Pharmaceutical Engineering (Practical)

Aim: To study the effect of surface area on rate of evaporation.

Requirements

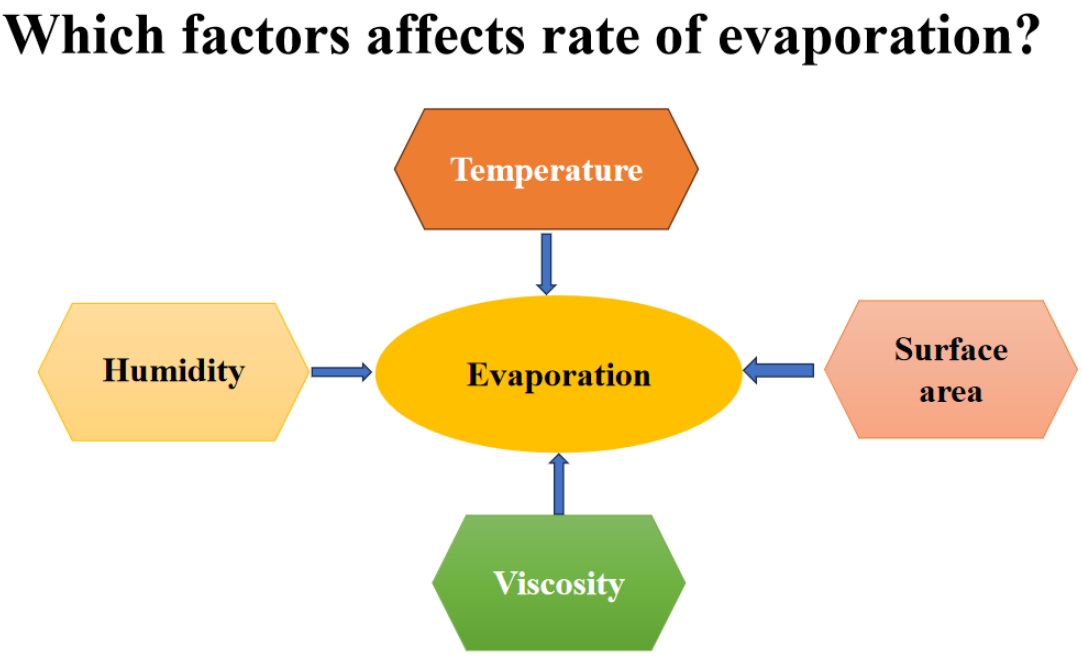
Chemicals : Distilled water

Apparatus: Beaker, measuring cylinder, thermometer, waterbath etc.

Theory:

Evaporation is unit operation which involves mass transfer and heat transfer. It is the process of removal of vapours of volatile liquids from the surface. Therefore, it is also known as surface phenomenon. The vapour will be collected back due to the reason of cost, toxicity and safety. This helps in preventing cross contamination, environmental pollution & fire hazards Practically evaporation process is used to get concentrated product. In pharmaceutical industries evaporation is used at different stages like Manufacturing of bulk drugs. For concentration of aqueous solution of sodium hydroxide, sodium chloride, glycerol, sugars & salts like ammonium nitrate.In Herbal extracts can be evaporated to get semisolid & dry product. For preparation of Penicillin., insulin, blood plasma, liver extract, thermolabile materials.

Evaporation depends on different factors like The rate at which heat can be transferred. The quantity of heat required. Maximum allowable temp of liquid, Pressure, Effective surface area, viscosity, Change in the concentration of liquid, Total time of evaporation, Scale formation on the surface., Impurities present in the mixture.



Procedure for study of effect of surface area on the rate of evaporation:

1. Take a clean beakers of different capacity (50ml, 100ml & 250 ml) fill measured volume of 40ml water in each beaker.

2. Weigh each beaker containing water and record it as initial weight (W)
3. Keep the beakers in water bath at 70°c for 20 min.
4. After 20 min, take the weight of beakers and record it as a final weight (W2)
5. Find out the difference in the weight of the beaker and calculate rate of evaporation.
6. Find out the radius of each beaker and calculate surface area of each beaker

Observation:

Temperature = 70°C

Radius of beakers

50 mL = ...cm

100 mL = ...cm

250 mL = ...cm

Surface area of beakers (πr2) cm2

50 mL = ... cm2

100 mL = ... cm2

250 mL = ... cm2

Observation Table:

Sr. No	Beaker capacity (mL)	Initial weight W_1 (gm)	final weight W_2 (gm)	Difference between (W_1-W_2)	Rate of evaporation (gm/min)
1.	50				
2.	100				
3.	150				

Calculation:

Rate of evaporation =(W1− W2)/Time of evaporation

Result:

Beaker capacity (mL)	Surface area (πr^2) cm^2	Rate of evaporation (gm/min)
50		
100		
250		

Conclusion:

From the observation table and result, it can be concluded that as the surface area increases, the rate of evaporation …….(increases/ decreases).