

Applicant: SynTech

Inventors: Apurva, Jai Gaikwad, Anshika Singh

Chemical Product Formula: C₆H₄O₅

Chemical Product Name: FDCA

Process Title: Production of FDCA using Pilot Process

EHS Summary:

- a. List the wastes generated and their quantity of generation.

Wastewater :

Contains volatile organic solvents (DMSO, DCM) along with water.

Flow rate of Wastewater = Wastewater flow rate during extraction

= 369,914.25 Kg/day

Acid-Water :

Contains sulphate salts (Na₂SO₄) and sulphuric acid (H₂SO₄) along with water.

Flow rate of acid-water = Acid-water flow rate in the filtration unit

= 310 Kg/day

CO₂ Emission :

CO₂ produced in the entire process

= 208,051.584 Kg/day

- b. What are the current regulations for the above waste materials? (Limits to which it can be disposed in the environment)

Chemical/ Wastes	Safety Concerns	Exposure Limits	Additional Information
Wastewater	Organic solvents (DMSO, DCM) are toxic and volatile;	DCM: ACGIH TLV: 50 ppm (8-hour TWA) DMSO: Low toxicity but enhances skin absorption of other chemicals.	Can cause groundwater contamination if not properly managed.
Acid-Water	Corrosive (H ₂ SO ₄), sulfate salts can cause scaling in water bodies	H ₂ SO ₄ : OSHA PEL - 1 mg/m ³ , Na ₂ SO ₄ : No strict exposure limit but can cause irritation at high concentrations.	High concentrations can lead to acid rain formation. Chronic exposure may cause lung inflammation and

CO₂ Emission

Greenhouse gas contributes to climate change.

OSHA PEL - 5,000 ppm (8-hour TWA),

dental erosion.

Volatile Organic Compounds (VOCs)

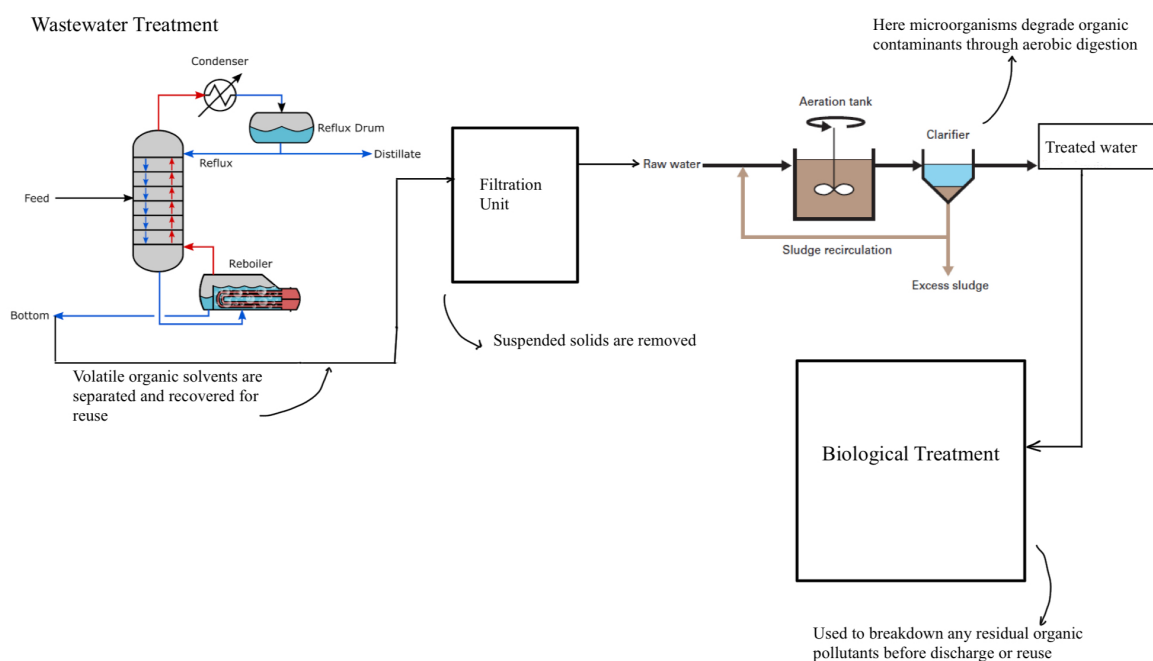
Includes DCM and other volatile organics, leads to liver toxicity, contributes to smog

DCM : OSHA PEL: 25 ppm (8-hour TWA)
ACGIH TLV - 50 ppm

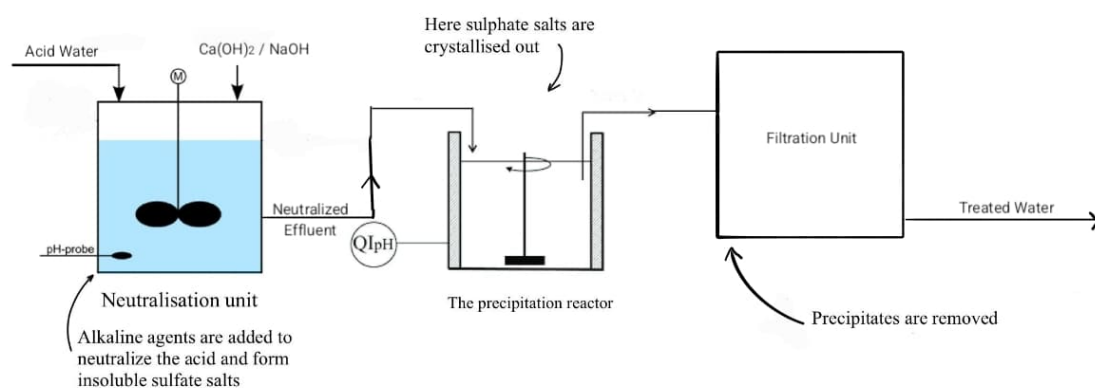
Short-term exposure can cause dizziness and nausea, while prolonged exposure increases cancer risk.

c. Describe the treatment procedure for wastes with a block diagram. Your chemical plant must be a zero liquid discharge plant.

1) Wastewater Treatment :



2) Acid Water Treatment :



As per the data from the technical team, we were able to achieve 95% recovery of volatile organic compounds and neutralization of acidic water from the proposed flowsheet diagram.

- d. Are there any safety concerns for the chemicals? Give exposure limits: Time Weighted Average (TWA) for 8 hours and short-term exposure limit (STEL) for 15 minutes.

Chemicals / Wastes	Health Concerns	TWA (ppm)	STEL (ppm)
Wastewater	Contains organic solvents (DMSO, DCM) which may be toxic to aquatic life and pose inhalation hazards.	DMSO: 250 ppm (non-volatile, low toxicity). DCM: 25 ppm.	DMSO: 150 ppm (500 mg/m ³). DCM: 125 ppm.
Acid-Water	Contains sulfate salts, sulfuric acid (H ₂ SO ₄), and water. Sulfuric acid is highly corrosive and can cause severe burns upon contact.	Sulfuric Acid: 1 mg/m ³	Sulfuric Acid: 3 mg/m ³
Carbon Dioxide (CO ₂)	Elevated concentrations can lead to respiratory issues and displace oxygen, causing asphyxiation in confined spaces.	5,000 ppm	30,000 ppm
Volatile Organic Compounds (VOCs)	Includes dichloromethane (DCM) and other organic vapors. Exposure can cause dizziness, nausea, and organ damage with prolonged exposure.	DCM: 25 ppm	DCM: 125 ppm

References: Provide reference for a material safety data sheet/industrial safety report/weblink.

Dichloromethane (DCM) Exposure Limits:

<https://www.osha.gov/chemicaldata/chemResult.html?recNo=153>

Dimethyl Sulfoxide (DMSO) Exposure Limits:

<https://www.thermofishersci.in/msds/dimethyl-sulfoxide.pdf>

https://en.wikipedia.org/wiki/Dimethyl_sulfoxide

Sulfuric Acid Exposure Limits (OSHA & NIOSH):

<https://www.osha.gov/chemicaldata/chemResult.html?recNo=250>

<https://www.cdc.gov/niosh/npg/npgd0577.html>

<https://www.cdc.gov/niosh/idlh/7664939.html>

Carbon Dioxide (CO₂) Exposure Limits:

<https://www.osha.gov/chemicaldata/chemResult.html?recNo=360>

Volatile Organic Compounds (VOCs):

<https://www.osha.gov/chemicaldata/chemResult.html?recNo=103>

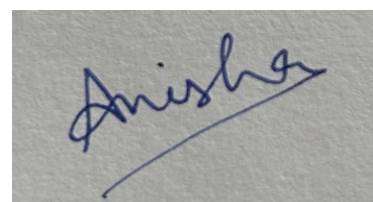
Dichloromethane (DCM) Limits: <https://www.osha.gov/chemicaldata/chemResult.html?recNo=153>

List the contributions of each author:

- Apurva determined the waste generation quantity.
- Apurva carried out the literature search and found the current regulations.
- Jai Gaikwad & Apurva found the necessary treatment steps and prepared the block diagram.
- Anshika Singh obtained TWA and STEL data.

Name	Roll No
Anisha Nanda	230145
Apurva	230180

Signature



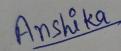
Jai Gaikwad

230407

A handwritten signature in black ink that reads "Apurva". The signature is written in a cursive style with a double underline.A handwritten signature in black ink that reads "Gaikwad". The signature is written in a cursive style with a double underline.

Anshika Singh

230163

A handwritten signature in blue ink that reads "Anshika". The signature is written in a cursive style with a double underline.