

Nature of Invention: Process design

Applicant: BCG

Inventors: Mudit Bhanwar , Aakash Saran

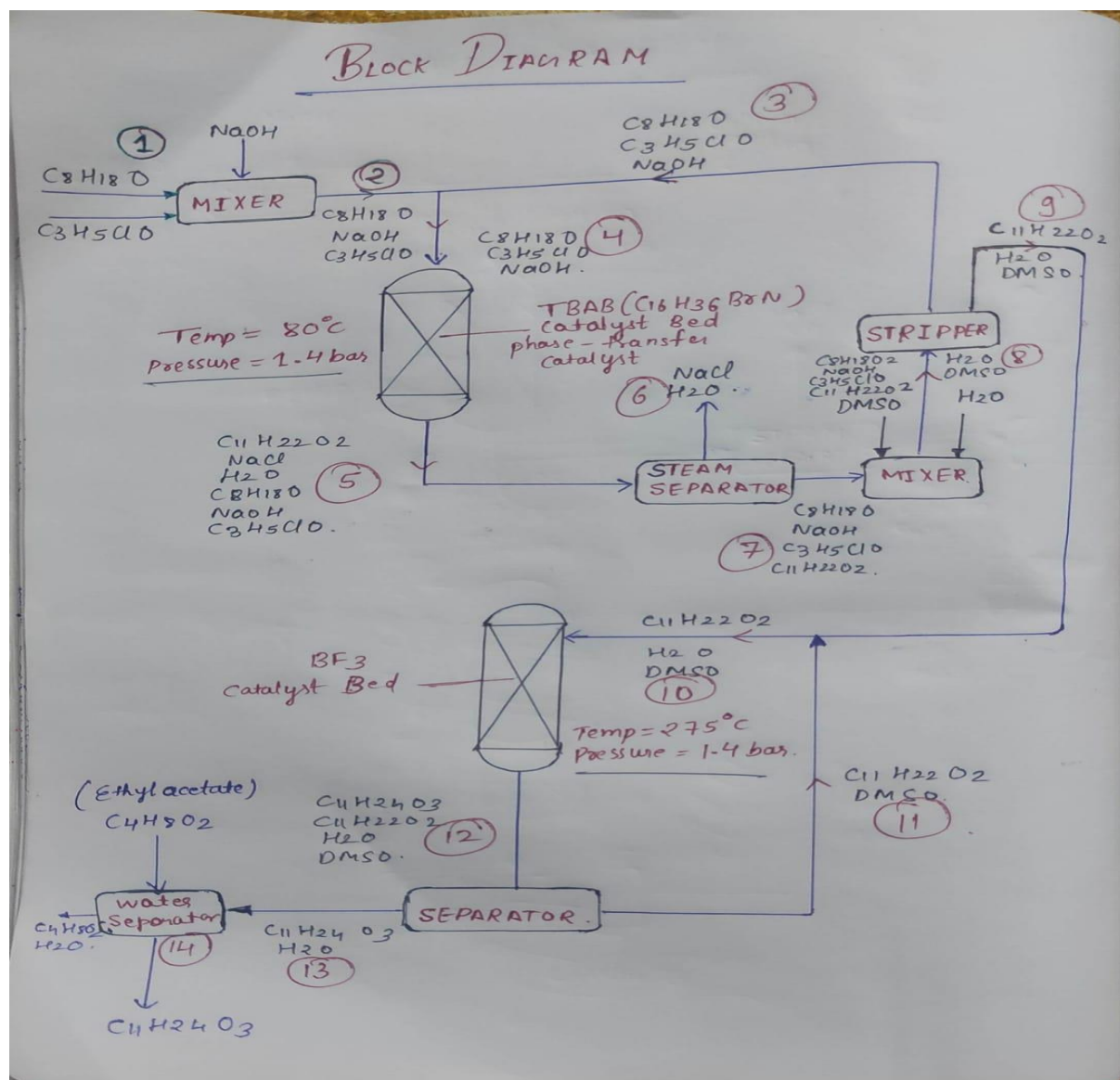
Chemical Formula:  $C_{11}H_{24}O_3$

Chemical Name: Ethyl-hexyl-glycerine

Process Title: Production of Ethylhexylglycerine from 2-ethylhexanol , epichlorohydrin , sodium hydroxide and water .

Process Description:

- Give the block diagram for the feasible process (as determined in market analysis report).  
List all unit operations and process conditions.



- b. Give the material balance for a scaled-up process plant with capacity of 1000 kg/day. (If needed, simplify the calculations by stating assumptions)

MASS BALANCE

\* All units are in kmol/day.

<p><u>Stream 1</u></p> <p>4.902 kmol NaOH 4.902 kmol C<sub>8</sub>H<sub>18</sub>O 4.902 kmol C<sub>3</sub>H<sub>5</sub>ClO.</p>	<p><u>Stream 2</u></p> <p>4.902 kmol NaOH 4.902 kmol C<sub>8</sub>H<sub>18</sub>O 4.902 kmol C<sub>3</sub>H<sub>5</sub>ClO.</p>	<p><u>Stream 3</u></p> <p>0.54467 kmol C<sub>8</sub>H<sub>18</sub>O 0.54467 kmol NaOH 0.54467 kmol C<sub>3</sub>H<sub>5</sub>ClO.</p>
<p><u>Stream 4</u></p> <p>5.44667 kmol C<sub>8</sub>H<sub>18</sub>O 5.44667 kmol NaOH 5.44667 kmol C<sub>3</sub>H<sub>5</sub>ClO.</p>	<p><u>Stream 5</u></p> <p>4.902 kmol C<sub>11</sub>H<sub>22</sub>O<sub>2</sub> 4.902 kmol NaCl 4.902 kmol H<sub>2</sub>O 0.54467 kmol C<sub>8</sub>H<sub>18</sub>O 0.54467 kmol NaOH 0.54467 kmol C<sub>3</sub>H<sub>5</sub>ClO.</p>	
<p><u>Stream 6</u></p> <p>4.902 kmol NaCl 4.902 kmol H<sub>2</sub>O</p>	<p><u>Stream 7</u></p> <p>4.902 kmol C<sub>11</sub>H<sub>22</sub>O<sub>2</sub> 0.54467 kmol C<sub>8</sub>H<sub>18</sub>O 0.54467 kmol NaOH 0.54467 kmol C<sub>3</sub>H<sub>5</sub>ClO.</p>	
<p><u>Stream 8</u></p> <p>0.54467 kmol C<sub>8</sub>H<sub>18</sub>O 0.54467 kmol NaOH 0.54467 kmol C<sub>3</sub>H<sub>5</sub>ClO. 4.902 kmol C<sub>11</sub>H<sub>22</sub>O<sub>2</sub> 5.4467 kmol H<sub>2</sub>O.</p>	<p><u>Stream 9</u></p> <p>4.902 kmol C<sub>11</sub>H<sub>22</sub>O<sub>2</sub> 5.4467 kmol H<sub>2</sub>O</p>	<p><u>Stream 10</u></p> <p>5.4467 kmol H<sub>2</sub>O 5.4467 kmol C<sub>11</sub>H<sub>22</sub>O<sub>2</sub></p>
<p><u>Stream 11</u></p> <p><del>4.902 kmol C<sub>11</sub>H<sub>22</sub>O<sub>2</sub></del> 0.54467 kmol C<sub>11</sub>H<sub>22</sub>O<sub>2</sub>.</p>	<p><u>Stream 12</u></p> <p>4.902 kmol C<sub>11</sub>H<sub>22</sub>O<sub>2</sub> 0.54467 kmol H<sub>2</sub>O 0.54467 kmol C<sub>11</sub>H<sub>22</sub>O<sub>2</sub>.</p>	
<p><u>Stream 13</u></p> <p>4.902 kmol C<sub>11</sub>H<sub>24</sub>O<sub>3</sub> 0.54467 kmol H<sub>2</sub>O.</p>	<p><u>Stream 14</u></p> <p>4.902 kmol C<sub>11</sub>H<sub>24</sub>O<sub>3</sub> (~ 1000 kg/day C<sub>11</sub>H<sub>24</sub>O<sub>3</sub>)</p>	

- c. List the capacity of reactors needed and evaluate the cost. Use Glass lined Carbon steel (GS lined CS) as the material of construction (MOC). Use the pressure according to reaction conditions. You will use only 70% of the total volume. If you design a 1000 L reactor, you can only fill 700 L reaction mixture.

Number of Reactors required (capacity = 500L) = 2

Number of Mixers (capacity = 500L) = 2

Number of Separator and Strippers (capacity = 500L) = 4

Total cost =  $8 \times 33500 / 4 = 67000$

**TOTAL FIXED COST = \$67,000**

**Capital cost (only for the reactor):**

example:

Equipment	Design Capacity (L)	No. of units	Cost/unit (\$ for year 2014)	Total Cost (\$ for year 2014)
Reactor 1 (Jacketed reactor, agitated, Carbon steel, atm. pressure)	2000	1	33,500	33,500

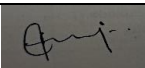
**References:** Provide reference for a research paper or an actual patent.

1. <http://www.matche.com/equipcost/Reactor.html>


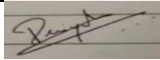
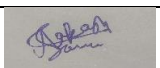
**List the contributions of each author:**

- Mudit Bhanwar and Aakash Saran designed the block diagram and the unit operations for the process and determined the unit operations required .
- Mudit Bhanwar and Aakash Saran did the mass balanced and determined the reaction conditions .
- Priyanka calculated the reactor costs .

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## CHE261A Patent Application

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