NON TECHNICAL NOTE

ON PROCESS TO BE RELEASED DIRECTLY FROM

CSIR - CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE, KARAIKUDI-6.

1. Name of the process : Electrochemical perflurination of sulfolane to perflurobutane sulfonylfluoride
2. Products : Perflurobutane sulfonylfluoride
3. Uses of the products : Intermediate for Fluoro surfactants.

   Fluoro surfactants provide exceptional wetting, leveling, emulsifying, foaming, or repellency, pore penetration, corrosion inhibition characteristics in a wide range of industrial and consumer products. It is used in tertiary oil recovery process.. Fluoro surfactants are used as anti fogging agents, premium cleaning agent in electronic industries, used as fire fighting foams and also improves the quality of deposit in plating industries. High cost can be offset by lower concentration use levels.
4. Advantages of the process : Single step and simple operation
5. a. Present consumption pattern : 5 to 10 Tonnes per annum

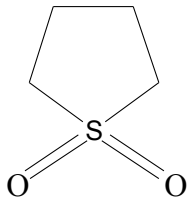
   b How is the demand being met? : By import

   c. Estimated future demand : > 25 Tonnes per annum

   d. Present market price : Rs.12,000/- per kg
6. Description of the process:

Electrochemical fluorination of Sulfolane

Anodic reaction:



$$+ \quad 10\ HF \xrightarrow[AHF]{ECF} CF_3CF_2CF_2CF_2SO_2F + 18\ H^+ + 18\ e^-$$

Perfluorobutanesulfonyl fluoride

Cathodic reaction:

$$18\ H^+ + 18\ e^- \longrightarrow 9\ H_2$$

A double walled one liter capacity stainless steel reactor with alternate pack of nickel anodes and cathodes were employed for the electrolysis. The temperature of cell and the condenser were maintained at less than or equal to 10^{o}C. Electrolysis was conducted under galvanostatic condition. The perfluorinated product settles at the bottom of the cell due to higher density (1.7 g/ml) than the reaction mixture and remains in the cell. The liquid product from the cell drained through a ball valve fixed at the bottom of the cell. The drained perfluoro product was washed by bicarbonate solution and then treated with water to make perfluoro product free from HF.

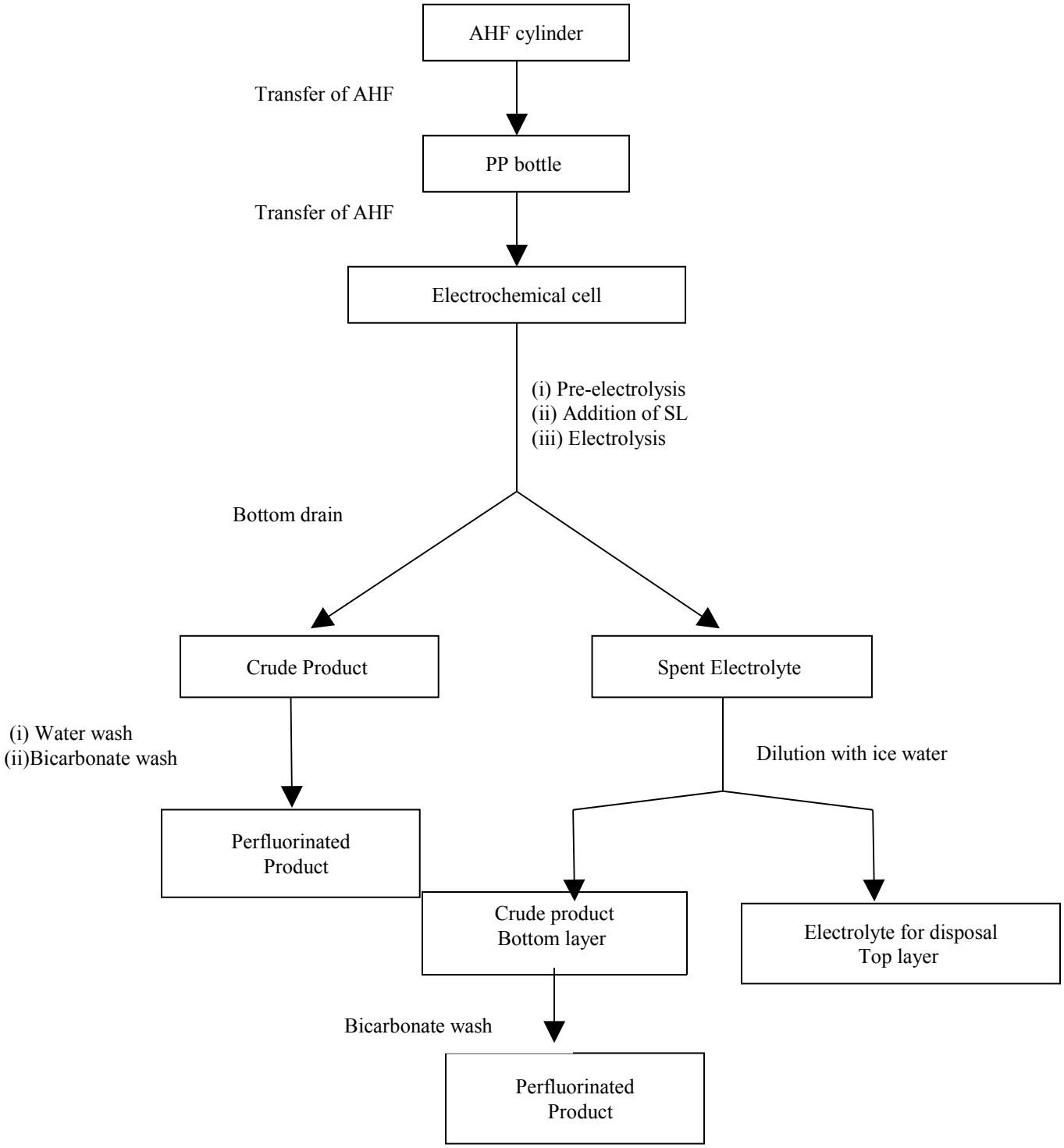
Material Yield = 40%

Current efficiency = 35%

Energy consumption = 31kWh/kg

7. Process flow sheet :

Flow sheet for Electrochemical fluorination of Sulfolane (SL)



Purification – By distillation of the crude product

8. Purity of the Crude product : 92% by GC analysis

9. Laboratory work details :

   a. Scale of investigation :1000ml capacity cell

   b. Can you supply samples : yes

   c. Quantity of product prepared :800 grams/batch of 12 days

10. Total Capital Investment :

   a. Total Capital Investment : Rs. 133 .00 lakhs

   b. Fixed capital investment : Rs. 103.00 lakhs

   c. Working capital investment : Rs. 30.00 lakhs

   d. Cost of production : Rs. 7400.00 per kg

   e. Selling price : Rs. 12000.00 per kg

   f. Annual Turnover : Rs. 180.00 lakhs

   g. Gross profit : Rs. 40.00 lakhs

   h. Net profit : Rs. 30.00 lakhs

   i. Return on investment : 30 %

11. Suggested terms of release of the process:

   Lump sum Premium :

12. Address for correspondence :

The Director
CSIR-CECRI
Karaikudi –630 006. Tamil Nadu

Requirements per kilogram of perfluoro butane sulfonyl fluoride

1. Sulfolane :1 kg
2. Anhydrous hydrogen fluoride :3.7 kg
3. Sodium bicarbonate : 0.5 kg
4. Power for electrolysis : 30 units
5. Power for other process : 10 units
6. Man power : Six persons for three shifts + one supervisor