Technical Team

Nature of Invention: Process Flow Diagram and Mass Balance.

Applicant: GreenovateX

Inventors: Sumit Chouhan, Sanjeeta Singh

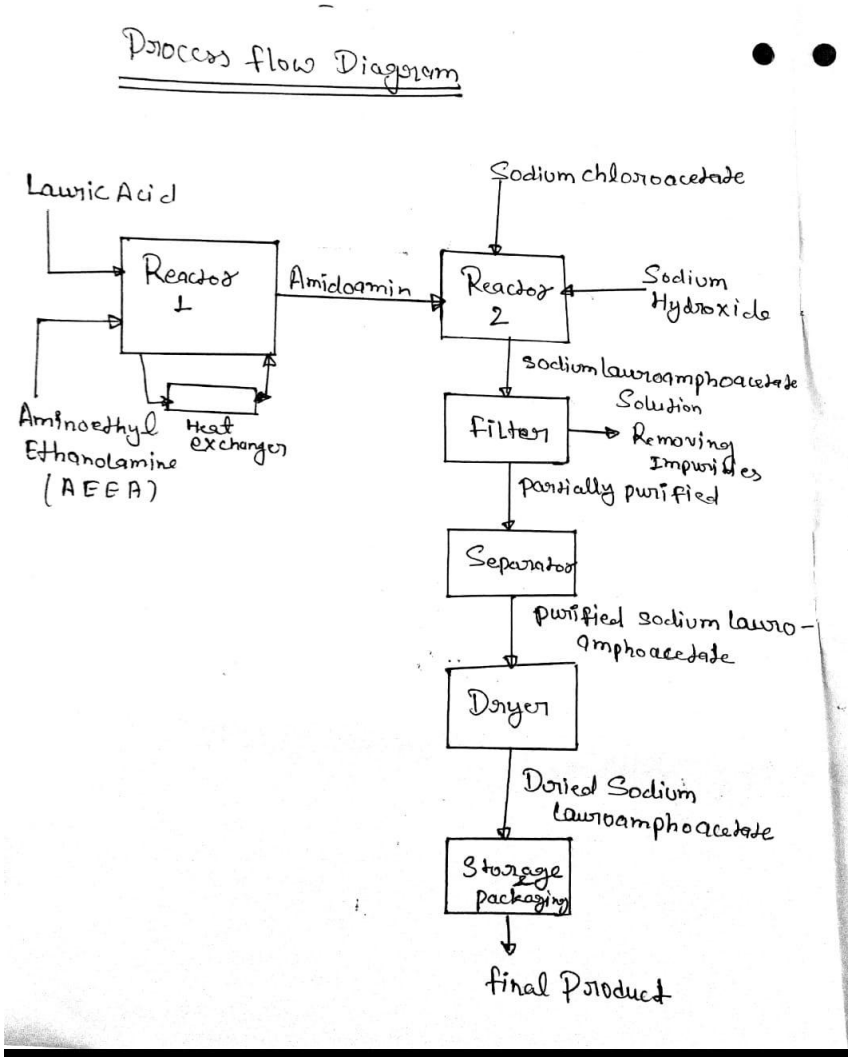
Chemical Formula:C18H35N2NaO4

Chemical Name: Sodium Lauroamphoacetate

Process Title: Production of Sodium Lauroamphoacetate from Lauric Acid

Raw materials and chemicals Required: Lauric Acid, Sodium Chloroacetate, Ammonia , Coconut Oil and Water and pH Adjusters.

Process Description (Block diagram):



Step 1: Amidation Reaction (Formation of Amidoamine Intermediate)

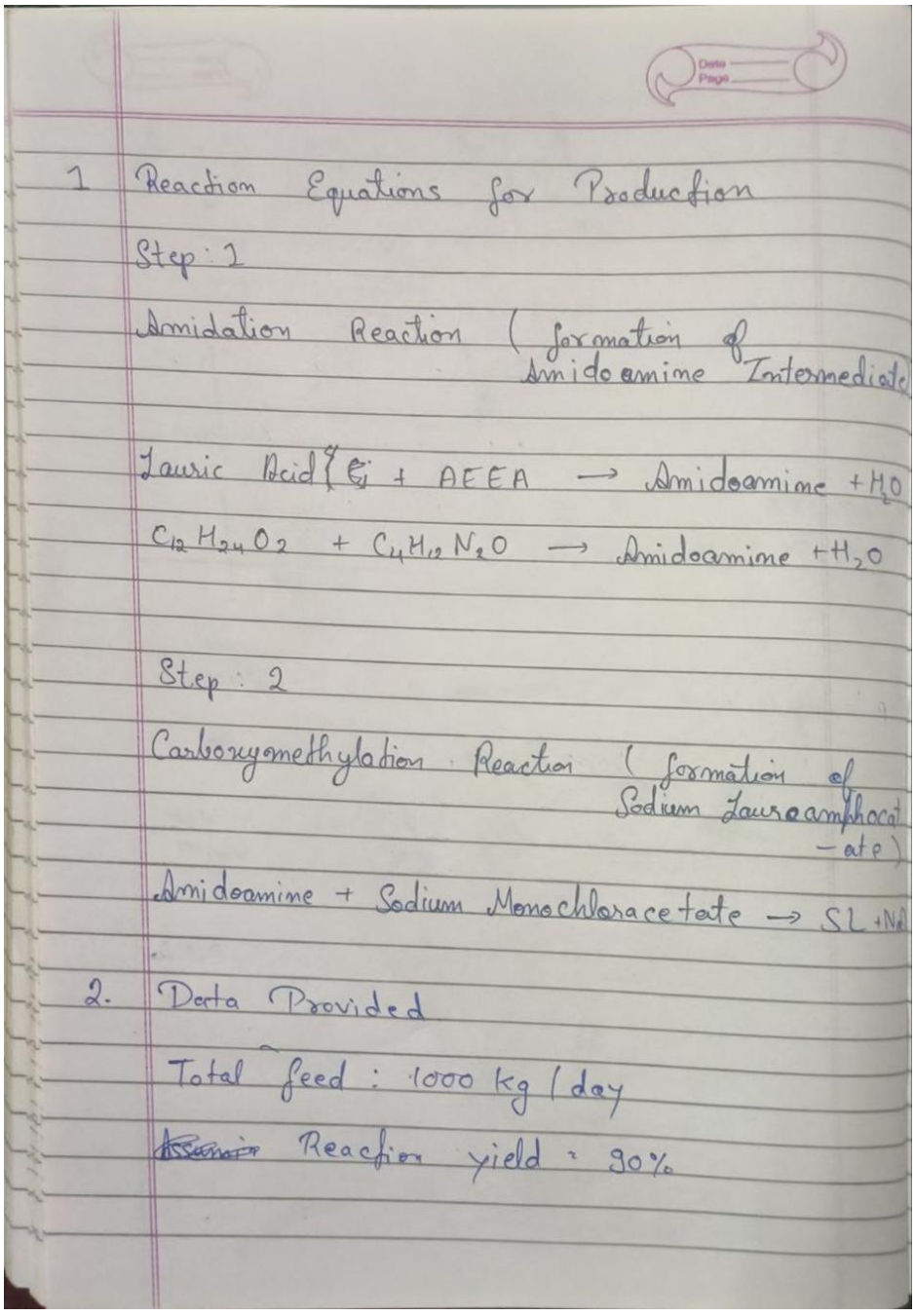
Lauric Acid+ AEEA→ Amidoamine+H2O

(C12H24O2) + (C4H12N2O) → Amidoamine+H2O

Step 2: Carboxymethylation Reaction (Formation of Sodium Lauroamphoacetate)

Amidoamine + Sodium Monochloroacetate → Sodium Lauroamphoacetate + NaCl

Material Balance:



Molecular Weights (MW):

Lauric Acid ($C_{12}H_{24}O_2$) = 200.32 g/mol

AEEA ($C_4H_{10}N_2O$) = 104.15 g/mol

Amidoamine intermediate = 286.47 g/mol

Sodium Monochloroacetate = 116.48 g/mol

Sodium Lauroamphoacetate = 368.48 g/mol

3. Mass flow Rate Calculation

Step 1

Assuming lauric acid makes up to 60% of the feed (600 kg/day)

$$\text{Moles of lauric acid} = \frac{600{,}000\ g}{200.32\ g/mol} = 2995\ mol/day$$

Since the reaction is 1:1 required AEEA is also 2995 moles

Mass of AEEA = $2995 \times 104.15 = 311{,}850\ g$

$= 311.85\ kg/day$

Mass of Amidoamine Intermediate produced -

$2995 \times 286.7 = 857,900\ g = 857.9\ kg/day$

Mass of Water (by product) :-

$2995 \times 18.015 = 53,950\ g = 53.95\ kg/day$

Amidation Reactor (R-101)

Mass processed for batch

Lauric Acid (600) kg + AEEA (312) kg = 812 kg

Density ~ 900 kg/m³

Volume for batch = $V = \frac{912}{900} = 1.01\ m^3$

Considering 70% fill factor

$V_{reactor} = \frac{1.01}{0.7} = 1.44\ m^3$

final reactor Size Selection : 1.5 m³ Glass-lined CS Reactor

Step 2 · Operating Conditions : 80-100°C, atmospheric pressure.

Total mass input ~ 1100 kg

As Amidoamine Intermediate reacts 1.1 with SMCA

Moles of SMCA = 2995 moles.

Mass of SMCA :

= 2995 × 116.48 = 348,840 g = 348.84 kg/day

Mass of Sodium Lauroamphoacetate (Final Product)

= 2995 × 368.48 = 1,103,200 g = 1103.2 kg/day

Mass of NaCl (by product)

= 2995 × 58.44 = 175.08 g = 175.08 kg/day

Carboxymethylation Reactor (R-102)

Mass processed per batch

Amidoamine (857.9 kg) + SMCA (348.8 kg) = 1206.7 kg

Density ~ 950 kg/m³

Volume required for batch

$$V = \frac{1206.7}{950} = 1.27\ m^3$$

Total volume Needed (Considering 70% fill factor)

$$V_{reactor} = \frac{1.27}{0.7} = 1.81\ m^3$$

Final reactor Size Selection : 2 m³ Glass-lined C-S Reator

4. Mole fractions. (final product moles)

mole fraction of Sodium lauroamphoacetate = $\frac{2995}{2995+2995}$ = 0.5

mole fraction of NaCl = $\frac{2995}{2995+2995}$ = 0.5

5 Filtration, Drying & Storage.

Filtration System : Nutsche Filter ~ 1.5 m^3
Evaporator for Solvet removal ~ 1.5 m^3 capacity
Storage tanks ~ 3 m^3 for final product.

Capital cost (only for the reactor):

example:

Equipment	Design Capacity (L)	No. of units	Cost/unit ($ for year 2014)	Total Cost ($ for year 2014)
Amidation Reactor (Glass-Lined CS, R-101)	1500	1	30,000	30,000
Carboxymethylation Reactor (Glass-Lined CS, R-102)	2000	1	40,000	40,000
Total Estimated Cost	----	----	-----	70,000

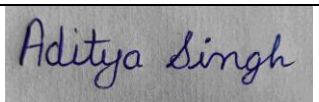
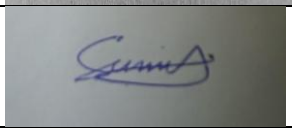
References: Provide reference for a research paper or an actual patent.

1. http://www.matche.com/equipcost/Reacto.html

List the contributions of each author:

- Sumit Chouhan : Reactor and equipment costing, Material Balance
- Sanjeeta: Block diagram

Sign the pdf and upload.

Name	Roll No	Signature
CEO Name	Aditya Singh	
First author Name	Sumit Chouhan	
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