WACKER

CAVASOL® W7 M – AN EFFICIENT PHASE TRANSPORT AGENT FOR HIGHLY HYDROPHOBIC EMULSION POLYMERS

Emulsion polymerization is one of the main techniques used to manufacture commercially important polymers. It is a radical polymerization that combines monomers in water using surfactants to form an emulsion. The resulting dispersion is often referred to as a 'latex.' These emulsions find applications in adhesives, paints, paper coating and textile coatings.

The Advantages of Emulsion Polymerization Include:

- Formation of high-molecular-weight polymers at fast polymerization rates
- The continuous water phase is an excellent conductor of heat
- The viscosity of the reaction medium remains close to that of water and is not dependent on molecular weight
- The final product can be used as is and does not generally need to be altered or processed

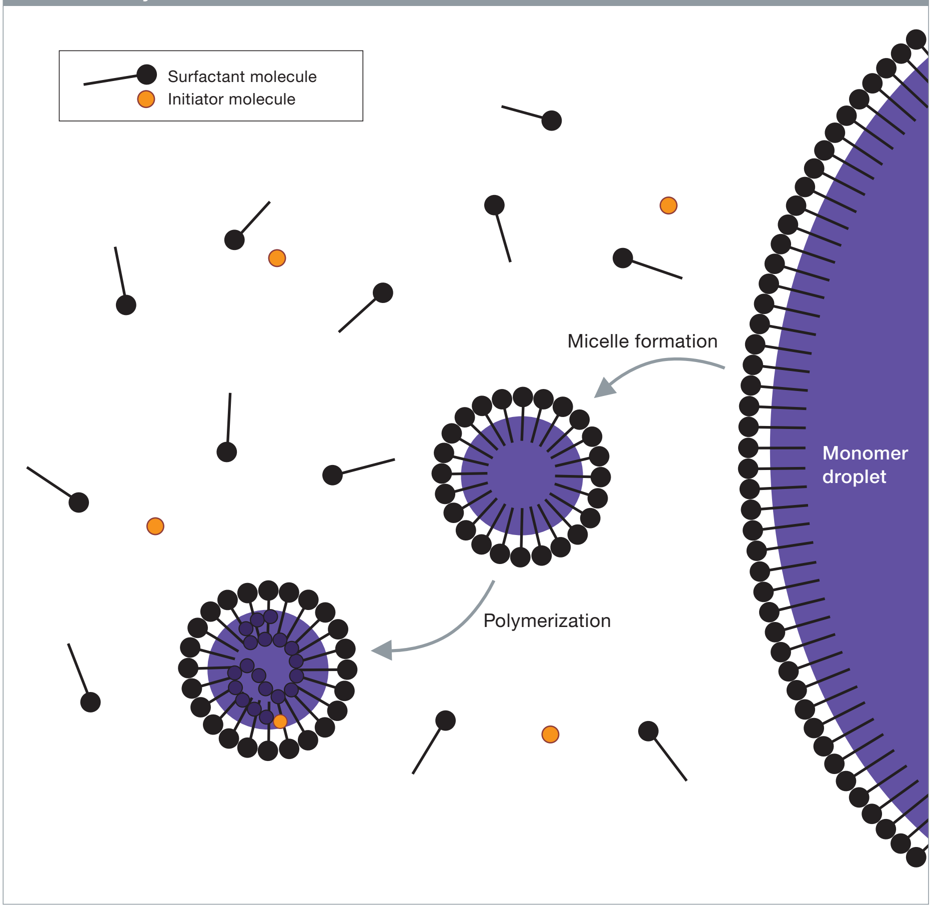
Emulsion Polymerization Process

The emulsion polymerization process is a free radical reaction carried out under heterogeneous conditions as shown to the right. Three separate phases coexist in the reaction medium:

- The monomers, which exist as emulsified droplets
- The growing polymer particles
- The continuous water phase

The polymerization process requires the continuous diffusion of monomers from the emulsified droplets through the aqueous medium into the polymer particles, where they are subsequently polymerized by free radical initiators in the polymer particles. This process of monomer diffusion requires a certain degree of water solubility, limiting this process to monomers with sufficient water solubility. Today there is a need to increase the hydrophobicity of polymers, since many uses of latex polymers are intended to protect the substrate from water.

Emulsion Polymerization Process

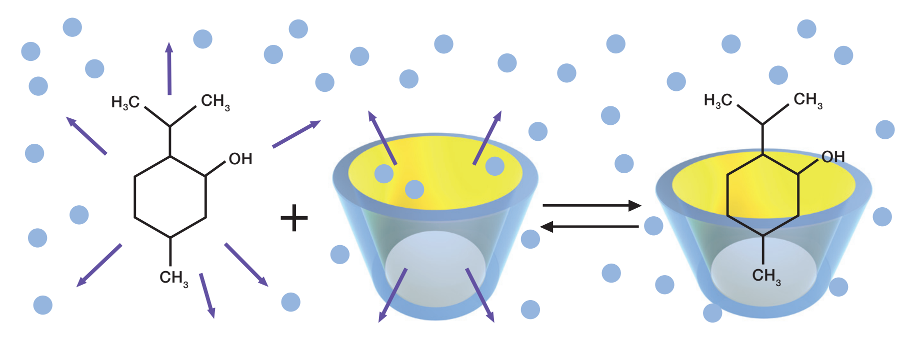


CAVAMAX® and CAVASOL® are registered trademarks of Wacker Chemie AG.

CAVAMAX® and CAVASOL® Cyclodextrins

CAVAMAX® and CAVASOL® cyclodextrins are a well-known group of natural carbohydrates, capable of encapsulating other organic molecules in a reversible equilibrium-controlled process. This process of 'molecular encapsulation' effectively modifies the properties of the organic guest molecules, e.g. reducing volatility, extending release over time, improving stability or water solubility.

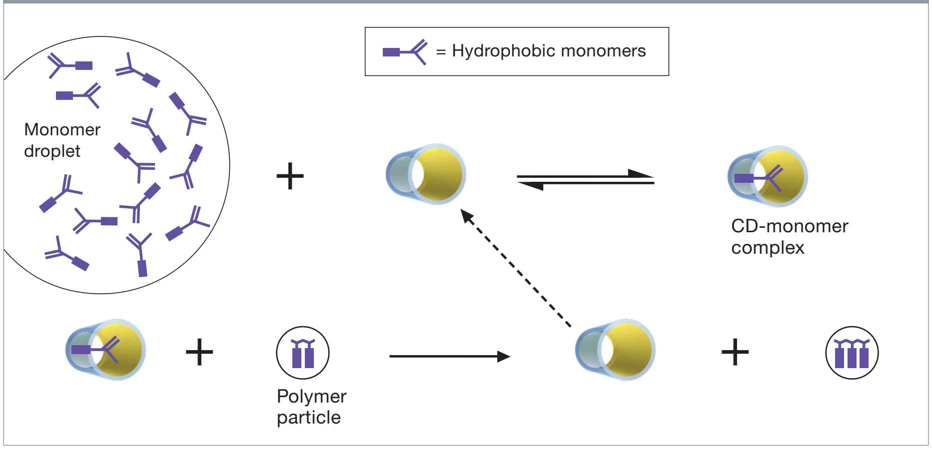
Molecular Encapsulation Process



Phase Transport Agent

As a phase transport agent, highly water-soluble CAVASOL® W7 M, an amphiphilic modified cyclodextrin, forms an inclusion complex with low-soluble hydrophobic monomers, e.g. lauryl or stearyl (meth)acrylate, in a reversible equilibrium-controlled process. This allows collection of a hydrophobic monomer, shuttling it out of the micelle across the continuous water phase to the growing polymer chain, where it decomplexes and adds to the growing polymer chain. The empty cyclodextrin is then free to repeat the journey.

Phase Transport Process



Technology	Emulsion Polymerization Using CAVASOL®			Mini-Emulsion Polymerization Using CAVASOL®	
Name	EP STMA 50	EP LMA 50	EP LMA 75	Mini STMA 50	Mini STMA 75
Appearance	Milky bluish white liquid	Milky bluish white liquid	Milky bluish white liquid	Milky bluish white liquid	Milky bluish white liquid
Solids content, % by weight	50% ±5%	50% ±5%	50% ±5%	50% ±5%	50% ±5%
PS (std. dev.) [µm]	0.144 (σ = 0.023)	0.143 (σ = 0.028)	0.137 (σ = 0.022)	0.145 (σ = 0.023)	0.127 (σ = 0.025)
pH	pH = 8	pH = 4–5	pH = 4–5	pH = 4–5	pH = 4–5
Glass transition temperature [°C]	2	-27	-40	nd [a]	nd [a]
Viscosity, KU	40	45–50	45–50	45–50	45–50

nd [a]: not determined

References / Source Information:

Breaking the solubility barrier in emulsion polymerizations, Lau., W., Int. Cyclodextrin Symposium 2000

Leyrer., R. J. et al., Macrolmol Chem. Phys. 2000, 201, 1235-1243

Wacker Chemie AG, 81737 Munich, Germany
www.wacker.com/contact, www.wacker.com/cavasol
Follow us on:

CAVASOL®

7775e/03.22 replaces 7775e/07.20