

Recommend Approval: <u><i>[Signature]</i></u> <u>6-28-11</u> Assistant Division Chief Date <u><i>[Signature]</i></u> <u>7/6/11</u> Division Chief Date	Maryland Department of Transportation State Highway Administration Office of Materials Technology MARYLAND STANDARD METHOD OF TESTS	
Approved: <u><i>[Signature]</i></u> <u>08/08/11</u> Director Date	<b>TEST FOR STYRENE – BUTADIENE LATEX          EMULSION FOR CONCRETE</b>	<b>MSMT          612</b>

**SCOPE:**

These procedures are used to qualify and evaluate styrene - butadiene latex emulsions used in concrete for thin bonded bridge deck overlays.

**SAMPLE**

Submit the original qualification sample to the laboratory in a 1 gal container. Submit with the sample the producer's certification containing the generic description, production date, lot identification number, lot size, and the information specified in the Administration's latex modified concrete specifications. The certification shall conform to Section TC 1.03 of the Specifications.

Do not take subsequent jobsite samples from cleanout lines or hoses which may contain trapped wash water.

**TOTAL WEIGHT PERCENT SOLIDS IN THE LATEX**

**MATERIALS AND EQUIPMENT:**

1. Balance conforming to M 231, class B.
2. Three disposable aluminum dishes having a maximum weight of 2 g and a minimum capacity of 2 mL.
3. Oven maintained at 285 ±2 F.
4. Desiccator.

**TEST PROCEDURE:**

1. Mix the latex sample by inverting the sample container 5 to 10 times.
2. Weigh each aluminum dish to the nearest mg before and after placing approximately 1 g of the latex emulsion in each.
3. Dry the samples in the oven for 2 hours.
4. Remove the samples from oven and cool them in the desiccator to room temperature.

5. Reweigh each sample after cooling.

**CALCULATIONS:**

$$P = \frac{W_1 - C}{W_2 - C} \times 100$$

where:

P = percent total solids,

C = weight of aluminum weighing dish,

W<sub>1</sub> = weight of aluminum weighing dish and dry sample, and

W<sub>2</sub> = weight of aluminum weighing dish and wet sample.

**REPORT:**

Report the average of the three samples as the weight percent solids.

**pH OF LATICES**

**MATERIALS AND EQUIPMENT:**

1. pH meter equipped with electrode and temperature compensator with a sensitivity of 0.03.
2. Two known buffer solutions. (pH 4, pH 7, pH 10 - depending on range needed)
3. Distilled water.
4. A 100 mL capacity glass beaker.

**TEST PROCEDURE:**

1. Standardize the electrode against the known buffer solutions at 77 ±2 F in as per the instrument's directions.
2. Pour 50 mL of the latex sample; adjusted to 46.0 percent solids, into the beaker.
3. Immerse the electrode and temperature compensator of the pH meter into the latex sample and read the pH unit directly from the instrument.

4. Rinse the electrode with distilled water after each determination until no visible traces of the latex sample remain.

**REPORT:**

Report the pH to the nearest 0.1 unit.

**PERCENT COAGULUM**

**MATERIALS AND EQUIPMENT:**

1. A No. 100 sieve.
2. Funnel.
3. Sample bottle.
4. Desiccator.
5. Balance conforming to of M 231, Class A.
6. Disposable aluminum weighing dish.
7. Oven maintained at  $250 \pm 2$  F.

**TEST PROCEDURE:**

1. Bring sieved latex to room temperature by allowing it to stand, if necessary.
2. Weigh 900 g latex and pour it through the No. 100 sieve. Collect the sieved latex by means of a clean funnel and sample bottle. Wash the residue on the No. 100 sieve with cool water followed by a warm rinse at 95 to 104 F.
3. Tare the aluminum dish; then transfer all residues from the No. 100 sieve into the dish. Place the dish in the oven to dry.
4. Cool the dish to room temperature in the desiccator and weigh to the nearest mg.

**CALCULATIONS:**

$$P_c = \frac{W_c \times 10\,000}{W_1 \times S}$$

where:

$P_c$  = percent coagulum,

$W_c$  = weight of coagulum,

$W_1$  = weight of latex used,

$S$  = percent solids, and

10 000 = factor to produce the result in percent.

### **REPORT:**

Report the weight percent coagulum to the nearest 0.001 percent.

## **VISCOSITY**

### **MATERIALS AND EQUIPMENT:**

1. Brookfield Synchro-Lectric Viscometer model RVP equipped with Spindle No.1.
2. An 800 mL beaker.
3. A No. 60 sieve.

### **TEST PROCEDURE:**

1. Weigh approximately 600 mL of the latex sample into a 800 mL beaker.
2. Lower the spindle of the viscometer into the latex sample to the indicated depth.
3. Start the viscometer and adjust the spindle speed to 10 rpm. After a minimum of 30 seconds, allow the viscometer to reach a constant value, and then simultaneously press the brake and switch off the motor. Take the reading on the proper scale. Record the average of three readings taken at this speed.

### **CALCULATIONS:**

$$V = RB$$

where:

$V$  = viscosity in centipoises at  $77 \pm 2$  F,

R = average of three readings at the same speed, and

B = conversion factor supplied with the viscometer.

**REPORT:**

Report the viscosity at 10 rpm in centipoises at  $77 \pm 2$  F.

**DENSITY**

**MATERIALS AND EQUIPMENT:**

1. Top loading analytical balance conforming to M 231, Class A.
2. Midget weight/gal cup.
3. Eyedropper.

**TEST PROCEDURE:**

1. Place Midget weight/gal cup on the balance and tare.
2. Fill Midget weight/gal cup to approximately 0.5 - 1 mm from the top using an eyedropper, with latex emulsion.
3. Carefully place the lid on the Midget weight/gal cup allowing excess material to escape through the hole in the lid. (If done too quickly, it will squirt out). Wipe off excess material from the outside of the cup.
4. Reweigh the Midget weight/gal cup and read lb/gal directly from the balance to the nearest 0.01 lb/gal.

**REPORT:**

Report the density of the latex emulsion at 46.0 percent solids to the nearest lb/gal.

**INFRARED FINGERPRINT SPECTRA**  
(for solid films and alcohol soluble portions)

**MATERIALS AND EQUIPMENT:**

1. Infrared spectrophotometer conforming to the following:

- Range - 4000 to 200  $\text{cm}^{-1}$
  - Resolution - 0.3  $\text{cm}^{-1}$
  - Frequency readout - linear in wave number
  - Frequency accuracy - 0.5  $\text{cm}^{-1}$
  - Frequency repeatability - 0.25  $\text{cm}^{-1}$
2. Infrared spectrophotometer pellet holder and cell which permit the infrared beam to pass through only the latex film, or through a sodium chloride window containing a coating of the latex film while the spectrum is being obtained.
  3. Sodium chloride windows approximately 39 x 19 x 4 mm, fitting a conventional window holder, and permitting the infrared beam to completely pass through the windows only.
  4. Filter paper equivalent to Whatman 40 or No. 2.
  5. Magnetic stirring bar and stirring plate.
  6. Two 50 mL beakers.
  7. 2 - Propanol (Isopropyl alcohol).
  8. Ethanol.
  9. An 8 x 8 in. glass plate.
  10. Razor blade, tweezers and absorbent paper towels.
  11. A 0.003 in. Bird film applicator.

### **FREE FILM**

#### **TEST PROCEDURE:**

1. Draw a film down onto the glass plate using a 0.003 in. Bird film applicator. Dry the film for a minimum of 15 minutes.
2. Place the dried specimen and glass plate under water (104  $\pm$ 9 F) and carefully peel the film from the plate using a razor blade and tweezers. Make sure the film surface does not overlap or adhere to itself.

3. Dry the film by placing it between absorbent paper towels and apply hand pressure for 5 seconds. Place the film on the pellet holder so that the infrared beam passes directly through the film.
4. Place the film holder in the instrument so that the infrared beam passes directly through the film.
4. Position the pen to read between 90 and 95 percent transmittance at 2100 to 2000  $\text{cm}^{-1}$  by adjusting the 100 percent dial. Examine the spectrum of this film between 3000 and 2800  $\text{cm}^{-1}$ . The tip of the peak at 2920  $\text{cm}^{-1}$  should be between 10 and 25 percent transmittance.
  - (a) If the peak at 2920  $\text{cm}^{-1}$  extends to a lower transmittance percentage, gently stretch the film to approximately 13 times its length, replace the stretched film into the holder, and reexamine the spectrum of the stretched film.
  - (b) If the peak at 2920  $\text{cm}^{-1}$  still extends to a transmittance lower than 10 percent, prepare another film using a Bird film applicator with a smaller clearance and obtain its spectrum using this procedure.

### **ALCOHOL EXTRACT**

#### **TEST PROCEDURE:**

1. Into a 50 mL beaker, mix 10 mL of latex emulsion with 10 mL of 2 - Propanol (Isopropyl Alcohol).
2. Filter thru filter paper into a 50 mL beaker.
3. Allow alcohol to evaporate overnight in hood.
4. Make a smear of the alcohol extract on a Sodium Chloride crystal window using a Q-tip.
5. Using the spectrophotometer, perform an infrared scan as specified by the manufacturer's instructions for a range of 4000 - 200  $\text{cm}^{-1}$ .
6. Compare the Infrared Scan to that of the original (control/acceptance) sample to see if they are identical.

#### **REPORT:**

Report whether or not the current Infrared Scan matches the original (control/acceptance) sample.