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RESEARCH SUMMARY

THE USE OF SOY METHYL ESTER-POLYSTYRENE SEALANTS AND INTERNAL CURING TO ENHANCE CONCRETE

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Introduction:

The purpose of this summary is to explore the use of Soy Methyl Ester - Polystyrene (SME-PS) blends for use as a durability-enhancing technology for concrete maintenance and extended life. This paper seeks to answer the research question, can SME-PS be used as a longer performing replacement for commercially available sealants such as silanes and other concrete surface treatments?

Concrete is responsible for nearly five percent of the world's carbon dioxide (CO2) emissions, which results from the manufacturing of cement [2010]. The production of 1 ton of cement clinker results in the release of 0.8 to 1 ton of CO2 emissions into the atmosphere [2010]. A cement clinker is a nodular material that is used as the binder in cement products. The problem is that the US infrastructure is dominated by concrete structures [2010]. Therefore, the need to study how concrete structures age and deteriorate over time when exposed to environmental conditions is important to understand to continue maintaining and expanding infrastructure [2010] without furthering the world's CO2 emissions problem. To increase sustainability practices, the industry needs to reduce its carbon emissions footprint from cement production [Golias]. Typically, concrete pavements are designed for 20-40 years of use [2010]. Therefore, by properly designing and maintaining these structures, these materials' lifespan may be extended, which saves materials and energy [2010]. Extending usable life not only delays/reduces the replacement of these structures but also reduces their maintenance cost [2010].

Methodology:

To answer the question above, three different sealants were tested: A soy methyl ester blend with 5% polystyrene by mass, (2) a solvent-based alkyl-alkoxy silane sealer (SBS), and (3) a water-based alkyl-alkoxysilane penetrating sealer (WBS) that consist of 40% silane [2010]. Samples were tested with and without treatment of a topical sealant during the tests [2010]. One concrete mixture and three mortar mixtures were used in the study.

Findings:

In all tests, samples treated with SME-PS were more durable than untreated samples. As concrete moisture levels increase, the amount of SME-PS absorbed into concrete decreases [2010]. In general, SME-PS is effective as a topical concrete durability application, where the dosage rate of SME-PS is directly correlated to the sealant's ability to limit concrete deterioration [Golias]. Experimental results show that the greater the penetration depth of SME-PS, the more effective it is at increasing concrete durability [2010]. SME-PS dramatically reduced damage from freezing and thawing cycles and was shown to be effective in delaying expansion due to ASR: a reaction that produces an expanding gel that creates cracks in cement. The SBS was shown to be slightly more effective in delaying expansion due to ASR, but further investigation indicates that SBS and other silane-based treated coatings are susceptible to damage by freezing and thawing [2010], diminishing their effectiveness. It is recommended that the dosage rate of SME-PS be maximized when used in the field and concrete be kept dry before applying SME-PS to increase the overall effectiveness and penetration of the sealant deep into the concrete [2010].

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