

ABSTRACT

Spiro, Jeffrey Andrew. M.S.C.E., Purdue University, August 2013. Use of Soy Methyl-Ester Prior to Cracking as a Surface Treatment Method to Minimize Chloride Penetration of Cracked Concrete. Major Professor: W. Jason Weiss.

Concrete can start to deteriorate and crack due to tensile forces and environmental conditions such as freezing and thawing, alkali-silica reaction, etc. Cracking provides an easier path for chlorides to enter into the concrete, which will cause the concrete and rebar to deteriorate faster than it would in an uncracked condition. There are numerous sealants that can be applied to concrete, both topically and admixed, that can increase the durability of the concrete. This thesis focuses on Soy Methyl-Ester (SME) that contains 2% Polystyrene (PS).

Soy Methyl-Ester is a byproduct of soy bean oil and is hydrophobic in nature. As a byproduct of soy bean oil, it is biodegradable, non-toxic, and sustainable. This thesis examines Soy Methyl-Ester with a 2% Polystyrene content (SME-PS) that was topically applied to the concrete specimens. Both sealed and unsealed beams were cracked in flexure and ponded with a 23.3% Sodium Chloride (NaCl) solution in order to examine the effectiveness of SME-PS at reducing the penetration depth of the chlorides. Titration results show a significant reduction in the chloride content in roughly the first 12 mm. Furthermore, sealed and unsealed concrete cylinders were used to test for diffusion coefficient, tortuosity, and drying rate. It has been shown through experimental tests that SME-PS can slightly delay the formation of Friedel's salt from the SIMCO test. Along with the drying test at 50% Relative Humidity (RH) and 23°C, the samples sealed with SME-PS had a significantly lower permeability and a higher saturation.