

Chapter 13 Emulsion Polymerization

- An emulsion consists of a discontinuous liquid phase dispersed throughout a different, continuous liquid phase –milk
- Most emulsion polymerizations are free radical reactions, and yield high molecular weight products.

(ex) SBR (styrene-butadiene rubber), latex paints and adhesives, PVC

- Ingredients:

- a) Water - - - 150
- b) A monomer (nt miscible in H₂O) - - -100
- c) Oil -in -water emulsifier - - -2~5
- d) Initiator in aqueous - - - 0.5

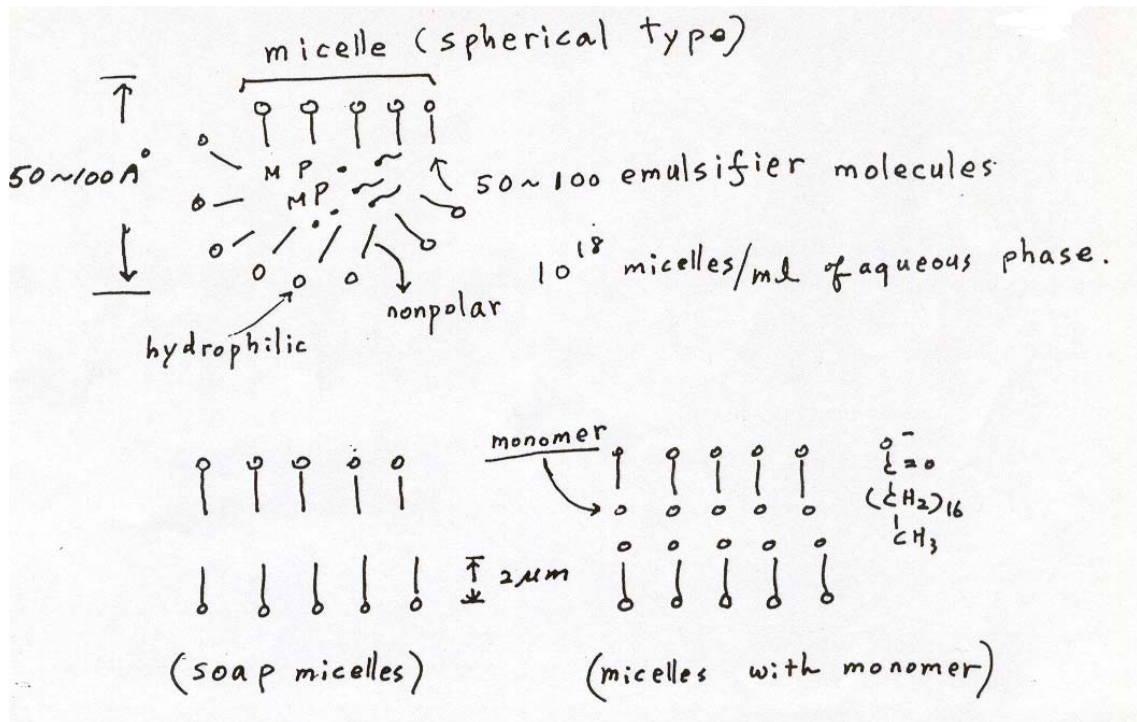
- Emulsifier

- a) anionic surfactants (salt or fatty acids soap)
- b) alkane sulfonic acids
- c) nonionic

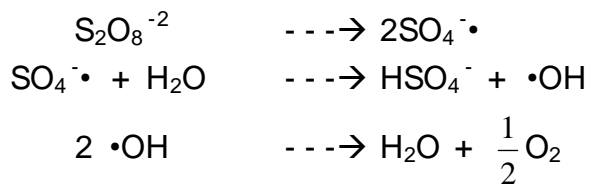
ex) Sodium stearate : ((CH₃(CH₂)₁₆COONa) \cong 300
 6×10^{19} molecules/ml of water
 \cong 30g/L (bulk onc. of soap)

- Critical micelle concentrations (cmc):

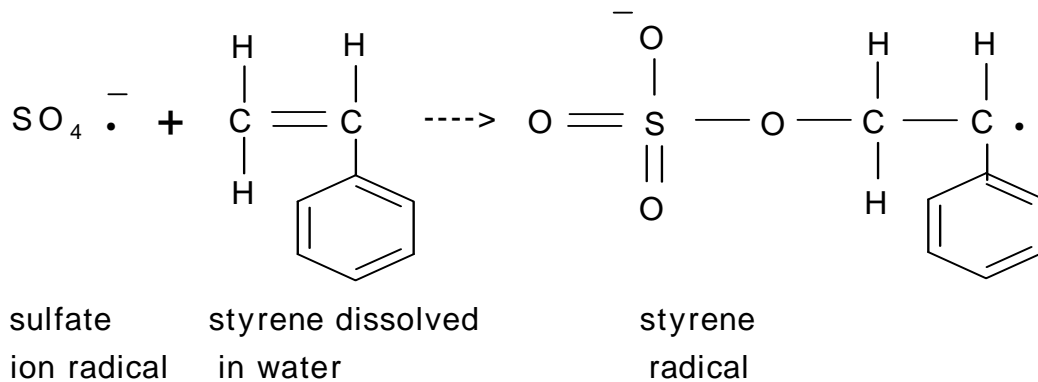
emulsifiers form aggregates . at cmc



- Free radicals must be generated in the aqueous phase.
- Initiator : water soluble salts of persulfuric acid :

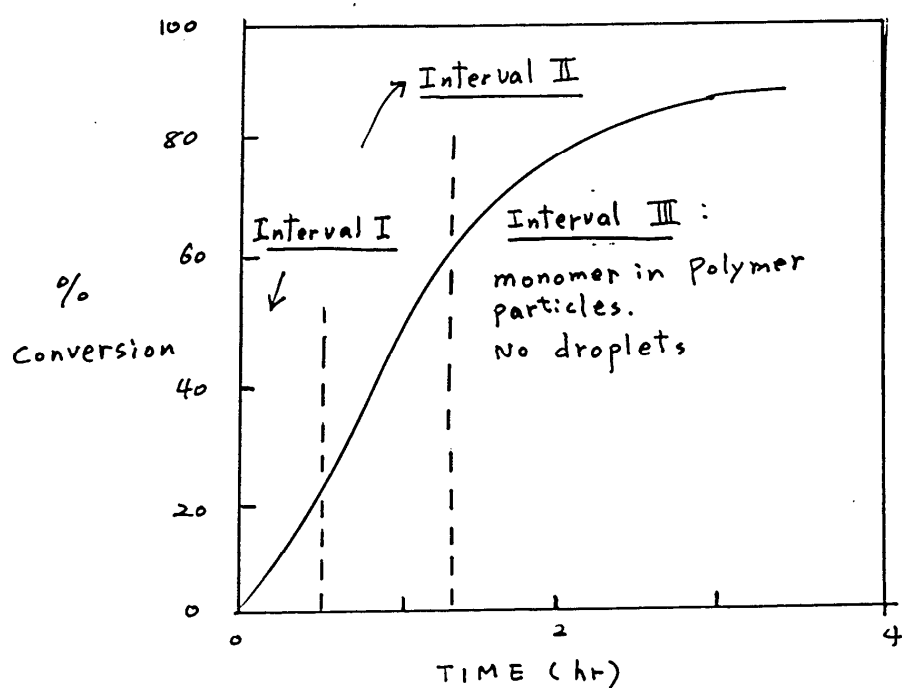


- : 40 ~ 80
- ex)



- Three stages in emulsion polymerization

- a) Interval I : a region of accelerating rate of conversion and proceeds until all the micelles are consumed. 10 ~ 15% of the total monomer is consumed.
- b) Interval II : the rate of polymerization is constant. All the micelles disappear, no monomer droplets remain. 1/3 monomer is consumed.
- c) Interval III : the rate of polymerization begins to decrease polymerization reaction is completed.



Course of an emulsion polymerization

Bulk polym.	Polymer가 monomer soluble	Polymer 가 monomer	NYLON, PET, PS
Solution polym.	Polymer monomer	Polymer	PP, PBD,
Emulsion polym.	가	monomer ,	PS, PVC, SBR, NBR
Suspension polym.	가	가 , monomer가	Styrene foam, PS ion exchange, PVC

a) bulk polymerization : monomer 가

(polymer가 monomer → polymer
 `` `` → ``)

b) solution polymerization : monomer (solvent)

(가 polymer → homogeneous polymerization
 `` `` → heterogeneous or precipitation polymerization)

c) emulsion polymerization :

(initiator)

(emulsifier) 가 .

d) suspension polymerization :

monomer initiator

monomer가 , , polymer 가 가
 .(pearl or bead polymerization)