

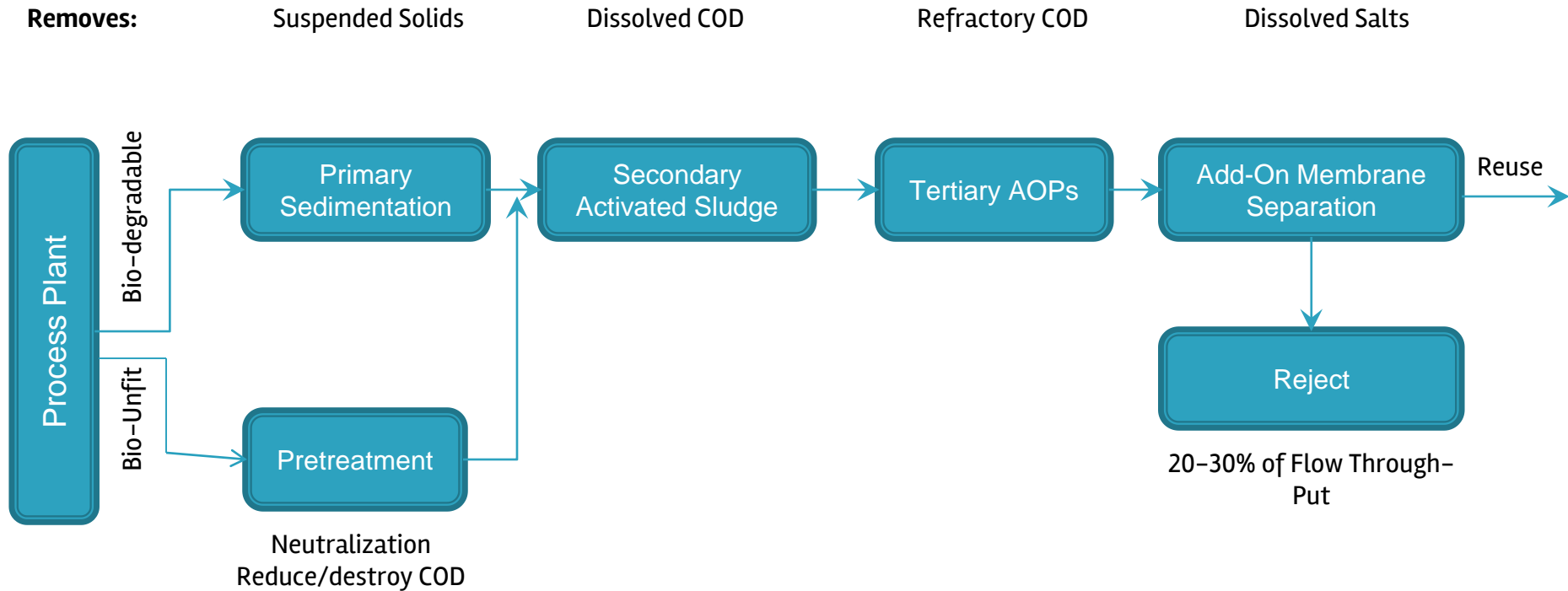
# **Pretreatment of Industrial Wastewater for ZLD/Resources Recovery**

**An Application of Oxidative Evaporation Technology**

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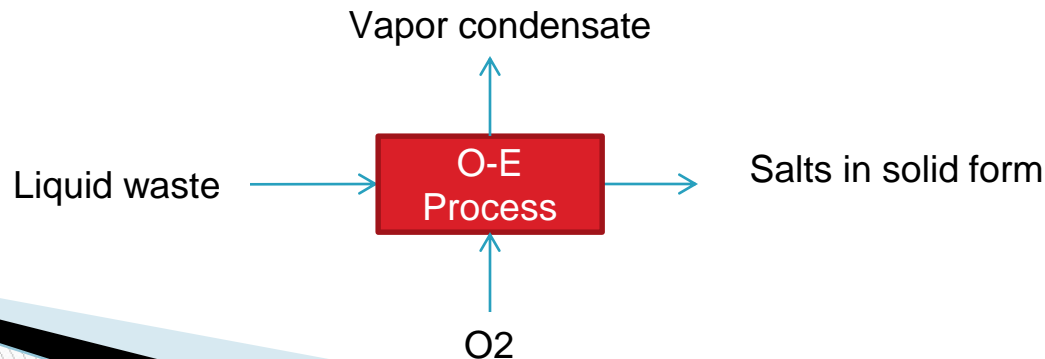
# Conventional Industrial Wastewater Treatment Systems



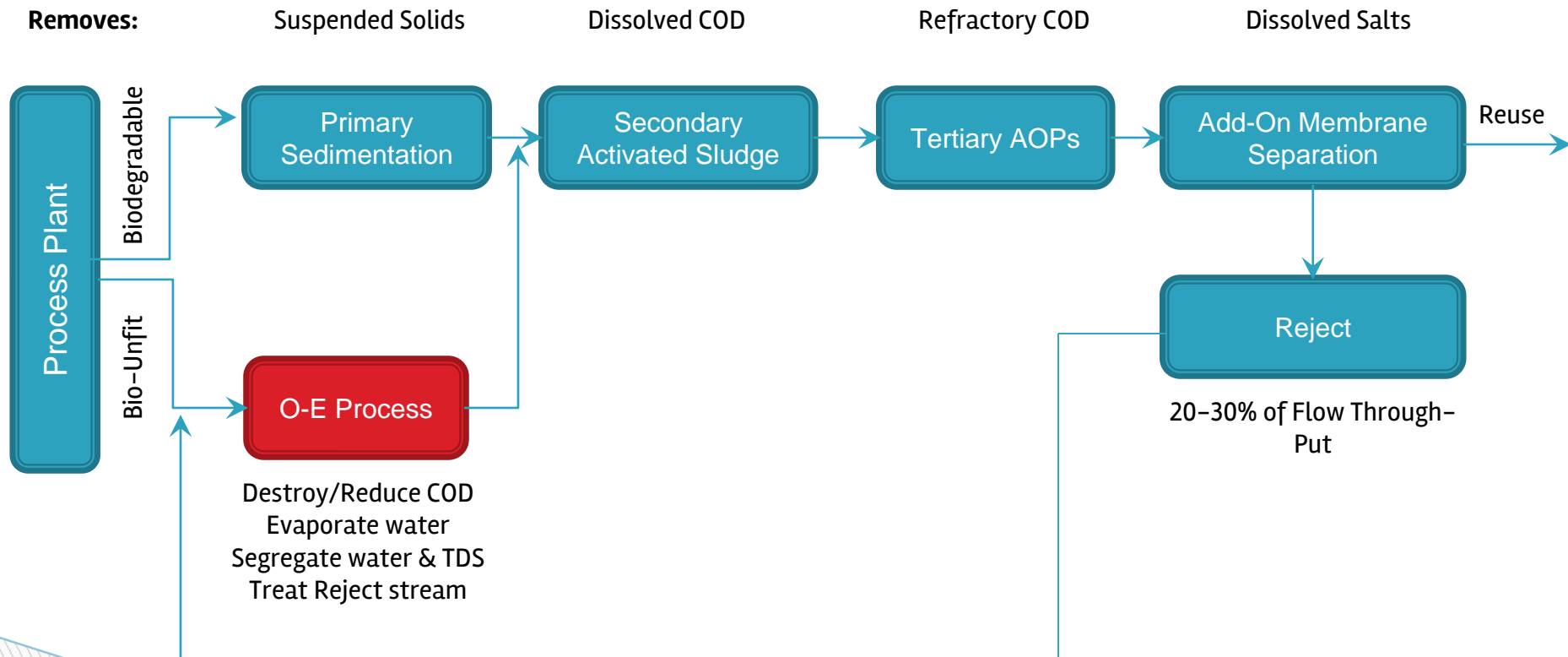
# Oxidative Evaporation Process

## A low energy wastewater evaporator

- Remove contaminants (COD) in water with Oxygen as oxidizing agent
- Utilizing reaction heat to evaporate water- a low energy evaporator
- Recover water and dissolved solids into two segregated products



# Conventional Wastewater Treatment Combined With O-E Process



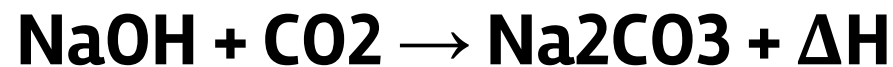
# O-E Process Principles

1. Oxygen is used to oxidize organic or inorganic compounds under elevated temperature in an alkaline environment

Liquid Phase Oxidation



Neutralization



# O-E Process Principles (cont.)

2. Oxidation reactions generate heat, which is utilized to evaporate water, leaving dissolved solids in solution

## Evaporation

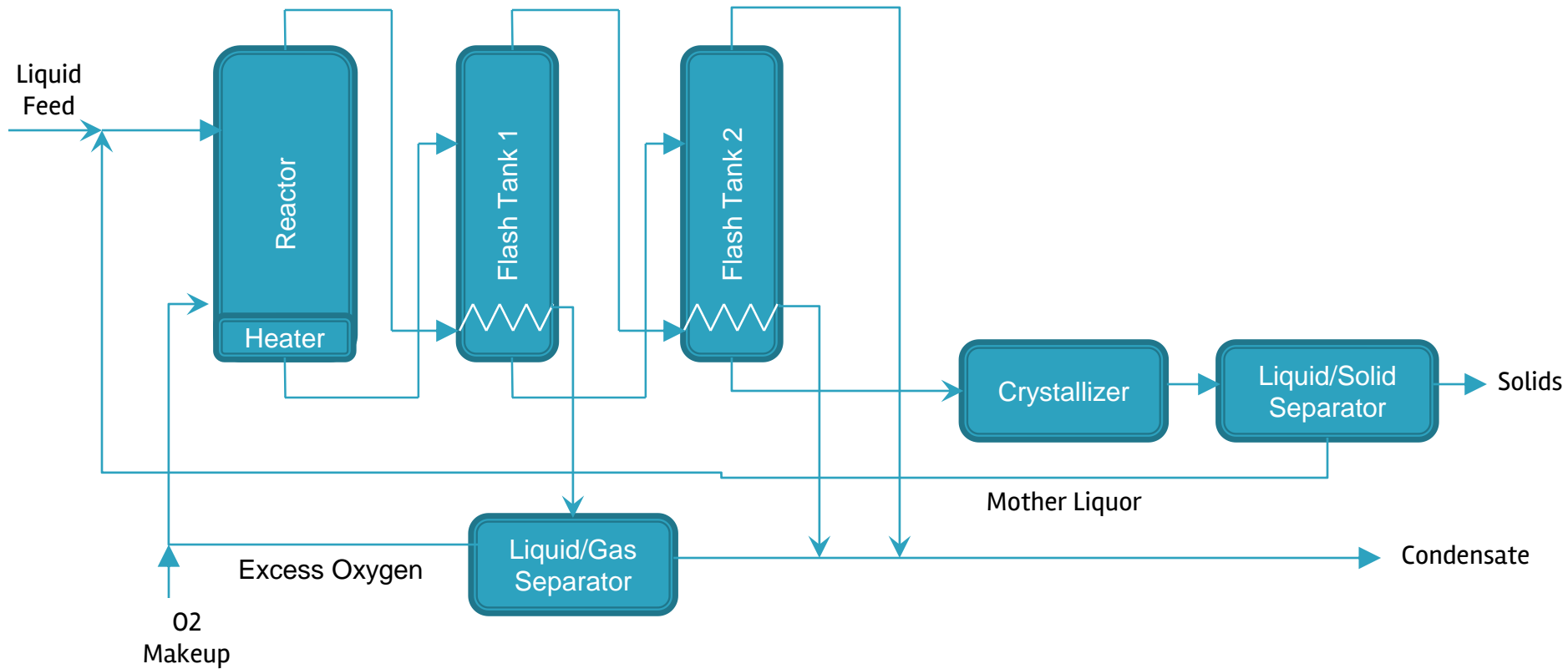


3. Liquid waste is recovered in two segregated product streams:

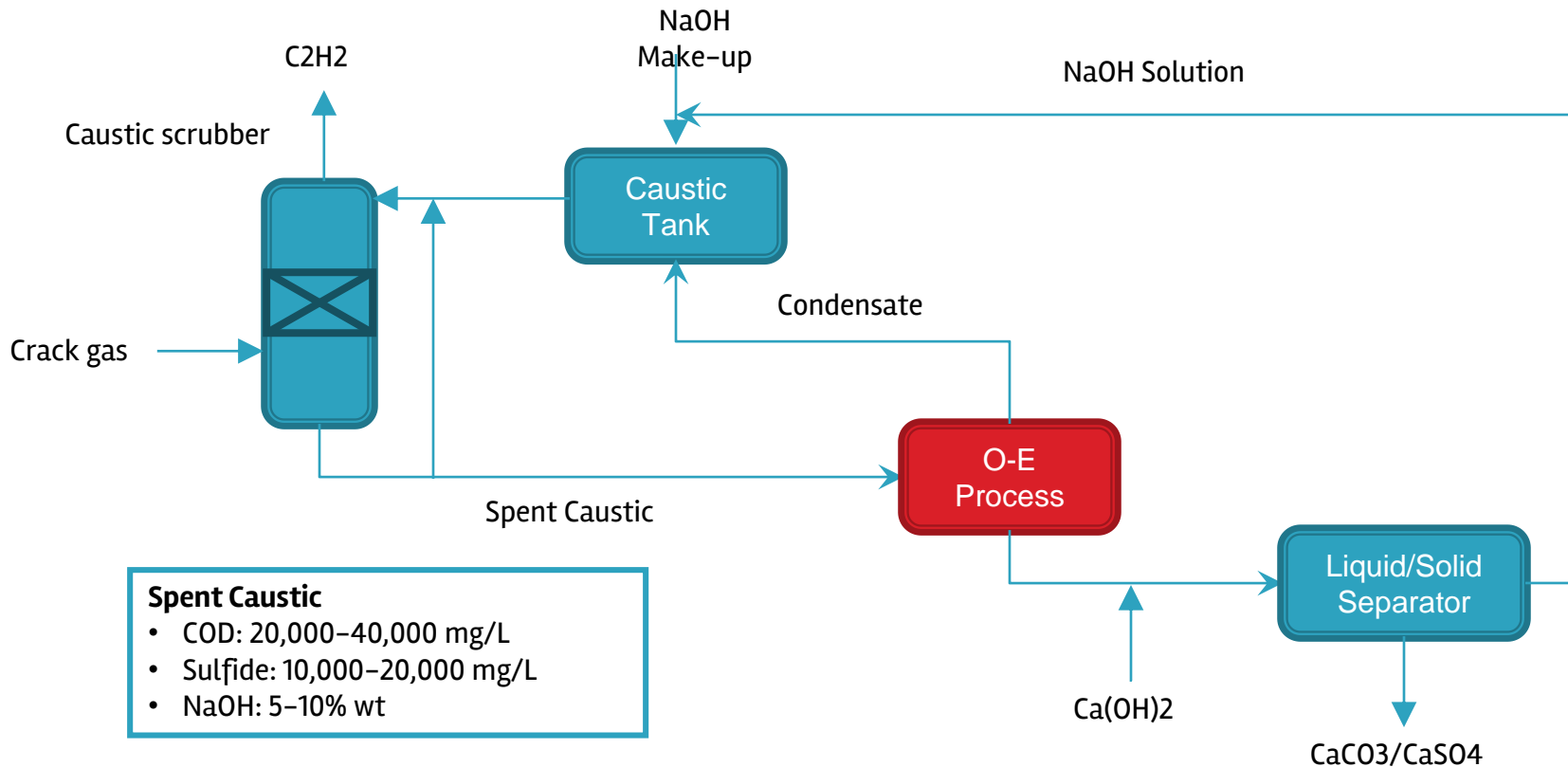
Vapor condensate

Salts in solid form

# O-E Process Flow Scheme



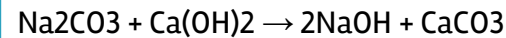
# Illustrative Use for Treating Spent Caustic (A Total Treatment)



## Spent Caustic

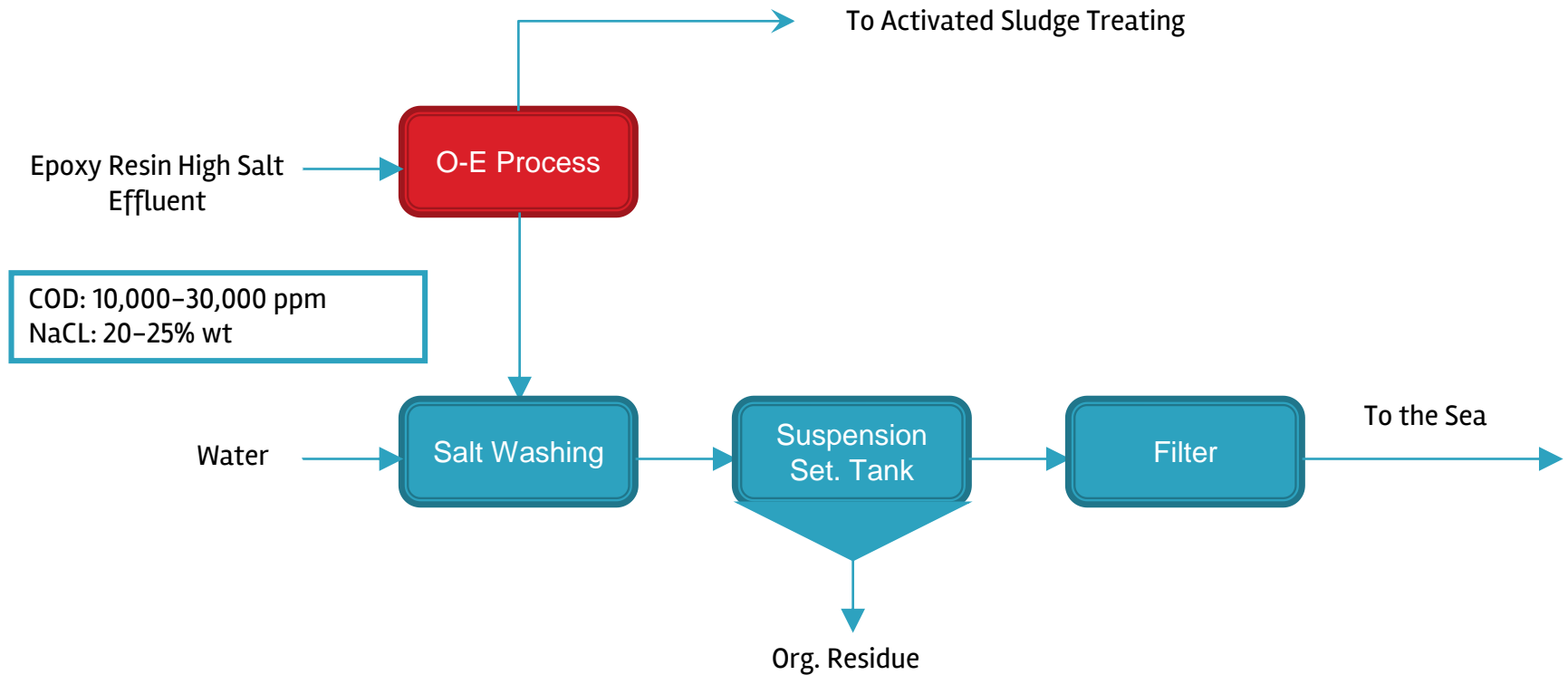
- COD: 20,000–40,000 mg/L
- Sulfide: 10,000–20,000 mg/L
- NaOH: 5–10% wt

## Recaustilization





# Application of O-E Process in Treating Epoxy Resin Waste



# Summary

- The conventional activated sludge process precludes receiving the process effluent containing biologically unfit factors. Segregating bio-unfit streams for Pretreatment is the essential measure in treating industrial wastewater
- A total recovery of water for re-use (i.e. ZLD) in the conventional treatment systems hinges on the water recovery from the reject of desalting operation

# Summary (cont.)

- Evaporation/Crystallization technology has evolved to solve the issue of disposing of salt laden water streams, by recovering water as salt-free vapor condensate and salt in crystallized forms
- The O-E process is a wastewater evaporation technology; it also functions to remove COD in wastewater. It is ideal as a pretreatment measure for treating effluents high in COD and/or salts. The OE Process aids achieving ZLD in the conventional treatment systems.

# Summary (cont.)

- Applications of O-E Process in treating spent caustic illustrates a Total Treatment (ZLD + Resources Recovery)
- The use of O-E Process as pretreatment for treating epoxy resin effluent illustrates achieving ZLD in the conventional treatment systems.

# Conclusions

1. Evaporation allows recovery of water from contaminated effluent. In contrast, the conventional approach is to remove contaminants out of water.
2. As a result, wastewater is recovered as vapor condensate and salts in solid form, which make it possible to polish the condensate and to also recover chemicals for reuse.
3. The O-E Process is a low energy evaporator, utilizing the reaction heat to evaporate water and provides the capability of removing COD in waste water.
4. The O-E Process may find additional applications in other industries to comply with the guidelines of ZLD.