



CHEM SYSTEMS INC.

ACTIVATION OF LIQUID POLYMERS

(Synthetic Organic Polyelectrolytes in Emulsion/Dispersion Form)

Activation of liquid polymers is a compound/complex organic chemical reaction requiring two distinct, successive phases.

PHASE I – INVERSION (“Breaking” the Polymer)

Is the emulsification of the hydrocarbon oil carrier (continuous phase) with concurrent dispersion of the polymer-in-water gel particles (discontinuous phase) with the incipient release of polymer into the dilution water as a continuous polymer solution.

MAJOR REQUIREMENTS:

- 1) Energy of activation, E (act.)
- 2) Particle Orientation
- 3) Time (seconds)

PHASE II – HYDRATION: (“Aging” the Polymer)

Is the progressive dissolution of uniformly dispersed polymer gel particles, in water, with successive increase in conformational volume (swelling) of the polymer molecules, by hydration, overtime, creating a dilute aqueous polymer solution with optimum activity.

MAJOR REQUIREMENTS:

- 1) Energy of Activation, E (act.)
- 2) Molecular Orientation
- 3) Time (minutes)

Activation of liquid polymer is dependent on the rate at which effective collisions occur at the molecular level.

$$\begin{array}{ccc} \text{RATE OF REACTION} & & \text{COLLISION FREQUENCY} & & \text{ENERGY FACTOR} \\ \text{(Effective Collisions} & = & \text{(Proximity, size, mass,} & \& \text{(E-activation)} & \& \\ \text{per unit of time)} & & \text{temperature etc.)} & & & & \\ \\ \text{ORIENTATION FACTOR} & & & & \text{PROBABILITY FACTOR} \\ \text{(Molecular conformation of} & & \& & \text{(Particle collisions with} \\ \text{polymer gel structures)} & & & & \text{sufficient energy to react)} \end{array}$$

LIQUID POLYMER ACTIVITY TESTING

Activity, percent activity, and activity testing of aqueous solutions of synthetic organic Polyelectrolytes are numerical comparisons of the performance of known, characterized, and verified aqueous polymer solutions against a known, characterized, and verified aqueous polymer solution control, or standard, prepared under controlled, verified, and repeatable conditions typically expressed as a percent of the control or standard test value.

Liquid Polymer Description

SOLUTION PRODUCTS

Solution polymers, whether, 2 to 7% HMW (High–Molecular–Weight) active polymer or 6.0% to 60% LMW (Low–Molecular–Weight) active polymer, are processed through the high-energy, high-turbulence, inline dilution circuit of the Activator system to produce a high-activity, high-performance, quality aqueous polymer solution. Easy to mix water based solutions generally fed direct to process

EMULSION PRODUCTS

Liquid emulsion polymers, whether 25 to 40% **active inverse-emulsions** or 50 to 70% **active dispersions**, require two distinct processing steps to completely activate the aqueous polymer solution product. These two steps are:

PHASE I – INVERSION (“Breaking” the Polymer)

PHASE II – HYDRATION (“Aging” the Polymer)

In Phase I, the inversion step, the Activator “breaks” the oil phase of the emulsion polymer by subjecting the mixture of high-activity polymer gel particles-in-oil to high-energy, high-shear mixing which instantaneously disperses the continuous oil phase and releases the discontinuous polymer gel particles subsequently freeing the polymer to dissolve in the dilution water through hydration and molecular diffusion.

In Phase II, the hydration step, the liberated polymer particles dissolve (hydrate) and diffuse inline or in a specially designed hydration, (holding) tanks with liquid level controls and properly sized, low speed, polymer solution agitators. The capacity of the “aging” tank depends on the requirements of the application and the optimum hydration time necessary to achieve maximum activity of the aqueous polymer solution (typically 5 to 25 minutes depending on polymer type, concentration, molecular weight, density, charge type, charge strength, and other chemical and physical properties and characteristics). Difficult to mix oil based products

Mannich Polymer

Range 30-50 % Range; require basic high energy mixing similar to solution polymers generally fed direct to process

ALL LIQUID PRODUCTS

Since there are literally hundreds of liquid polymer products commercial available, it is absolutely essential to select the Activator System which satisfies both the application requirements and the processing requirements of the liquid polymer product itself. Consult Chem Systems Inc. and your polymer vendor for application and process recommendations.