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RESEARCH SUMMARY

EVALUATION OF SMEP BLENDS FOR USE IN CONCRETE

Coates, Mohtar, Tao and Weiss, Purdue University, 2008.

Introduction:

This paper summarizes Coates (2008), a thesis that evaluates the potential use of Soy Methyl Ester (SME) in the field of concrete. The study set out to identify the fresh and hardened properties of cement materials that are affected by the use of SME-PS blends—a combination of Soy Methyl Ester and Polystyrene—and analyze its performance as an additive to cement mixture or a spray on fully formed cement. Performance was measured for the following properties:

1. **Compressive Strength** – The resistance of a material to breaking under compression.
2. **Shrinkage** – The contraction in the concrete caused by moisture loss from drying.
3. **Viscosity** – The relationship between how thick the fresh concrete is and how easily it flows.
4. **Setting and Hydration Time** – The relationship between paste ceasing to be fluid/plastic and time required for a paste to achieve a certain degree of hardness.
5. **Air Content** – The volume of air voids in cement paste, which reduces the strength of concrete over time.
6. **Evaporation Rate** – The rate at which water evaporates from fresh concrete during the setting process.
7. **SME Penetration** – The depth to which applied SME can travel into concrete and minimize water absorption.
8. **Water Absorption** – The ability of water to travel into the pores of the concrete.
9. **Chloride Penetration** – Refers to the depth to which chloride ions from the environment penetrate the concrete, often leading to corrosion.

Findings:

Coates (2008) set out to identify the fresh and hardened properties of cementitious materials that are affected using SME-PS blends and analyze its performance in several topical or admixture applications. To that end, the study revealed several important findings:

- SME-PS blends do not have significant impacts on the basic mechanical properties investigated in this study. The maximum reduction in compressive strength was 18%, which may be attributed to reduced water absorption during the cement hardening process.
- SME-PS blends reduced water absorption by 74-94% when the SME-PS was added to the cement mixture. Applied directly to the formed concrete, water absorption results showed a reduction in water absorption of 85-93%.
- SME-PS blends reduced chloride penetration by approximately 68%. The blends with higher polystyrene contents appear to perform better in reducing chloride spread.
- The potential of SME-PS as a penetrating sealer was confirmed by x-ray measurements which showed no visible water penetration after 4.5 hours of water pooled on a concrete treated with SME-PS directly.
- An application of SME-PS blends directly to concrete or added to the mixture aided in reducing water loss due to evaporation during the first 24 hours of cement hardening process. Directly applied to concrete, SME-PS was shown to reduce water loss by 46% after 6 hours, and admixed SME-PS did not change the total evaporation after 6 hours.
- The SME-PS blends do not negatively affect the rate of hydration of cement pastes.
- Measurements of hardened air void content also revealed that there was little effect on the air void content and size distribution of samples.
- Use of highly viscous blends as an admixture can alter the viscosity of cement mixtures. However, the application of SME-PS blends for this purpose appears impractical for use as a viscosity modifying admixture (VMA) because of the high doses required.

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