine, sodium bromide, potassium bromide, potassium bromate and n-propyl bromide were evaluated by us as well as by the third parties. The analyses as per Indian Standard (111, 112, 113), AnalaR (114) and OSHA (115) specifications respectively by all concerned are summarized below in Table-28.
### 3.1 Summary of analytical evaluation

**TABLE- 28**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Title</th>
<th>Reference table No. of chapter-3</th>
<th>Table No. this chapter</th>
<th>Analyzed by</th>
<th>Code No. given if any</th>
<th>Analyses reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bromine recovered from effluent-A₁</td>
<td>15(a)</td>
<td>29</td>
<td>In house</td>
<td>-</td>
<td>111</td>
</tr>
<tr>
<td>2</td>
<td>Bromine recovered from effluent-A₁</td>
<td>15(a)</td>
<td>30</td>
<td>Third party</td>
<td>15(b)4</td>
<td>111</td>
</tr>
<tr>
<td>3</td>
<td>Bromine recovered from effluent-A₂</td>
<td>15(a)</td>
<td>31</td>
<td>Third party</td>
<td>15(b)10</td>
<td>111</td>
</tr>
<tr>
<td>4</td>
<td>Bromine recovered from effluent-A₂</td>
<td>16(a)</td>
<td>32</td>
<td>In house</td>
<td>-</td>
<td>111</td>
</tr>
<tr>
<td>5</td>
<td>Bromine recovered from effluent-A₂</td>
<td>16(a)</td>
<td>33</td>
<td>Third party</td>
<td>16(b)8</td>
<td>111</td>
</tr>
<tr>
<td>6</td>
<td>Bromine recovered from effluent-A₃</td>
<td>17(a)</td>
<td>34</td>
<td>In house</td>
<td>-</td>
<td>111</td>
</tr>
<tr>
<td>7</td>
<td>Bromine recovered from effluent-A₃</td>
<td>17(a)</td>
<td>35</td>
<td>Third party</td>
<td>17(b)5</td>
<td>111</td>
</tr>
<tr>
<td>8</td>
<td>Bromine recovered from effluent-A₃</td>
<td>17(a)</td>
<td>36</td>
<td>Third party</td>
<td>17(b)8</td>
<td>111</td>
</tr>
<tr>
<td>9</td>
<td>Bromine recovered from effluent-C₁</td>
<td>18(a)</td>
<td>37</td>
<td>In house</td>
<td>-</td>
<td>111</td>
</tr>
<tr>
<td>10</td>
<td>Bromine recovered from effluent-C₁</td>
<td>18(a)</td>
<td>38</td>
<td>Third party</td>
<td>18(b)6</td>
<td>111</td>
</tr>
<tr>
<td>11</td>
<td>Sodium bromide from recovered bromine from effluent-A₁, A₂, A₃ and C₁</td>
<td>19(a)</td>
<td>39</td>
<td>In house</td>
<td>-</td>
<td>112</td>
</tr>
<tr>
<td>12</td>
<td>Sodium bromide from recovered bromine from effluent-A₁, A₂, A₃ and C₁</td>
<td>19(a)</td>
<td>40</td>
<td>Third party</td>
<td>19(b)9</td>
<td>112</td>
</tr>
<tr>
<td>13</td>
<td>Sodium bromide recovered directly from effluent-A₂ and effluent-A₃</td>
<td>20(a)</td>
<td>41</td>
<td>In house</td>
<td>-</td>
<td>112</td>
</tr>
<tr>
<td>14</td>
<td>Sodium bromide recovered directly from effluent-A₂ and effluent A₃</td>
<td>20(a)</td>
<td>42</td>
<td>Third party</td>
<td>20(b)4</td>
<td>112</td>
</tr>
<tr>
<td>15</td>
<td>Sodium bromide recovered directly from effluent-A₂ and effluent-A₃</td>
<td>20(a)</td>
<td>43</td>
<td>Third party</td>
<td>20(b)9</td>
<td>112</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Title</td>
<td>Reference table No. of chapter-3</td>
<td>Table No. this chapter</td>
<td>Analyzed by</td>
<td>Code No. given if any</td>
<td>Analyses reference</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------</td>
<td>---------------------------------</td>
<td>-----------------------</td>
<td>--------------</td>
<td>----------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>16</td>
<td>Potassium bromide from recovered bromine of effluent-A₁, A₂, A₃ and C₁</td>
<td>21(a)</td>
<td>44</td>
<td>In house</td>
<td></td>
<td>113</td>
</tr>
<tr>
<td>17</td>
<td>Potassium bromide from recovered bromine of effluent-A₁, A₂, A₃ and C₁</td>
<td>21(a)</td>
<td>45</td>
<td>Third party</td>
<td>21(b)2</td>
<td>113</td>
</tr>
<tr>
<td>18</td>
<td>Potassium bromide from recovered bromine of effluent-A₁, A₂, A₃ and C₁</td>
<td>21(a)</td>
<td>46</td>
<td>Third party</td>
<td>21(b)10</td>
<td>113</td>
</tr>
<tr>
<td>19</td>
<td>Potassium bromate recovered chemically from recovered bromine of effluent-A₁, A₂, A₃ and C₁</td>
<td>22(a)</td>
<td>47</td>
<td>In house</td>
<td></td>
<td>114</td>
</tr>
<tr>
<td>20</td>
<td>Potassium bromate recovered chemically from recovered bromine of effluent-A₁, A₂, A₃ and C₁</td>
<td>22(a)</td>
<td>48</td>
<td>Third party</td>
<td>22(b)7</td>
<td>114</td>
</tr>
<tr>
<td>21</td>
<td>Potassium bromate recovered chemically from recovered bromine of effluent-A₁, A₂, A₃ and C₁</td>
<td>22(a)</td>
<td>49</td>
<td>Third party</td>
<td>22(b)3</td>
<td>114</td>
</tr>
<tr>
<td>22</td>
<td>Potassium bromide recovered from the mother liquor of potassium bromate</td>
<td>23(a)</td>
<td>50</td>
<td>In house</td>
<td></td>
<td>113</td>
</tr>
<tr>
<td>23</td>
<td>Potassium bromide recovered from the mother liquor of potassium bromate</td>
<td>23(a)</td>
<td>51</td>
<td>Third party</td>
<td>23(b)9</td>
<td>113</td>
</tr>
<tr>
<td>24</td>
<td>n-propyl bromide from effluent-B₁</td>
<td>27</td>
<td>52</td>
<td>In House</td>
<td></td>
<td>115</td>
</tr>
<tr>
<td>25</td>
<td>n-propyl bromide from effluent-B₁</td>
<td>27</td>
<td>53</td>
<td>Third party</td>
<td>27(b)2</td>
<td>115</td>
</tr>
<tr>
<td>26</td>
<td>n-propyl bromide from effluent-B₁</td>
<td>27</td>
<td>54</td>
<td>Third party</td>
<td>27(b)5</td>
<td>115</td>
</tr>
</tbody>
</table>
3.2.1 Analysis of bromine recovered from effluent-A1

**TABLE- 29**

<table>
<thead>
<tr>
<th>Batch No.</th>
<th>Bromine % by mass</th>
<th>Chlorine (as Cl) % by mass</th>
<th>Non Volatile matter % by mass</th>
<th>Iodine (as I) % by mass</th>
<th>Sulphates (as SO₄) % by mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99.22</td>
<td>0.20</td>
<td>0.03</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>2</td>
<td>99.53</td>
<td>0.15</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>3</td>
<td>99.38</td>
<td>0.17</td>
<td>0.03</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>4</td>
<td>98.90</td>
<td>0.30</td>
<td>0.03</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>5</td>
<td>99.06</td>
<td>0.20</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>6</td>
<td>99.53</td>
<td>0.17</td>
<td>0.01</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>7</td>
<td>99.69</td>
<td>0.10</td>
<td>0.01</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>8</td>
<td>99.22</td>
<td>0.20</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>9</td>
<td>99.38</td>
<td>0.15</td>
<td>0.01</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>10</td>
<td>99.22</td>
<td>0.20</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
</tbody>
</table>

**NOTE:**

1. The analyses done as per IS 2142.
2. Sample of Batch No.4 and Batch No.10 given to third party for analysis with a code no. 15(b) 4 & 15(b) 10 respectively.
3.2.2 Analysis of bromine recovered from effluent-A1

**TABLE- 30**

| Analysis carried out and certified by | Third party * |
| Certificate issued to | Hardik Jadeja, Department of chemistry, Bhavnagar University, Bhavnagar. |

**Particulars of sample submitted**

| Nature | Liquid bromine |
| Batch No. | 15(b) 4 |
| Quantity | 15 ML. |
| Packing | Bottle packing |
| Third party reference No | 05633/06-07 |
| Date | 24-06-2006 |
| Method of analysis | As per IS: 2142-1992 |

**Test Report**

| Description | Reddish-brown coloured, fuming liquid. |
| Bromine % by mass | 99.50 (Limit: Min. 98.50) |
| Chlorine (as Cl) % by mass | 00.42 (Limit: Max. 00.50) |
| Non Volatile matter % by mass | 00.008 (Limit: Max. 00.05) |
| Iodine (as I) % by mass | 00.05 (Limit: Max. 00.05) |
| Sulphates (as SO₄) % by mass | 00.015 (Limit: Max. 00.015) |

* Choksi Laboratories Limited, Indore.
### 3.2.3 Analysis of bromine recovered from effluent-A<sub>1</sub>

**TABLE- 31**

Analysis carried out and certified by : Third party *

Certificate issued to : Hardik Jadeja,  
Department of chemistry,  
Bhavnagar University,  
Bhavnagar.

**Particulars of sample submitted**

<table>
<thead>
<tr>
<th>Nature</th>
<th>Liquid bromine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch No.</td>
<td>15(b) 10</td>
</tr>
<tr>
<td>Quantity</td>
<td>20 ML.</td>
</tr>
<tr>
<td>Packing</td>
<td>Bottle packing</td>
</tr>
<tr>
<td>Date</td>
<td>10-07-2006</td>
</tr>
<tr>
<td>Method of analysis</td>
<td>As per IS: 2142-1992</td>
</tr>
</tbody>
</table>

**Test Report**

<table>
<thead>
<tr>
<th>Description</th>
<th>Dark red fuming liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bromine % by mass</td>
<td>99.60</td>
</tr>
<tr>
<td>Chlorine (as Cl) % by mass</td>
<td>00.32</td>
</tr>
<tr>
<td>Non Volatile matter % by mass</td>
<td>00.01</td>
</tr>
<tr>
<td>Iodine (as I) % by mass</td>
<td>00.05</td>
</tr>
<tr>
<td>Sulphates (as SO₄) % by mass</td>
<td>00.015</td>
</tr>
</tbody>
</table>

* Perfect Analytical Laboratories, Bhavnagar.
### 3.3.1 Analysis of bromine recovered from effluent-A$_2$

**TABLE- 32**

<table>
<thead>
<tr>
<th>Batch No.</th>
<th>Bromine % by mass</th>
<th>Chlorine (as Cl) % by mass</th>
<th>Non Volatile matter % by mass</th>
<th>Iodine (as I) % by mass</th>
<th>Sulphates (as SO$_4$) % by mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99.14</td>
<td>0.20</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>2</td>
<td>99.47</td>
<td>0.15</td>
<td>0.03</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>3</td>
<td>99.31</td>
<td>0.17</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>4</td>
<td>99.47</td>
<td>0.15</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>5</td>
<td>99.79</td>
<td>0.10</td>
<td>0.01</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>6</td>
<td>99.14</td>
<td>0.20</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>7</td>
<td>99.31</td>
<td>0.17</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>8</td>
<td>98.82</td>
<td>0.30</td>
<td>0.03</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>9</td>
<td>99.47</td>
<td>0.15</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>10</td>
<td>99.31</td>
<td>0.17</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
</tbody>
</table>

**NOTE:**

1. The analyses done as per IS 2142.
2. Sample of Batch No.8 given to third party for analysis with a code no. 16(b) 8.
### 3.3.2 Analysis of bromine recovered from effluent-A2

#### TABLE- 33

**Analysis carried out and certified by** : Third party *

**Certificate issued to** : Hardik Jadeja,  
Department of chemistry,  
Bhavnagar University,  
Bhavnagar.

**Particulars of sample submitted**

<table>
<thead>
<tr>
<th>Nature</th>
<th>Liquid bromine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch No.</td>
<td>16(b) 8</td>
</tr>
<tr>
<td>Quantity</td>
<td>20 ML.</td>
</tr>
<tr>
<td>Packing</td>
<td>Bottle packing</td>
</tr>
<tr>
<td>Date</td>
<td>10-07-2006</td>
</tr>
<tr>
<td>Method of analysis</td>
<td>As per IS: 2142-1992</td>
</tr>
</tbody>
</table>

**Test Report**

<table>
<thead>
<tr>
<th>Description</th>
<th>Dark red fuming liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bromine % by mass</td>
<td>99.48</td>
</tr>
<tr>
<td>Chlorine (as Cl) % by mass</td>
<td>00.45</td>
</tr>
<tr>
<td>Non Volatile matter % by mass</td>
<td>00.009</td>
</tr>
<tr>
<td>Iodine (as I) % by mass</td>
<td>00.05</td>
</tr>
<tr>
<td>Sulphates (as SO₄) % by mass</td>
<td>00.015</td>
</tr>
</tbody>
</table>

*(Limit: Min. 98.50) (Limit: Max. 00.50) (Limit: Max. 00.05) (Limit: Max. 00.05) (Limit: Max. 00.015)*

* Perfect Analytical Laboratories, Bhavnagar.
### 3.4.1 Analysis of bromine recovered from effluent-A3

**TABLE- 34**

<table>
<thead>
<tr>
<th>Batch No.</th>
<th>Bromine % by mass</th>
<th>Chlorine (as Cl) % by mass</th>
<th>Non Volatile matter % by mass</th>
<th>Iodine (as I) % by mass</th>
<th>Sulphates (as SO₄) % by mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99.20</td>
<td>0.20</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>2</td>
<td>99.52</td>
<td>0.15</td>
<td>0.01</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>3</td>
<td>99.36</td>
<td>0.20</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>4</td>
<td>99.68</td>
<td>0.10</td>
<td>0.01</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>5</td>
<td>99.04</td>
<td>0.25</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>6</td>
<td>99.52</td>
<td>0.15</td>
<td>0.01</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>7</td>
<td>99.68</td>
<td>0.10</td>
<td>0.01</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>8</td>
<td>98.88</td>
<td>0.30</td>
<td>0.03</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>9</td>
<td>99.36</td>
<td>0.20</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>10</td>
<td>99.52</td>
<td>0.15</td>
<td>0.01</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
</tbody>
</table>

**NOTE:**
1. The analyses done as per IS 2142.
2. Sample of Batch No.5 and Batch No.8 given to third party for analysis with a code no. 17(b) 5 & 17(b) 8 respectively.
3.4.2 Analysis of bromine recovered from effluent-A3

<table>
<thead>
<tr>
<th>TABLE- 35</th>
</tr>
</thead>
</table>

Analysis carried out and certified by : Third party *
Certificate issued to : Hardik Jadeja, Department of chemistry, Bhavnagar University, Bhavnagar.

**Particulars of sample submitted**

<table>
<thead>
<tr>
<th>Nature</th>
<th>Liquid bromine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch No.</td>
<td>17(b) 5</td>
</tr>
<tr>
<td>Quantity</td>
<td>15 ML.</td>
</tr>
<tr>
<td>Packing</td>
<td>Bottle packing</td>
</tr>
<tr>
<td>Third party reference No</td>
<td>05634/06-07</td>
</tr>
<tr>
<td>Date</td>
<td>24-06-2006</td>
</tr>
<tr>
<td>Method of analysis</td>
<td>As per IS: 2142-1992</td>
</tr>
</tbody>
</table>

**Test Report**

<table>
<thead>
<tr>
<th>Description</th>
<th>Reddish-brown coloured, fuming liquid.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bromine % by mass</td>
<td>99.52 (Limit: Min. 98.50)</td>
</tr>
<tr>
<td>Chlorine (as Cl) % by mass</td>
<td>0.40 (Limit: Max. 0.50)</td>
</tr>
<tr>
<td>Non Volatile matter % by mass</td>
<td>0.006 (Limit: Max. 0.05)</td>
</tr>
<tr>
<td>Iodine (as I) % by mass</td>
<td>0.05 (Limit: Max. 0.05)</td>
</tr>
<tr>
<td>Sulphates (as SO4) % by mass</td>
<td>0.015 (Limit: Max. 0.015)</td>
</tr>
</tbody>
</table>

* Choksi Laboratories Limited, Indore.
3.4.3 Analysis of bromine recovered from effluent-A3

TABLE- 36

Analysis carried out and certified by : Third party *
Certificate issued to : Hardik Jadeja,  
Department of chemistry,  
Bhavnagar University,  
Bhavnagar.

Particulars of sample submitted

Nature : Liquid bromine
Batch No. : 17(b) 8
Quantity : 20 ML.
Packing : Bottle packing
Date : 10-07-2006
Method of analysis : As per IS: 2142-1992

Test Report

Description : Dark red fuming liquid
Bromine % by mass : 99.50 (Limit: Min. 98.50)
Chlorine (as Cl) % by mass : 00.42 (Limit: Max. 00.50)
Non Volatile matter % by mass : 00.009 (Limit: Max. 00.05)
Iodine (as I) % by mass : 00.05 (Limit: Max. 00.05)
Sulphates (as SO₄) % by mass : 00.015 (Limit: Max. 00.015)

* Perfect Analytical Laboratories, Bhavnagar.
### 3.5.1 Analysis of bromine recovered from effluent-C₁

**TABLE- 37**

<table>
<thead>
<tr>
<th>Batch No.</th>
<th>Bromine % by mass</th>
<th>Chlorine (as Cl) % by mass</th>
<th>Non Volatile matter % by mass</th>
<th>Iodine (as I) % by mass</th>
<th>Sulphates (as SO₄) % by mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99.14</td>
<td>0.20</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>2</td>
<td>99.31</td>
<td>0.20</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>3</td>
<td>99.47</td>
<td>0.15</td>
<td>0.01</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>4</td>
<td>99.31</td>
<td>0.20</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>5</td>
<td>99.79</td>
<td>0.10</td>
<td>0.01</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>6</td>
<td>99.06</td>
<td>0.20</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>7</td>
<td>99.22</td>
<td>0.17</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>8</td>
<td>98.90</td>
<td>0.30</td>
<td>0.03</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>9</td>
<td>99.36</td>
<td>0.20</td>
<td>0.02</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
<tr>
<td>10</td>
<td>99.52</td>
<td>0.15</td>
<td>0.01</td>
<td>&lt;0.05</td>
<td>&lt;0.015</td>
</tr>
</tbody>
</table>

**NOTE:**
1. The analyses done as per IS 2142.
2. Sample of and Batch No. 6 given to third party for analysis with a code no. 18(b) 6.
### 3.5.2 Analysis of bromine recovered from effluent-C<sub>1</sub>

#### TABLE- 38

<table>
<thead>
<tr>
<th>Particulars of sample submitted</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature</td>
<td>Liquid bromine</td>
</tr>
<tr>
<td>Batch No.</td>
<td>18(b) 6</td>
</tr>
<tr>
<td>Quantity</td>
<td>20 ML.</td>
</tr>
<tr>
<td>Packing</td>
<td>Bottle packing</td>
</tr>
<tr>
<td>Date</td>
<td>10-07-2006</td>
</tr>
<tr>
<td>Method of analysis</td>
<td>As per IS: 2142-1992</td>
</tr>
</tbody>
</table>

**Test Report**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark red fuming liquid</td>
<td></td>
</tr>
<tr>
<td>Bromine % by mass</td>
<td>99.68   (Limit: Min. 98.50)</td>
</tr>
<tr>
<td>Chlorine (as Cl) % by mass</td>
<td>00.20   (Limit: Max. 0.05)</td>
</tr>
<tr>
<td>Non Volatile matter % by mass</td>
<td>00.01   (Limit: Max. 0.05)</td>
</tr>
<tr>
<td>Iodine (as I) % by mass</td>
<td>00.05   (Limit: Max. 0.05)</td>
</tr>
<tr>
<td>Sulphates (as SO₄) % by mass</td>
<td>00.015  (Limit: Max. 0.015)</td>
</tr>
</tbody>
</table>

* Perfect Analytical Laboratories, Bhavnagar.
### 3.6.1 Analysis of sodium bromide from recovered bromine from effluent-A1, A2, A3 and C1

**TABLE- 39**

<table>
<thead>
<tr>
<th>Batch No.</th>
<th>NaBr % by Wt. of dried material</th>
<th>Chloride (as Cl) % by Wt.</th>
<th>Bromates (as BrO₃) % by Wt.</th>
<th>Heavy metals (as Pb) % by Wt.</th>
<th>Iron (as Fe) % by Wt.</th>
<th>Sulphates (as SO₄) % by Wt.</th>
<th>Moisture % by wt.</th>
<th>Alkali (as Na₂CO₃) % by Wt.</th>
<th>Barium</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99.40</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.008</td>
<td>0.20</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>2</td>
<td>99.14</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.10</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>3</td>
<td>98.88</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>4</td>
<td>99.40</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.10</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>5</td>
<td>99.65</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.008</td>
<td>0.20</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>6</td>
<td>99.14</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>7</td>
<td>99.40</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>8</td>
<td>99.40</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.25</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>9</td>
<td>99.14</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.15</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>10</td>
<td>99.65</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.10</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
</tbody>
</table>

**NOTE:**
1. The analyses done as per IS 2780.
2. Sample of Batch No.9 given to third party for analysis with a code No.19 (b) 9.
3.6.2 *Analysis of sodium bromide from recovered bromine from effluent-A1, A2, A3 and C1*

**TABLE- 40**

Analysis carried out and certified by : Third party *
Certificate issued to : Hardik Jadeja,  
Department of chemistry,  
Bhavnagar University,  
Bhavnagar.

**Particulars of sample submitted**

<table>
<thead>
<tr>
<th>Nature</th>
<th>Sodium bromide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch No.</td>
<td>19(b) 9</td>
</tr>
<tr>
<td>Quantity</td>
<td>------</td>
</tr>
<tr>
<td>Packing</td>
<td>------</td>
</tr>
<tr>
<td>Date</td>
<td>10-07-2006</td>
</tr>
<tr>
<td>Method of analysis</td>
<td>As per IS: 2780-1964</td>
</tr>
</tbody>
</table>

**Test Report**

<table>
<thead>
<tr>
<th>Description</th>
<th>: White crystalline powder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium bromide, % by Weight</td>
<td>: 99.35 (Limit: Min. 98.50)</td>
</tr>
<tr>
<td>Chlorides (as Cl), % by Weight</td>
<td>: &lt;0.60 (Limit: Max. 0.0060)</td>
</tr>
<tr>
<td>Bromates (as BrO₃), % by Weight</td>
<td>: &lt;0.001 (Limit: Max. 0.001)</td>
</tr>
<tr>
<td>Heavy metals (as Pb), % by Weight</td>
<td>: &lt;0.001 (Limit: Max. 0.001)</td>
</tr>
<tr>
<td>Iron (as Fe), % by Weight</td>
<td>: &lt;0.008 (Limit: Max. 0.008)</td>
</tr>
<tr>
<td>Sulphates (as SO₄), % by Weight</td>
<td>: &lt;0.06 (Limit: Max. 0.06)</td>
</tr>
<tr>
<td>Moisture, % by Weight</td>
<td>: 0.25 (Limit: Max. 0.050)</td>
</tr>
<tr>
<td>Arsenic (as As₂O₃), % by Weight</td>
<td>: Nil (Limit: Max. 10 ppm)</td>
</tr>
<tr>
<td>Alkali (as Na₂CO₃), % by Weight</td>
<td>: &lt;0.02 (Limit: Max. 0.02)</td>
</tr>
<tr>
<td>Barium</td>
<td>: Passes test to pass test</td>
</tr>
</tbody>
</table>

* Perfect Analytical Laboratories, Bhavnagar.
3.7.1 Analysis of sodium bromide recovered directly from effluent-A$_2$ and A$_3$

**TABLE- 41**

<table>
<thead>
<tr>
<th>Batch No.</th>
<th>NaBr % by Wt. of dried material</th>
<th>Chloride (as Cl) % by Wt.</th>
<th>Bromates (as BrO$_3$) % by Wt.</th>
<th>Heavy Metals (as Pb) % by Wt.</th>
<th>Iron (as Fe) % by Wt.</th>
<th>Sulphates (as SO$_4$) % by Wt.</th>
<th>Moisture % by Wt.</th>
<th>Alkali (as Na$_2$CO$_3$) % by Wt.</th>
<th>Barium</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>96.82</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>2</td>
<td>97.85</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.10</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>3</td>
<td>98.37</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>4</td>
<td>99.14</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>5</td>
<td>99.14</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>6</td>
<td>97.08</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>7</td>
<td>97.85</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.10</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>8</td>
<td>98.41</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>9</td>
<td>99.14</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.10</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
<tr>
<td>10</td>
<td>99.40</td>
<td>&lt;0.6</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.10</td>
<td>&lt;0.02</td>
<td>Passes test</td>
</tr>
</tbody>
</table>

**NOTE :**

1. The analyses done as per IS 2780.
2. Sample of Batch no. 4 and Batch No. 9 given to third party for analysis with a code no. 20(b) 4 & 20(b) 9 respectively.
**3.7.2 Analysis of sodium bromide recovered directly from effluent-A₂ & A₃**

**TABLE- 42**

Analysis carried out and certified by : Third party *
Certificate issued to : Hardik Jadeja,
Department of chemistry,
Bhavnagar University,
Bhavnagar.

**Particulars of sample submitted**

<table>
<thead>
<tr>
<th>Nature</th>
<th>Sodium bromide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch No.</td>
<td>20(b) 4</td>
</tr>
<tr>
<td>Quantity</td>
<td>-------</td>
</tr>
<tr>
<td>Packing</td>
<td>-------</td>
</tr>
<tr>
<td>Third party reference No</td>
<td>05142/06-07/R&amp;D</td>
</tr>
<tr>
<td>Date</td>
<td>15-06-2006</td>
</tr>
<tr>
<td>Method of analysis</td>
<td>As per IS: 2780-1964</td>
</tr>
</tbody>
</table>

**Test Report**

<table>
<thead>
<tr>
<th>Description</th>
<th>White crystalline powder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium bromide, % by Weight</td>
<td>99.58 (Limit: Min. 98.50)</td>
</tr>
<tr>
<td>Chlorides (as Cl), % by Weight</td>
<td>Complies (Limit: Max. 00.60)</td>
</tr>
<tr>
<td>Bromates (as BrO₃), % by Weight</td>
<td>Complies (Limit: Max. 00.001)</td>
</tr>
<tr>
<td>Heavy metals (as Pb), % by Weight</td>
<td>Complies (Limit: Max. 00.001)</td>
</tr>
<tr>
<td>Iron (as Fe), % by Weight</td>
<td>Complies (Limit: Max. 00.008)</td>
</tr>
<tr>
<td>Sulphates (as SO₄), % by Weight</td>
<td>Complies (Limit: Max. 00.06)</td>
</tr>
<tr>
<td>Moisture, % by Weight</td>
<td>03.10 (Limit: Max. 05.00)</td>
</tr>
<tr>
<td>Arsenic (as As₂O₃), % by Weight</td>
<td>Complies (Limit: Max. 10 ppm)</td>
</tr>
<tr>
<td>Alkali (as Na₂CO₃), % by Weight</td>
<td>Complies (Limit: Max. 00.02)</td>
</tr>
<tr>
<td>Barium</td>
<td>Complies to pass test</td>
</tr>
</tbody>
</table>

* Choksi Laboratories Limited, Baroda.
### 3.7.3 Analysis of sodium bromide recovered directly from effluent-A₂ & A₃

**TABLE- 43**

**Analysis carried out and certified by** : Third party *

**Certificate issued to** : Hardik Jadeja,
Department of chemistry,
Bhavnagar University,
Bhavnagar.

**Particulars of sample submitted**

<table>
<thead>
<tr>
<th>Nature</th>
<th>Sodium bromide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch No.</td>
<td>20(b) 9</td>
</tr>
<tr>
<td>Quantity</td>
<td>------.</td>
</tr>
<tr>
<td>Packing</td>
<td>------</td>
</tr>
<tr>
<td>Date</td>
<td>10-07-2006</td>
</tr>
<tr>
<td>Method of analysis</td>
<td>As per IS: 2780-1964</td>
</tr>
</tbody>
</table>

**Test Report**

<table>
<thead>
<tr>
<th>Description</th>
<th>: White crystalline powder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium bromide, % by Weight</td>
<td>: 99.28 (Limit: Min. 98.50)</td>
</tr>
<tr>
<td>Chlorides (as Cl), % by Weight</td>
<td>&lt;0.00.60 (Limit: Max. 00.60)</td>
</tr>
<tr>
<td>Bromates (as BrO₃), % by Weight</td>
<td>&lt;0.00.01 (Limit: Max. 00.001)</td>
</tr>
<tr>
<td>Heavy metals (as Pb), % by Weight</td>
<td>&lt;0.00.01 (Limit: Max. 00.001)</td>
</tr>
<tr>
<td>Iron (as Fe), % by Weight</td>
<td>&lt;0.00.08 (Limit: Max. 00.008)</td>
</tr>
<tr>
<td>Sulphates (as SO₄), % by Weight</td>
<td>&lt;0.00.06 (Limit: Max. 00.006)</td>
</tr>
<tr>
<td>Moisture, % by Weight</td>
<td>: 00.32 (Limit: Max. 05.00)</td>
</tr>
<tr>
<td>Arsenic (as As₂O₃), % by Weight</td>
<td>: Nil (Limit: Max. 10 ppm)</td>
</tr>
<tr>
<td>Alkali (as Na₂CO₃), % by Weight</td>
<td>: &lt;0.00.02 (Limit: Max. 00.02)</td>
</tr>
<tr>
<td>Barium</td>
<td>: Passes test to pass test</td>
</tr>
</tbody>
</table>

* Perfect Analytical Laboratories, Bhavnagar.
### 3.8.1 Analysis of potassium bromide from recovered bromine of effluent-A_{1}, A_{2}, A_{3} and C_{1}

**TABLE- 44**

<table>
<thead>
<tr>
<th>Batch No.</th>
<th>KBr % by mass of dried material</th>
<th>pH of Aq. solution</th>
<th>Chloride (As Cl) % by mass</th>
<th>Bromate (as BrO_3) % by mass</th>
<th>Heavy metals (as Pb) % by mass</th>
<th>Iron (as Fe) % by mass</th>
<th>Sulphates (as SO_4) % by mass</th>
<th>Moisture % by mass</th>
<th>Alkaline earth metals (as Mg) % by mass</th>
<th>Barium</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99.37</td>
<td>7.1</td>
<td>0.20</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>2</td>
<td>98.77</td>
<td>7.2</td>
<td>0.20</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>3</td>
<td>99.07</td>
<td>7.1</td>
<td>0.19</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.10</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>4</td>
<td>99.66</td>
<td>7.1</td>
<td>0.20</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>5</td>
<td>99.37</td>
<td>7.2</td>
<td>0.19</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>6</td>
<td>99.37</td>
<td>7.1</td>
<td>0.20</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.10</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>7</td>
<td>99.07</td>
<td>7.2</td>
<td>0.19</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.10</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>8</td>
<td>99.66</td>
<td>7.2</td>
<td>0.18</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>9</td>
<td>99.37</td>
<td>7.1</td>
<td>0.18</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>10</td>
<td>99.37</td>
<td>7.1</td>
<td>0.19</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.20</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
</tbody>
</table>

**NOTE :**
1. The analyses done as per IS 2797.
2. Sample of Batch No.2 and Batch No.10 given to third party for analysis with a code no. 21(b) 2 & 21(b) 10 respectively.
3.8.2 Analysis of potassium bromide from recovered bromine of effluent-A1, A2, A3 and C1

TABLE- 45

Analysis carried out and certified by : Third party *
Certificate issued to Hardik Jadeja,
Department of chemistry,
Bhavnagar University,
Bhavnagar.

Particulars of sample submitted
Nature : Potassium bromide
Batch No. : 21(b) 2
Quantity : ------
Packing : ------
Third party reference No : 05143/06-07/R&D
Date : 15-06-2006
Method of analysis : As per IS: 2797-1998

Test Report
Description : White crystalline powder
Potassium bromide, % by Weight : 99.54 (Limit: Min. 99.00)
pH : 6.75 (Limit: 6.0 to 7.5)
Chlorides (as Cl), % by Weight : Complies (Limit: Max. 00.20)
Bromates (as BrO3), % by Weight : Complies (Limit: Max. 00.001)
Iodides : Complies --
Heavy metals (as Pb), % by Weight : Complies (Limit: Max. 00.001)
Iron (as Fe), % by Weight : Complies (Limit: Max. 00.001)
Sulphates (as SO4), % by Weight : Complies (Limit: Max. 00.01)
Alkaline earth metals (as Mg) % by Weight : Complies (Limit: Max. 00.005)
Sodium (as Na), % by Weight : 00.038 (Limit: Max. 00.05)
Moisture, % by Weight : 00.13 (Limit: Max. 00.50)
Arsenic (as As2O3), % by Weight : Complies (Limit: Max. 5.00 ppm)
Matter insoluble in water : 00.0003 (Limit: Max. 00.005)

* Choksi Laboratories Limited, Baroda.
3.8.3 *Analysis of potassium bromide from recovered bromine of effluent-A₁, A₂, A₃ and C₁*

**TABLE- 46**

Analysis carried out and certified by : Third party *
Certificate issued to : Hardik Jadeja, Department of chemistry, Bhavnagar University, Bhavnagar.

**Particulars of sample submitted**

<table>
<thead>
<tr>
<th>Nature</th>
<th>Potassium bromide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch No.</td>
<td>21(b) 10</td>
</tr>
<tr>
<td>Quantity</td>
<td>------.</td>
</tr>
<tr>
<td>Packing</td>
<td>------</td>
</tr>
<tr>
<td>Date</td>
<td>10-07-2006</td>
</tr>
<tr>
<td>Method of analysis</td>
<td>As per IS: 2797-1998</td>
</tr>
</tbody>
</table>

**Test Report**

<table>
<thead>
<tr>
<th>Description</th>
<th>White crystalline powder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium bromide, % by mass</td>
<td>99.55 (Limit: Min. 98.50)</td>
</tr>
<tr>
<td>pH of aqueous solution</td>
<td>6.80 (Limit: 6.0 to 7.5)</td>
</tr>
<tr>
<td>Chlorides (as Cl), % by mass</td>
<td>00.05 (Limit: Max. 00.45)</td>
</tr>
<tr>
<td>Bromates (as BrO₃), % by mass</td>
<td>&lt;00.001 (Limit: Max. 00.001)</td>
</tr>
<tr>
<td>Iodides</td>
<td>Nil --</td>
</tr>
<tr>
<td>Heavy metals (as Pb), % by mass</td>
<td>&lt;00.001 (Limit: Max. 00.001)</td>
</tr>
<tr>
<td>Iron (as Fe), % by mass</td>
<td>&lt;00.008 (Limit: Max. 00.008)</td>
</tr>
<tr>
<td>Sulphates (as SO₄), % by mass</td>
<td>&lt;00.06 (Limit: Max. 00.06)</td>
</tr>
<tr>
<td>Alkaline earth metals (as Mg) % by mass</td>
<td>00.01 (Limit: Max. 00.01)</td>
</tr>
<tr>
<td>Sodium (as Na), % by mass</td>
<td>00.027 --</td>
</tr>
<tr>
<td>Moisture, % by mass</td>
<td>00.15 (Limit: Max. 01.00)</td>
</tr>
<tr>
<td>Arsenic (as As₂O₃), % by mass</td>
<td>Nil (Limit: Max. 10.00 ppm)</td>
</tr>
<tr>
<td>Barium</td>
<td>Passes test to pass test</td>
</tr>
<tr>
<td>Matter insoluble in water, % by mass: &lt;00.005</td>
<td>--</td>
</tr>
</tbody>
</table>

* Perfect Analytical Laboratories, Bhavnagar.
3.9.1 Analysis of potassium bromate recovered chemically from recovered bromine of effluent-A1, A2, A3 and C1

<table>
<thead>
<tr>
<th>Batch No.</th>
<th>KBrO₃ % by mass of dried material</th>
<th>Insoluble matter %</th>
<th>Free acid %</th>
<th>Free alkali %</th>
<th>Bromide (as Br) %</th>
<th>Sulphates (as SO₄) %</th>
<th>Iron (as Fe) %</th>
<th>Heavy metals (as Pb) %</th>
<th>Moisture %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99.80</td>
<td>&lt;0.003</td>
<td>NIL</td>
<td>0.002</td>
<td>&lt;0.01</td>
<td>&lt;0.005</td>
<td>Nil</td>
<td>&lt;0.001</td>
<td>0.020</td>
</tr>
<tr>
<td>2</td>
<td>99.80</td>
<td>&lt;0.003</td>
<td>NIL</td>
<td>0.002</td>
<td>&lt;0.01</td>
<td>&lt;0.005</td>
<td>Nil</td>
<td>&lt;0.001</td>
<td>0.020</td>
</tr>
<tr>
<td>3</td>
<td>99.94</td>
<td>&lt;0.003</td>
<td>NIL</td>
<td>0.001</td>
<td>&lt;0.01</td>
<td>&lt;0.005</td>
<td>Nil</td>
<td>&lt;0.001</td>
<td>0.015</td>
</tr>
<tr>
<td>4</td>
<td>99.94</td>
<td>&lt;0.003</td>
<td>NIL</td>
<td>0.002</td>
<td>&lt;0.01</td>
<td>&lt;0.005</td>
<td>Nil</td>
<td>&lt;0.001</td>
<td>0.020</td>
</tr>
<tr>
<td>5</td>
<td>99.94</td>
<td>&lt;0.003</td>
<td>NIL</td>
<td>0.001</td>
<td>&lt;0.01</td>
<td>&lt;0.005</td>
<td>Nil</td>
<td>&lt;0.001</td>
<td>0.020</td>
</tr>
<tr>
<td>6</td>
<td>99.94</td>
<td>&lt;0.003</td>
<td>NIL</td>
<td>0.001</td>
<td>&lt;0.01</td>
<td>&lt;0.005</td>
<td>Nil</td>
<td>&lt;0.001</td>
<td>0.015</td>
</tr>
<tr>
<td>7</td>
<td>99.94</td>
<td>&lt;0.003</td>
<td>NIL</td>
<td>0.001</td>
<td>&lt;0.01</td>
<td>&lt;0.005</td>
<td>Nil</td>
<td>&lt;0.001</td>
<td>0.020</td>
</tr>
<tr>
<td>8</td>
<td>99.94</td>
<td>&lt;0.003</td>
<td>NIL</td>
<td>0.002</td>
<td>&lt;0.01</td>
<td>&lt;0.005</td>
<td>Nil</td>
<td>&lt;0.001</td>
<td>0.020</td>
</tr>
<tr>
<td>9</td>
<td>99.94</td>
<td>&lt;0.003</td>
<td>NIL</td>
<td>0.001</td>
<td>&lt;0.01</td>
<td>&lt;0.005</td>
<td>Nil</td>
<td>&lt;0.001</td>
<td>0.015</td>
</tr>
<tr>
<td>10</td>
<td>99.94</td>
<td>&lt;0.003</td>
<td>NIL</td>
<td>0.002</td>
<td>&lt;0.01</td>
<td>&lt;0.005</td>
<td>Nil</td>
<td>&lt;0.001</td>
<td>0.015</td>
</tr>
</tbody>
</table>

NOTE:
1. The analyses done as per AnalaR.
2. Sample of Batch No.7 & Batch No. 3 given to third party for analysis with a code no. 22(b) 7 & 22(b)3 respectively.
3.9.2 Analysis of potassium bromate recovered chemically from recovered bromine of effluent-A₁, A₂, A₃ and C₁

TABLE- 48

Analysis carried out and certified by : Third party *
Certificate issued to : Hardik Jadeja,
Department of chemistry,
Bhavnagar University,
Bhavnagar.

Particulars of sample submitted

Nature : Potassium bromate
Batch No. : 22(b) 7
Quantity : ------
Packing : ------
Date : 10-07-2006
Method of analysis : As per 'AnalaR' standards

Test Report

Description : White crystalline powder
Assay (after drying) : 99.92% (Limit: Min. 99.90%)
pH of 5% solution : 7.1
Bromide (Br) : <0.01% (Limit: Max. 0.01%)
Nitrogen compounds (N) : <0.001% (Limit: Max. 0.001%)
Sulphates (SO₄) : <0.005% (Limit: Max. 0.005%)
Iron (Fe) : <0.0005% (Limit: Max. 0.0005%)
Heavy metals (Pb) : <0.001% (Limit: Max. 0.001%)
Sodium (Na) : <0.006% (Limit: Max. 0.006%)
Loss of drying : 0.01% (Limit: Max. 0.025%)

* Perfect Analytical Laboratories, Bhavnagar.
3.9.3 Analysis of potassium bromate recovered chemically from recovered bromine of effluent-\(A_1\), \(A_2\), \(A_3\) and \(C_1\)

**TABLE- 49**

Analysis carried out and certified by : Third party *
Certificate issued to : Hardik Jadeja, Department of chemistry, Bhavnagar University, Bhavnagar.

**Particulars of sample submitted**

<table>
<thead>
<tr>
<th>Nature</th>
<th>Potassium bromate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch No.</td>
<td>22(b) 3</td>
</tr>
<tr>
<td>Quantity</td>
<td>------</td>
</tr>
<tr>
<td>Packing</td>
<td>------</td>
</tr>
<tr>
<td>Third party reference No</td>
<td>05144/06-07/R&amp;D</td>
</tr>
<tr>
<td>Date</td>
<td>15-06-2006</td>
</tr>
<tr>
<td>Method of analysis</td>
<td>As per 'AnalaR' standards</td>
</tr>
</tbody>
</table>

**Test Report**

<table>
<thead>
<tr>
<th>Description</th>
<th>White crystalline powder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assay (after drying)</td>
<td>99.92% (Limit: Min. 99.90%)</td>
</tr>
<tr>
<td>pH of 5% solution</td>
<td>7.32 (Limit: 5.0 to 9.0)</td>
</tr>
<tr>
<td>Bromide (Br)</td>
<td>Complies (Limit: Max. 0.01%)</td>
</tr>
<tr>
<td>Nitrogen compounds (N)</td>
<td>Complies (Limit: Max. 0.001%)</td>
</tr>
<tr>
<td>Sulphates (SO(_4))</td>
<td>Complies (Limit: Max. 0.005%)</td>
</tr>
<tr>
<td>Iron (Fe)</td>
<td>Complies (Limit: Max. 0.0005%)</td>
</tr>
<tr>
<td>Lead (Pb)</td>
<td>Complies (Limit: Max. 0.0005%)</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>Complies (Limit: Max. 0.0005%)</td>
</tr>
<tr>
<td>Sodium (Na)</td>
<td>0.006% (Limit: Max. 0.01%)</td>
</tr>
<tr>
<td>Loss of drying</td>
<td>0.014% (Limit: Max. 0.025%)</td>
</tr>
</tbody>
</table>

* Choksi Laboratories Limited, Baroda.
3.10.1 Analysis of potassium bromide recovered from the mother liquor of potassium bromate

**TABLE- 50**

<table>
<thead>
<tr>
<th>Batch No.</th>
<th>KBr % by mass of dried material</th>
<th>pH of Aq. solution</th>
<th>Chloride (as Cl) % by mass</th>
<th>Bromate (as BrO₃) % by mass</th>
<th>Heavy metals (as Pb) % by mass</th>
<th>Iron (as Fe) % by mass</th>
<th>Sulphates (as SO₄) % by mass</th>
<th>Moisture % by mass</th>
<th>Alkaline earth metals (as Mg) % by mass</th>
<th>Barium</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99.07</td>
<td>7.1</td>
<td>0.20</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.2</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>2</td>
<td>99.37</td>
<td>7.2</td>
<td>0.20</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.2</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>3</td>
<td>99.37</td>
<td>7.1</td>
<td>0.20</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.2</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>4</td>
<td>99.66</td>
<td>7.1</td>
<td>0.19</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.1</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>5</td>
<td>99.37</td>
<td>7.1</td>
<td>0.20</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.2</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>6</td>
<td>99.07</td>
<td>7.2</td>
<td>0.20</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.15</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>7</td>
<td>99.37</td>
<td>7.2</td>
<td>0.18</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.2</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>8</td>
<td>99.37</td>
<td>7.1</td>
<td>0.20</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.2</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>9</td>
<td>99.66</td>
<td>7.2</td>
<td>0.20</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.2</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
<tr>
<td>10</td>
<td>99.07</td>
<td>7.2</td>
<td>0.20</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.008</td>
<td>&lt;0.06</td>
<td>0.2</td>
<td>0.005</td>
<td>Passes test</td>
</tr>
</tbody>
</table>

**NOTE:**
1. The analyses done as per IS 2797.
2. Sample of Batch No.9 given to third party for analysis with a code no. 23(b) 9.
### 3.10.2 Analysis of potassium bromide recovered from mother liquor of potassium bromate

#### TABLE- 51

Analysis carried out and certified by : Third party *

Certificate issued to : Hardik Jadeja, Department of chemistry, Bhavnagar University, Bhavnagar.

**Particulars of sample submitted**

<table>
<thead>
<tr>
<th>Nature</th>
<th>Potassium bromide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch No.</td>
<td>23(b) 9</td>
</tr>
<tr>
<td>Quantity</td>
<td>------</td>
</tr>
<tr>
<td>Packing</td>
<td>------</td>
</tr>
<tr>
<td>Date</td>
<td>10-07-2006</td>
</tr>
</tbody>
</table>

**Method of analysis** : As per IS: 2797-1998

**Test Report**

<table>
<thead>
<tr>
<th>Description</th>
<th>White crystalline powder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium bromide, % by mass</td>
<td>99.62</td>
</tr>
<tr>
<td>(Limit: Min. 98.50)</td>
<td></td>
</tr>
<tr>
<td>pH of aqueous solution</td>
<td>6.9</td>
</tr>
<tr>
<td>(Limit: 6.0 to 7.5)</td>
<td></td>
</tr>
<tr>
<td>Chlorides (as Cl), % by mass</td>
<td>00.035</td>
</tr>
<tr>
<td>(Limit: Max. 00.45)</td>
<td></td>
</tr>
<tr>
<td>Bromates (as BrO₃), % by mass</td>
<td>&lt;00.001</td>
</tr>
<tr>
<td>(Limit: Max. 00.001)</td>
<td></td>
</tr>
<tr>
<td>Iodides</td>
<td>Nil</td>
</tr>
<tr>
<td>Heavy metals (as Pb), % by mass</td>
<td>&lt;00.001</td>
</tr>
<tr>
<td>(Limit: Max. 00.001)</td>
<td></td>
</tr>
<tr>
<td>Iron (as Fe), % by mass</td>
<td>&lt;00.008</td>
</tr>
<tr>
<td>(Limit: Max. 00.008)</td>
<td></td>
</tr>
<tr>
<td>Sulphates (as SO₄), % by mass</td>
<td>&lt;00.06</td>
</tr>
<tr>
<td>(Limit: Max. 00.06)</td>
<td></td>
</tr>
<tr>
<td>Alkaline earth metals (as Mg) % by mass</td>
<td>00.01</td>
</tr>
<tr>
<td>(Limit: Max. 00.01)</td>
<td></td>
</tr>
<tr>
<td>Sodium (as Na), % by mass</td>
<td>00.021</td>
</tr>
<tr>
<td>Moisture, % by mass</td>
<td>00.10</td>
</tr>
<tr>
<td>(Limit: Max. 01.00)</td>
<td></td>
</tr>
<tr>
<td>Arsenic (as As₂O₃), % by mass</td>
<td>Nil</td>
</tr>
<tr>
<td>(Limit: Max. 10.00 ppm)</td>
<td></td>
</tr>
<tr>
<td>Barium</td>
<td>Passes test to pass test</td>
</tr>
<tr>
<td>Matter insoluble in water, % by mass</td>
<td>&lt;00.005</td>
</tr>
</tbody>
</table>

* Perfect Analytical Laboratories, Bhavnagar.
### 3.11.1 Analysis of n-propyl bromide from effluent-$B_1$

**TABLE - 52**

<table>
<thead>
<tr>
<th>Batch No.</th>
<th>Appearance</th>
<th>Assay (by G.C.) %</th>
<th>Specific gravity</th>
<th>n-propanol (by G.C.) %</th>
<th>Other organic impurities (by G.C.) %</th>
<th>Moisture % (by K.F.) w/w</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clear Colour less</td>
<td>99.50</td>
<td>1.349</td>
<td>0.135</td>
<td>0.365</td>
<td>0.05</td>
</tr>
<tr>
<td>2</td>
<td>Clear Colour less</td>
<td>99.85</td>
<td>1.351</td>
<td>0.090</td>
<td>0.060</td>
<td>0.05</td>
</tr>
<tr>
<td>3</td>
<td>Clear Colour less</td>
<td>99.12</td>
<td>1.351</td>
<td>0.250</td>
<td>0.630</td>
<td>0.04</td>
</tr>
<tr>
<td>4</td>
<td>Clear Colour less</td>
<td>99.32</td>
<td>1.355</td>
<td>0.220</td>
<td>0.460</td>
<td>0.05</td>
</tr>
<tr>
<td>5</td>
<td>Clear Colour less</td>
<td>99.20</td>
<td>1.355</td>
<td>0.250</td>
<td>0.550</td>
<td>0.04</td>
</tr>
<tr>
<td>6</td>
<td>Clear Colour less</td>
<td>99.31</td>
<td>1.357</td>
<td>0.243</td>
<td>0.447</td>
<td>0.05</td>
</tr>
<tr>
<td>7</td>
<td>Clear Colour less</td>
<td>99.50</td>
<td>1.351</td>
<td>0.110</td>
<td>0.390</td>
<td>0.03</td>
</tr>
<tr>
<td>8</td>
<td>Clear Colour less</td>
<td>99.28</td>
<td>1.352</td>
<td>0.095</td>
<td>0.385</td>
<td>0.04</td>
</tr>
<tr>
<td>9</td>
<td>Clear Colour less</td>
<td>99.32</td>
<td>1.359</td>
<td>0.239</td>
<td>0.441</td>
<td>0.05</td>
</tr>
<tr>
<td>10</td>
<td>Clear Colour less</td>
<td>99.30</td>
<td>1.357</td>
<td>0.225</td>
<td>0.475</td>
<td>0.05</td>
</tr>
</tbody>
</table>

**Note:**
1. Analysis done by GC.
2. Samples of Batch No.2 & Batch No.5 given to third party for analysis with code 27(b) 2 and 27(b) 5 respectively.
3.11.2 Analysis of n-propyl bromide from effluent-B₁

TABLE- 53

Analysis carried out and certified by : Third party *
Certificate issued to : Hardik Jadeja,
Department of chemistry,
Bhavnagar University,
Bhavnagar.

Particulars of sample submitted

<table>
<thead>
<tr>
<th>Nature</th>
<th>n-propyl bromide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch No.</td>
<td>27(b) 2</td>
</tr>
<tr>
<td>Quantity</td>
<td>50 ML</td>
</tr>
<tr>
<td>Packing</td>
<td>Bottle packing</td>
</tr>
<tr>
<td>Third party certificate No</td>
<td>060531/00245/03</td>
</tr>
<tr>
<td>Date</td>
<td>31-05-2006</td>
</tr>
<tr>
<td>Method of analysis</td>
<td>GC</td>
</tr>
</tbody>
</table>

Test Report

<table>
<thead>
<tr>
<th>Description</th>
<th>Clear colourless liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assay</td>
<td>99.87%</td>
</tr>
<tr>
<td>Specific gravity</td>
<td>1.3284 (at 20°C)</td>
</tr>
<tr>
<td>Moisture</td>
<td>0.060%</td>
</tr>
<tr>
<td>N-propanol (by GC)</td>
<td>0.042%</td>
</tr>
<tr>
<td>Other organic impurities (by GC)</td>
<td>0.086%</td>
</tr>
</tbody>
</table>

* Vaibhav Analytical Services, Ahmedabad.
N-Propyl Bromide

Result Table - Calculation Method Unical

<table>
<thead>
<tr>
<th>Peak</th>
<th>Reten. Time</th>
<th>Area</th>
<th>Height</th>
<th>WGO</th>
<th>Area</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.475</td>
<td>16285.3014</td>
<td>1.245.2738</td>
<td>0.0687</td>
<td>99.471</td>
<td>99.455</td>
</tr>
<tr>
<td>2</td>
<td>4.527</td>
<td>6.3788</td>
<td>0.5268</td>
<td>0.2267</td>
<td>0.0428</td>
<td>0.0428</td>
</tr>
<tr>
<td>3</td>
<td>14.453</td>
<td>14.0374</td>
<td>0.4497</td>
<td>0.4267</td>
<td>0.0861</td>
<td>0.0861</td>
</tr>
<tr>
<td>- Total</td>
<td>16308.3175</td>
<td>1249.4543</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

VATBHAN ANALYTICAL SERVICES
### 3.11.3 Analysis of n-propyl bromide from effluent-B$_1$

**TABLE – 54**

Analysis carried out and certified by: Third party *

Certificate issued to: Hardik Jadeja, Department of chemistry, Bhavnagar University, Bhavnagar.

**Particulars of sample submitted**

<table>
<thead>
<tr>
<th>Nature</th>
<th>n-propyl bromide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch No.</td>
<td>27(b) 5</td>
</tr>
<tr>
<td>Quantity</td>
<td>15 ML</td>
</tr>
<tr>
<td>Packing</td>
<td>Bottle packing</td>
</tr>
<tr>
<td>Third party reference No</td>
<td>05635/06-07</td>
</tr>
<tr>
<td>Date</td>
<td>17-06-2006</td>
</tr>
<tr>
<td>Method of Analysis</td>
<td>GC</td>
</tr>
</tbody>
</table>

**Test Report**

<table>
<thead>
<tr>
<th>Description</th>
<th>Clear colourless liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assay, %</td>
<td>99.87%</td>
</tr>
<tr>
<td>Moisture content, %</td>
<td>0.08%</td>
</tr>
</tbody>
</table>

* Choksi Laboratories Limited, Indore.
CHOKSI LABORATORIES LTD.

Acquired Date: 15-06-06
Volume: 1.0 ul

Sample Name: N-PROPYL BROMIDE-5635
Sample Description: PURITY
Method Description: AS PER CLIENT SPECIFICATION

<table>
<thead>
<tr>
<th>No.</th>
<th>RT</th>
<th>Name</th>
<th>Area</th>
<th>Area %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.56</td>
<td></td>
<td>5508</td>
<td>0.067</td>
</tr>
<tr>
<td>2</td>
<td>2.66</td>
<td></td>
<td>4692</td>
<td>0.057</td>
</tr>
<tr>
<td>3</td>
<td>2.80</td>
<td>N-PROPYL BROMIDE</td>
<td>8156236</td>
<td>99.191</td>
</tr>
<tr>
<td>4</td>
<td>3.04</td>
<td></td>
<td>20999</td>
<td>0.255</td>
</tr>
<tr>
<td>5</td>
<td>4.43</td>
<td></td>
<td>13570</td>
<td>0.165</td>
</tr>
<tr>
<td>6</td>
<td>4.76</td>
<td></td>
<td>16257</td>
<td>0.196</td>
</tr>
<tr>
<td>7</td>
<td>8.24</td>
<td></td>
<td>5465</td>
<td>0.066</td>
</tr>
</tbody>
</table>

8222727 100.000

Developed by: ID8000313

Peak rejection level: 0
Graph for: Client

Page Indicator: 1 / 1
3.11.4 Analytical method for characterisation of product n-propyl bromide by Gas Chromatography

The analytical test procedure used for determining the purity of n-propyl bromide in this research work is gas chromatography procedure, which is as follows.

Analytical Procedure

Apparatus
- A gas chromatograph equipped with a flame ionization detector. A Chemito model 8610 with suitable electronic integrator was used in this study.
- A GC column capable of separating the analyte from any interference. The column used in this study was a 25-meter BP-5 capillary column with a 0.25 μm film thickness and 0.22-mm i.d.
- A 10-μL syringe or other convenient size for sample injection.

Reagents
- UHP grade nitrogen, hydrogen and air.
- 1-Bromo propane (CAS 106-94-5). 1-Bromo propane, 99%, was obtained from Merck Chemical Company.

Standard preparation and calibration
Inject fixed volume (0.2 to 0.5 μl) of the standard n-propyl bromide as such in to gas chromatograph. For getting the largest possible peaks of the component adjust the lowest possible attenuation. Consider the retention time of the component as a reference standard.

Procedure
Inject fixed volume (0.2 to 0.5 μl) of the sample of n-propyl bromide as such in to gas chromatograph and trace out the chromatogram as per above.

Analysis
- Gas chromatograph conditions
  Injection size : 0.2 to 0.5 μl
  Flow rates
  Nitrogen (carrier) : 1.2 ml/min.
  Hydrogen : 30 ml/min.
  Air : 300 ml/min.
- Temperatures
  Injector : 200 °C
  Detector : 230 °C
  Column : 50°C for 4 min, 10°/min to 200 °C, hold for 8 min at 200 °C
Calculations

Identify the n-propyl bromide peak by comparing the retention time with reference standard.

Calculate the % of n-propyl bromide by area% with the help of following equation.

\[
B2 = \frac{A2 \times B1}{A1}
\]

Where,

A1 = purity of standard n-propyl bromide as given by the supplier
A2 = purity of standard n-propyl bromide as analyzed (by GC area %)
B1 = purity of n-propyl bromide sample analyzed   (by GC area %)
B2 = purity of n-propyl bromide sample