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INVESTIGATION OF VISCOSITY INSTABILITY IN ASPHALTIC TOPPING COMPOUND CONTAINING RG-144

INTRODUCTION

Cosmicoat, Inc., Wooster, Ohio recently reported a viscosity instability problem with a tennis court asphalt topping compound containing RG-144. Approximately 11% RG-144 is used, based on the asphalt in water emulsion. The asbestos is premixed in water with Tamol 731, an anionic surfactant and the paste then added to an asphaltic emulsion along with sand. Mixing is performed with a ribbon blender.

Cosmicoat reported that viscosity increased significantly with accelerated heat aging (approximately 48°C).

SUMMARY

Accelerated heat aging was found to increase the viscosity of the asphalt formulation. However, the change in viscosity was attributed to instability of the emulsion at elevated temperature. Water separation and coagulation was evident to varying degrees depending on the type and amount of surfactant used. In most instances, the emulsion could be redispersed with a moderate amount of mixing. Equal parts of anionic Tergitol 4 and diethylene glycol were the most effective combination of additives evaluated in maintaining emulsion stability. Due to the complexity of emulsion systems and the numerous types of surfactant available, no attempt was made to optimize the formulation.

The surfactant currently used by Cosmicoat is Tamol 731, an anionic sodium salt of polymeric carboxylic acid which is primarily used for dye and pigment dispersion. There are several surfactants such as nonionic polyethylene glycol ethers that are specifically recommended for high-temperature emulsion stability. It is suggested that Cosmicoat contact Mr. D. R. Schomer regarding specific recommendations pertaining to surfactant application (Union Carbide Corporation, Chemicals & Plastics Division, 1300 Lakeside Avenue, Cleveland, OH 44114, telephone: 216-621-4200, etc. 220).

DISCUSSION

Several samples of the formulation were prepared with various surfactants and DEG based on an asphalt emulsion received from Cosmicoat. Mixing was performed with a Lightnin mixer at 1200 rpm for 30 minutes. Viscosity was measured with a Brookfield viscometer at 5 rpm using a #3 spindle prior to and after heat aging at 48°C for approximately 20 hours. The basic Cosmicoat formulation consisted of:

	Parts by Weight
Water	275
Surfactant (Tamol 731)	8
Asbestos (RG-144)	60
Asphalt	250
Sand*	220

* Sand was not used in the laboratory formulations.

Accelerated heat aging was found to alter the viscosity of the emulsion to varying degrees (refer Table I). However, the change in viscosity was attributed to instability of the asphaltic emulsion and unrelated to the asbestos. An average of approximately 10% weight loss was recorded after 20 hours at 48°C. Water separation and coagulation was evident in all the samples and varied according to the type and amount of surfactant used. Equal parts of Tergitol 4 and diethylene glycol (4 parts each) were found to produce the most stable and "smooth" formulation. It redispersed easily with hand mixing to a smooth, creamy texture. Instability of the system appeared to be dependent on the type and amount of surfactant used. Prolonged exposure to heat caused the emulsion to "break," however, most of the systems could be redispersed with mixing.

Tamol 731 is an anionic sodium salt of polymeric carboxylic acid recommended primarily for dye and pigment dispersion. It is a most effective dispersant for chrysotile as evidenced by the test results. The principle function of the surfactant in this formulation is to maintain the asphalt in water emulsion. There are several surfactants such as nonionic polyethylene glycol ethers that are specifically recommended for high-temperature emulsion stability. We have limited background in this particular area, however, Union Carbide's Chemicals & Plastics Division has considerable expertise with surfactant systems. It is recommended that Cosmicoat contact Mr. D. R. Schomer at Union Carbide Corporation, 1300 Lakeside Avenue, Cleveland, Ohio for further assistance.

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TABLE I

	Water	Surfactant	RG-144	Asphalt	DEG[1]	Viscosity (cps) @5 rpm Initial	Viscosity (cps) @5 rpm After Heat Aging[2] (3) (4)	Comments
I	275g	8g Tamol	60g	250g	--	3000	6200/2400	Some water separation evident after heat aging. Redispersed, but grainy appearance.
II	275g	8g Tergitol 4	60g	250g	--	1800	2500/2000	Some water separation evident after heat aging. Redispersed but grainy appearance.
III	275g	8g Tergitol 4	60g	250g	8g	2000	2000/2000	Some water separation evident after heat aging. Redispersed some grainy texture.
IV	275g	None	60g	250g	8g	2800	*/32,000	*Considerable separation after heat aging. Very grainy and lumpy. Could not redisperse.
V	275g	4g Tergitol 4	60g	250g	4g	2000	3000/1600	Rough, granular appearance with some water separation after heat aging. Redispersed easily by hand to smooth paste.
VI	275g	2g Tergitol 4	60g	250g	2g	2000	18,000/7400	Rough and grainy. Could not redisperse after heat aging.
VII	275g	4g Tergitol 4	60g	250g	--	2200	10,600/3800	Separation occurred. Could not redisperse after heat aging.
VIII	275g	4g Aerosil OT	60g	250g	4g	2000	8000/2300	Some separation and grainy texture.

(1) DEG - diethylene glycol

(2) Heat aged for approximately 20 hours @48°C

(3) Hand stirred prior to viscosity measurement

(4) Mixed 5 minutes with Lightnin mixer at approximately 1200 rpm prior to viscosity measurement.