Applicant: **SynthoChem**

Inventors: Raman Jorewal, Ashutosh Bhardwaj, Pranjal Gautam

Chemical Product Formula: R(OCH2CH(OH)CH2)n(OGl)c where R = C8 to C10 alkyl chain and Gl = glucose unit

Chemical Product Name: Alkyl Polyglucoside (AGP-0814)

Process Title: Acid Catalysed Reaction of Alcohol and Glucose

EHS Summary:

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

APG is considered to be relatively environmentally friendly, as it is derived from renewable resources, such as glucose and fatty acids, and it is biodegradable. The waste generated during the production of APG include excess reactants, by-products, and wastewater from the manufacturing process. The wastes generated with their quantities are:

Process waste: During the production process, various chemicals and solvents are used, such as ethanol, methanol, and sodium hydroxide in which NaOH is the major waste. These substances are considered as process waste and need to be properly handled and disposed of to prevent any harm to the environment. Quantitatively, the production of 1 ton of alkyl polyglucoside can generate up to 0.2 tonnes of sodium hydroxide waste.

Water waste: Alkyl polyglucoside production typically requires significant amounts of water, and the wastewater generated from the process can contain high levels of organic matter, salts, and other contaminants. Quantitatively, the production of 1 ton of alkyl polyglucoside can generate up to 2-3 tonnes of wastewater.

Energy waste: The production process requires energy to operate equipment, such as pumps and mixers, and to heat and cool the reaction mixture. Quantitatively, the amount of energy generated can be estimated to 200kWh per 1 ton of APG produced.

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

The current regulations issued by the Central Pollution Control Board (CPCB) are as illustrated in the following table:

Organic Chemicals Manufacturing Industry	A. Effluents Standards	
		Limiting concentration in mg/l, except for pH and Bioassay test
	Compulsory parameters	
	pH	6.5-8.5
	BOD 3 days at 27 °C	100
	Oil & Grease	10
	Bioassay test +	Minimum 90% survival after 96 hours in 100% effluent
	Additional Parameters	
	Nitrate (as N)	10
	Arsenic (as As)	0.2
	Chromium (Hexavalent)	0.1
	Chromium Total	1.0
	Lead (as Pb)	0.1
	Cyanide (as CN)	0.2
	Zinc (as Zn)	5.0
	Mercury (as Hg)	0.01
	Copper (as Cu)	2.0
	Nickel (as Ni)	2.0
	Phenolics (as C_6H_5OH)	5.0
	Sulphide	2.0
	+ The Bioassay test shall be conducted as per IS: 6582-1971	

C. Effluent Standards for Incinerator
Note: (i) Effluent from scrubber(s) and floor washing shall flow through closed conduit or pipe network and be treated to comply with effluent standards mentioned in 'A' above. (ii) The built up in Total Dissolved Solids (TDS) in wastewater of floor washings shall not exceed 1000 mg/l over and above the TDS or raw water used.
D. Storm water
Note: (i) Storm water shall not be allowed to mix with scrubber water and/or floor washings. (ii) Storm water shall be channelized through separate drains passing through a HDPE lined pit having holding capacity of 10 minutes (hourly average) of rainfall.]

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

A zero liquid discharge (ZLD) plant is designed to minimize liquid waste by recovering and treating wastewater, and then concentrating the remaining solid waste for disposal.

The following processes takes place in the ZLD plant:

Pre-treatment: The wastewater generated during the production process is first collected and sent to a pre-treatment system to remove any large solids and contaminants, such as oil and grease.

Primary treatment: The pre-treated wastewater is then sent to a primary treatment system, which include physical, chemical, and biological treatment processes. The primary treatment removes suspended solids, organic matter, and some dissolved contaminants.

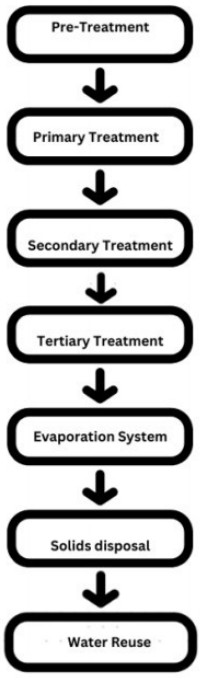
Secondary treatment: The treated wastewater from the primary treatment system is then sent to a secondary treatment system, which include additional physical, chemical, and biological treatment processes. The secondary treatment further removes contaminants and ensures that the wastewater meets the discharge standards or can be recycled for use in the production process.

Tertiary treatment: The treated wastewater from the secondary treatment system is then sent to an RO system, membrane filtration, or adsorption, which removes dissolved salts and other impurities from the wastewater. The Tertiary treatment produces a high-quality permeate stream and a concentrated brine stream.

Evaporation system: The concentrated brine stream from the RO system is then sent to an evaporation system, which evaporates the water and concentrates the remaining solids. The evaporation system can be a multiple effect evaporator or a mechanical vapor recompression (MVR) evaporator.

Solids disposal: The concentrated solids from the evaporation system are then collected and disposed of properly, such as in a landfill or through incineration.

Water reuse: The treated permeate stream from the RO system can be reused in the production process or sent to a further polishing system for additional treatment.



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.**

The production of alkyl polyglucoside (APG) involves the use of several chemicals, some of which may pose safety concerns during handling and use. Some of the commonly used chemicals in APG production and associated safety concerns include:

1. Fatty alcohols: Fatty alcohols are used as a starting material for APG production. These chemicals can be flammable and may cause skin and eye irritation if not handled properly.
2. Glucose: Glucose is used as a reactant in APG production. It is generally considered safe, but high concentrations can cause skin irritation and may be hazardous if ingested.
3. Sodium hydroxide: Sodium hydroxide is used as a catalyst in APG production. It is a strong base that can cause severe skin and eye irritation and may be corrosive if ingested.
4. Hydrogen peroxide: Hydrogen peroxide is sometimes used as a bleaching agent in APG production. It is a strong oxidizing agent that can cause skin and eye irritation and may be corrosive if ingested.

To ensure safe handling and use of these chemicals, appropriate personal protective equipment should be worn, such as gloves, goggles, and protective clothing. Adequate ventilation should be provided in the production area, and proper handling and storage procedures should be followed. Workers should also be trained in the safe use and handling of these chemicals to minimize the risk of accidents and exposure.

1. Inhalation hazards: Some of the chemicals used in the production of APG can release harmful vapours or gases when heated or exposed to air, which can cause respiratory problems if inhaled.
2. Skin and eye irritation: Contact with certain chemicals used in the production of APG, such as alkali hydroxides, can cause skin and eye irritation or burns.
3. Fire and explosion hazards: Some of the chemicals used in the production of APG can be flammable or reactive and pose a fire or explosion hazard if not handled properly.
4. Environmental hazards: The production of APG can generate wastewater and by-products that may be hazardous to the environment if not properly treated or disposed of.

COMPOUND	TWA (mg/m^3)	STEL(mg/m^3)
Sodium hydroxide	2	2.6
Fatty alcohol ethoxylates	1	3
Alkyl polyglucoside	10	20
Hydrogen peroxide	1	3

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

https://www.irocoatingadditive.com/environmental-assessment-alkyl-polyglucoside/

Guidelines : https://cpcb.nic.in/env-protection-act/

Safety concerns: https://www.osha.gov/chemicaldata/630/

List the contributions of each author:

- Raman Jorewal – determined the wastes generated and their quantities and found the current guidelines.
- Pranjal Gautam - found necessary treatment steps and prepared the block diagram.
- Ashutosh Bhardwaj – found safety concerns and obtained TWA and STEL data.

Sign the pdf and upload.

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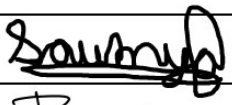
Saumya Gupta (CEO)	210944	
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