Equipment III
Evaporators and Crystallizers

Course Objectives

1. Describe the purpose and function of evaporators and crystallizers.
2. Describe typical applications of evaporators and crystallizers in chemical processing.
3. Distinguish between the different types of evaporators and crystallizers.
4. Explain the function of auxiliary or support equipment to the function of evaporators and crystallizers.
5. Identify typical operating parameters associated with controlling an evaporator and a crystallizer.
6. Describe common performance issues related to evaporators and crystallizers including their causes and indicators.

Key Terms (Define the following)

anti-solvent - _____

_____

crystal - _____

_____

metastable zone (MSZ) - _____

_____

primary nucleation - _____

_____

saturation point - _____

_____

seeding - _____

_____

secondary nucleation - _____

_____

super-saturation - _____

_____

Principles

Evaporator Classifications

Design

- Pan
- Tubular
  - Short tube
  - Long tube
    - Falling film
    - Rising film
- Plate
  - Falling film
  - Rising Film
- Wiped film

Flow

- Natural circulation
- Forced circulation

Questions

1. List four processes that use thermal separation.
   1) _____
   2) _____
   3) _____
   4) _____

2. What is the effect on evaporation of each of the following?
   pressure - _____
   _____

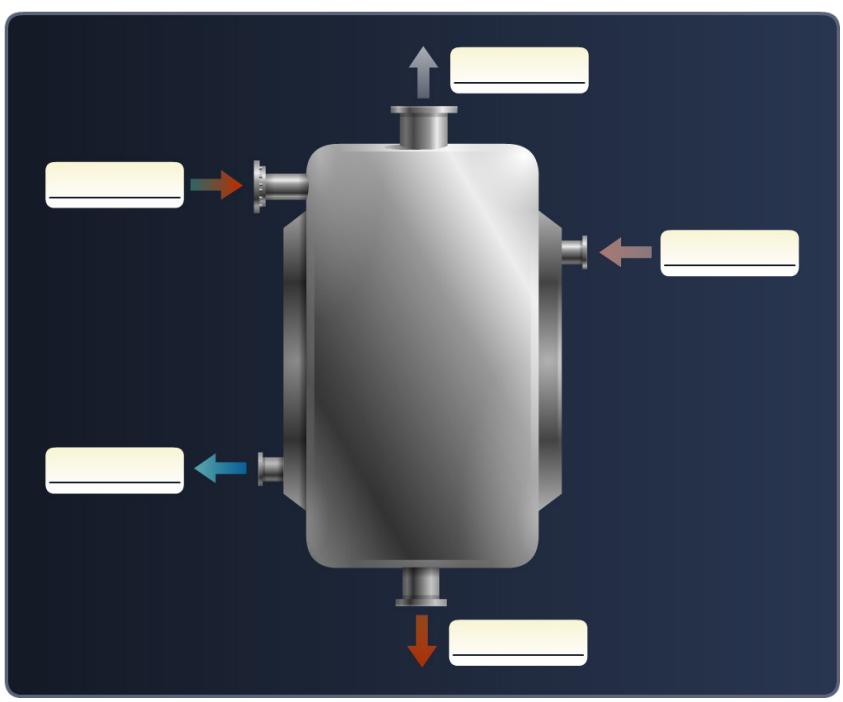
   temperature - _____
   _____

   concentration of impurities - _____
   _____

3. List three reasons for using an evaporator to separate compounds from a solution.
   1) _____
   2) _____
   3) _____

4. List two examples where evaporators are used in chemical processing.
   1) _____
   2) _____

5. Label the components of this evaporator.



6. Describe the difference between a falling film long tube evaporator and a rising film long tube evaporator.

7. What are the advantages of wiped film evaporators?

8. In a double effect evaporator system, what is the feed to the second evaporator?

9. What is the purpose of a vapor recompression system?

10. Describe the two methods for recompressing evaporated steam from an evaporator.
    1)
    2)

11. What is the primary difference between an evaporator and a crystallizer?

12. List the four mechanisms for creating super-saturation.

13. Describe three ways to create crystal nuclei.
    1)
    2)
    3)

14. What is the disadvantage of excessive secondary nucleation?

15. How is crystal habit modified?

16. List four types of equipment used in evaporative crystallization.

17. List three types of equipment used in cooling crystallization.

18. Describe the purpose of the two sections in a classified-suspension (Oslo) crystallizer.

19. List four types of equipment used to separate the solvent liquid from formed crystals downstream from a crystallizer.

20. Describe two problems that could cause crystals that are too small.
    1)
    2)