Sr. IDP

VORTEX 12.0

Asia's Largest ChemFest

PROBLEM STATEMENTS 2025

PRIZE POOL OF

₹ 3 LAKHS

IDP A

Vent-gas component recovery

A vent gas stream from a process plant contains hydrogen and benzene. It is essential to separate benzene from the gas stream for further use of hydrogen gas.The gas stream is at 3.5 kg/cm2g and 10 deg C

The composition of the inlet stream is as follows:

Components	kg/hr
Benzene	1.43
Hydrogen	4.46
Ammonia	0.86
Total	6.75

Desired output:

The expected composition of the product gas stream is as follows.

Components	kg/hr
Benzene	0.01
Hydrogen	4.46
Ammonia	0.86
Total	5.33

Design a process to carry out the separation of benzene from the gas stream for a continuous process plant.

Evaluate various options. Estimate operating cost and capital expenditure.

IDP B

Oral peptide delivery

Semaglutide is a GLP-1 agonist peptide molecule and is used in the treatment of diabetes. While the autoinjector of semaglutide under the brand name Ozempic has gained much attraction in the market as a weight loss drug, its use in the treatment of type 2 diabetes cannot be undermined. Despite the rampant use and popularity of Ozempic, it has been observed that patients prefer the tablet dosage form of semaglutide over injectable formulations. However, semaglutide is a BCS class 4 molecule and is not easily absorbed from the GIT. It has low solubility at a pH range 2-6. It is also unstable to light, heat, oxidation, moisture, and pH.

Problem Statement:

With this in mind, suggest a formulation strategy to deliver 14 mg of semaglutide in the tablet dosage form. Please include the following information:

1. Formulation composition and rationale explaining the choice of excipients along with manufacturers of chosen excipients

2. Proposed mechanism of absorption of semaglutide for the proposed formulation strategy

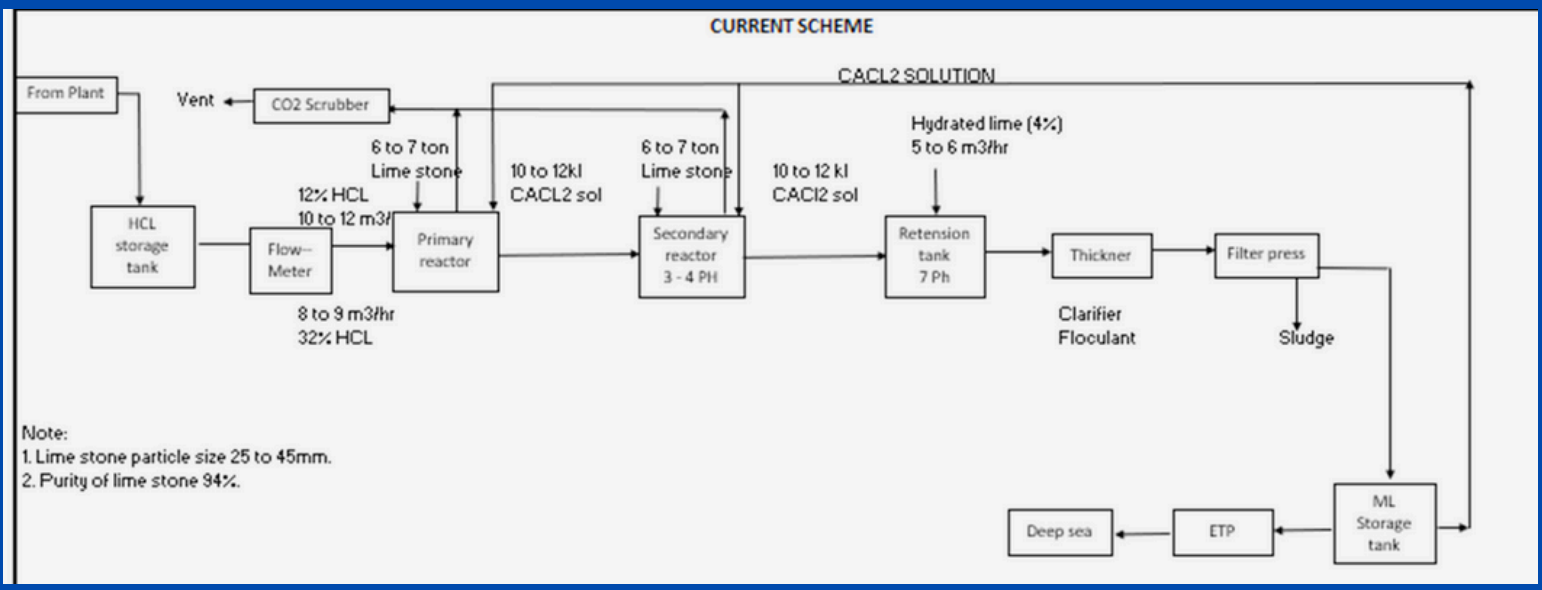
3. Method of manufacturing the formulation at an industrial scale

4. A method of analyzing semaglutide and determining its absorption from the tablet formulation (in vitro, in silico, or in vivo techniques could be proposed for determining absorption).

IDP C

CaCl2 plant: To augment HCl handling capacity with lime-stone

Spent acid from various industries needs to be treated at the CaCl2 plant. The current method used for this process is shown in the schematic below. Participants are expected to propose innovative modifications to the existing plant setup based on scientific principles, practical considerations, and relevant literature.



IDP D

Continuous Process for Grignard Reagent Preparation

Grignard reagents (R–Mg–X), where R is an organic group and X is a halogen, are widely used in organic synthesis to form carbon-carbon bonds. This enables the production of alcohols, carboxylic acids, esters, and other complex organic compounds. Currently, Grignard reagents are prepared through a batch process.

Due to the hazardous nature and high exothermicity of the reaction objective is to convert a batch process to a continuous process for the preparation of Grignard reagents, thereby enhancing process safety and efficiency

IDP E

Develop a portable, Quick, Easy-to-Apply, Green, Biodegradable Stain Remover for Fabric Care

Objective:

The objective is to develop a portable and convenient on-the-go stain remover that allows users to effectively treat stains immediately without the need to wash or launder the entire garment. The formulation should quickly break down stains, be easy to apply, and work on a variety of fabrics. This product should provide an effective solution for consumers seeking an efficient, time-saving stain removal option that fits seamlessly into their busy lifestyles. The solution should be green and biodegradable. Further, the solution should not affect the fabric in terms of color, shine, texture, etc. A safer solution for baby garments is an added advantage. The solution can be an all-in-one or two-pod product and should be oleochemical-based. The solution provided should be free of any potential IP infringement.

Background:

Stain removal in clothing is often time-consuming and requires the entire garment to be washed, which may not be convenient in many situations. Traditional stain removal methods typically involve soaking, scrubbing, or laundering the whole piece of clothing, which can be impractical, especially when time or resources are limited. Additionally, in scenarios where a garment is not yet soiled enough to justify a full wash, the stain remains, leading to potential embarrassment or prolonged use of stained clothing. There is a growing need for a solution that can quickly and efficiently remove stains without requiring the washing of the entire garment, especially for individuals on the go or those looking for a quick fix in everyday life

IDP F

DMF separation process

20 % DMF-Water Separation in Chemical Industries
A waste stream containing 20% DMF and water is generated in chemical industries. This aqueous stream cannot be discharged into the sea nor bio-degradable unless the DMF concentration is reduced to below acceptable limit. The objective is to develop an economical method for separating DMF from the water, reducing the water's Chemical Oxygen Demand (COD) to less than 1000 ppm of DMF and ensuring recovered DMF purity of 99.5% .