Applicant: UltravioletChemicals

Inventors:

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Chemical Product Formula: $C_8H_{16}O$

Chemical Product Name: 2-Octanone

Process Title: Alkali fusion of castor oil

EHS Summary:

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

The production of 2-Octanone by alkali fusion of castor oil using Pb3O4 may generate various wastes, including:

- **Solid waste:** The alkali fusion process may generate solid waste such as unreacted castor oil, Pb3O4 residues, and other impurities.
- **Liquid waste:** The production process may also generate liquid waste such as the organic phase (2-Octanone) and the aqueous phase (containing the alkali, water, and other impurities).
- **Hazardous waste:** The production process may generate hazardous waste such as lead-containing waste, which may require special handling and disposal procedures to prevent environmental pollution.
- **Energy waste:** The production process may consume a significant amount of energy, which may result in greenhouse gas emissions and other environmental impacts.
- **Water waste:** The production process may consume a significant amount of water, which may result in wastewater discharges and water pollution.

In general, the production process may generate solid waste such as unreacted castor oil and Pb3O4 residues in the range of 5-10% of the total weight of the raw materials used. The organic phase (2-Octanone) may constitute up to 90% of the total weight, while the aqueous phase (containing the alkali, water, and other impurities) may constitute up to 5% of the total weight.

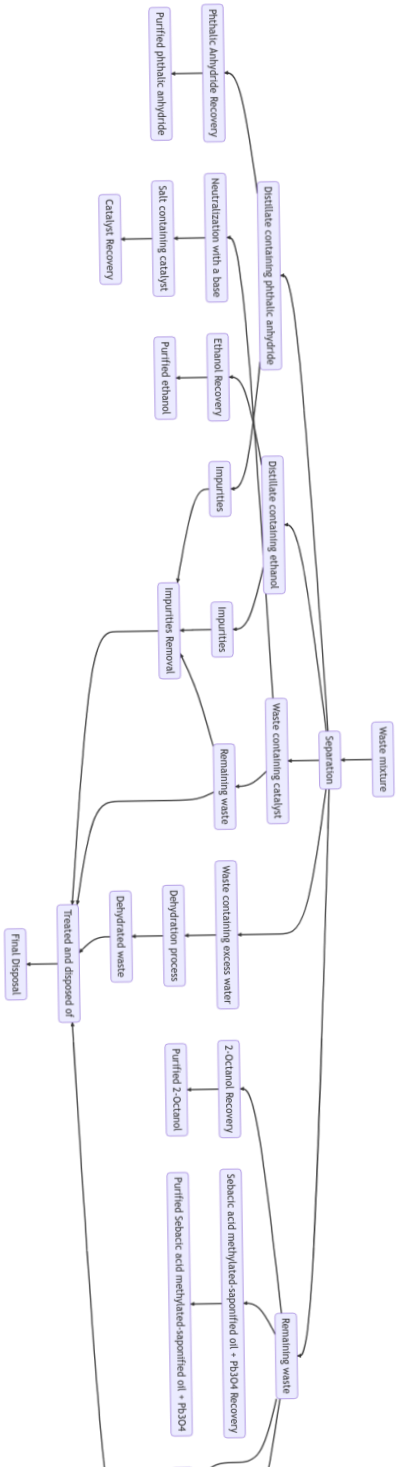
The production process may also generate hazardous waste such as lead-containing waste, which may range from 0.5% to 2% of the total weight of the raw materials used.

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

The regulations are as follows -

- **Hazardous waste –** According to the Hazardous waste management rules, 2016, which specify the limits for the concentration of lead that can be present in the waste before it is disposed of. The limits for lead in hazardous waste that can be disposed of in India are as follows:
    - Landfills: The concentration of lead in hazardous waste that is disposed of in landfills must not exceed 1000 mg/kg.
    - Incineration: The concentration of lead in hazardous waste that is incinerated must not exceed 5000 mg/kg.
- **Liquid Wastes and water wastes -** In general, the concentration limits for various pollutants in liquid wastes are specified in the applicable laws and regulations. These limits vary depending on the type of pollutant and the location and method of disposal. The concentration limit for total dissolved solids (TDS) in treated effluent discharged into inland surface water bodies is 2,100 mg/l as per the Environmental Impact Assessment (EIA) Notification, 2006.
- **Solid waste -** Permissible limits for pollutants in landfill leachate:
    - pH: 6.5 to 8.5
    - Biochemical Oxygen Demand (BOD): 100 mg/l
    - Chemical Oxygen Demand (COD): 250 mg/l
    - Total Suspended Solids (TSS): 100 mg/l
    - Total Dissolved Solids (TDS): 2100 mg/l
    - Phenolic compounds: 1 mg/l
    - Heavy metals (such as lead, cadmium, mercury, and chromium): various limits depending on the landfill class)
- **Permissable limits for ambient air quality -**
    - Particulate Matter (PM10): 100 µg/m3 (24-hour average)
    - Sulphur Dioxide (SO2): 80 µg/m3 (24-hour average)
    - Nitrogen Dioxide (NO2): 80 µg/m3 (24-hour average)
    - Ozone (O3): 100 µg/m3 (8-hour average)

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


Waste mixture
Separation
Waste containing catalyst
Distillate containing phthalic anhydride
Phthalic Anhydride Recovery
Purified phthalic anhydride
Distillate containing ethanol
Neutralization with a base
Salt containing catalyst
Catalyst Recovery
Ethanol Recovery
Purified ethanol
Impurities
Impurities Removal
Impurities
Remaining waste
Waste containing excess water
Dehydration process
Dehydrated waste
Treated and disposed of
Final Disposal
2-Octanol Recovery
Purified 2-Octanol
Remaining waste
Sebacic acid methylated-saponified oil + PbSO4 Recovery
Purified Sebacic acid methylated-saponified oil + PbSO4

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.

Some safety concerns related to the production of 2-octanone include:

- **Fire and explosion hazards:** 2-octanone is flammable and may form explosive vapor/air mixtures. Therefore, appropriate safety measures should be taken when handling and storing this chemical, such as using proper ventilation, avoiding sources of ignition, and wearing personal protective equipment.
- **Health hazards**: 2-octanone can cause irritation to the skin, eyes, and respiratory system. Exposure to high concentrations may also cause headache, dizziness, and nausea. Therefore, appropriate measures should be taken to prevent exposure, such as using protective clothing, gloves, and respirators.
- **Environmental hazards:** 2-octanone is toxic to aquatic organisms and may cause harm to the environment if released into water or soil. Therefore, appropriate measures should be taken to prevent environmental contamination, such as using spill containment measures and disposing of waste properly.

The Threshold Limit Value (TLV) for 2-octanone, established by the American Conference of Governmental Industrial Hygienists (ACGIH), is **25 parts per million (ppm) as a Time-Weighted Average (TWA)** for an 8-hour workday and **50 ppm as a Short-Term Exposure Limit (STEL) for a 15-minute period.**

References:

1. 2-Octanone reagent grade, 98 111-13-7 (sigmaaldrich.com)
2.

List the contributions of each author:

- Author 1 determined the waste generation quantity.
- Author 1 and 2 carried out the literature search and found the current regulations.
- Authors 2 and 3 found necessary treatment steps and prepared the block diagram.
- Author 3 obtained TWA and STEL data.

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