THE CHEMFEST

VORTEX 9.0

Jr. IDP Problem Statement

VORTEX 9.0 THE CHEMFEST

For First Year

Greenhouse gases are atmospheric gases that absorb and re-emit infrared energy from the atmosphere down to the earth's surface. These gases include water vapour (H2O), methane (CH4), carbon dioxide (CO2), nitrous oxide (N2O), Ozone (O3), hydrochlorofluorocarbon (HCFCs), etc. Out of these, the concentration of CO2 is around 413.2 ppm (By World Meteorological Organization (WMO)).

From 1990 to 2020 the warming effect on the climate is increased by 47% due to greenhouse gases (Out of which CO2 accounts for an 80% increase). CO2 emission is one of the main causes of global warming. Due to this increasing CO2 emission, the sea level is rising and the temperature of the earth is expected to increase in a few years.

So, to control the CO2 emission scientists/researchers have found the technology or process called Carbon Capture and Storage (CCS). CCS is the process of capturing and storing carbon dioxide (CO2) before it is released into the atmosphere. It was developed by Shell for use in the Athabasca Oil sands Project.

What do we expect from you?

1. Which are the main sources of CO2 emission? (List out all possible sources that you can think of and you know)
2. What is CCS (Carbon Capture and Storage)? What are its types? How it is being done in industries?
3. What innovative methods/technology you can think of to control this emission? Do mention the Cost factor. (Method should not be hypothetical, it must have some scientific logic)
4. What other ways can you think of to restrict CO2 emission? As a responsible citizen, how can you try to control the climatic change caused by CO2 emissions?
5. What useful products can be made from CO2 and How? (You don't need to explain it in detail, just explain it in short)

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Note: - Try to keep your abstract in round 1 up to one page only.

THE PRODIGY series of events

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For Second Year

Butanol is one of the very important petrochemical products manufactured by industries. It has wide application as a solvent. It is used as a Paint thinner and also it is required for the production of acrylic paint. Cosmetic products have a lot of importance for today's generation. Butanol is now being used in many cosmetic products like in nail care cosmetics, eye makeup (low concentration), etc. It is also used as a base for perfumes. **What are other uses you can think of?**

Commercially Butanol is produced by fermentation of carbohydrates in a process known as acetone–butanol–ethanol (ABE) **What are the other raw materials that can be used for the production of Butanol?**

However, there are several drawbacks of ABE fermentation:

- High substrate cost
- Low solvent concentration in the fermentation broth
- Production of low-value by-products (acetone and ethanol).

Traditionally ABE fermentation usually suffers from low butanol yield and other limitations. **What are other drawbacks of the ABE fermentation process?**

For that reason, you need to design the plant in such a way that it can lead to the maximum production of Butanol. Teams are free to use any technology or the combination of different processes they prefer as long as it can support their choice with appropriate calculations. The main goal of engineers is to develop processes for the benefit of mankind and remember the 3 'R's : Reduce, Recycle, and Reuse. **Innovative strategy is mostly appreciated.** A good solution should be scientifically realistic and commercially feasible. Greater detail allows us to understand the solution better.

Try to cover as many of the below points as possible:

- A high-quality process flow sheet / PFD
- The process should lead to minimum pollution.
- Process must be low-cost, energy-efficient for solvent purification and recovery.
- Make sure you consider process safety, handling of this type of products and environmental considerations
- **Show all material and energy balance calculations to support your solution.**
- Short and succinct but quantitative and technically precise solutions are preferred.
- **Do mention the economy of your process (try to make it as low as possible).**
- Estimate the TRL (Technology Readiness Level) of your technology on a scale of 1 to 10.
- Wherever possible, mention compositions, state, stream flows (kg/hr., etc.) clearly.

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