Silane with Latex Coatings for Protecting Structural Concrete Surfaces

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Abstract:
The performance of silane and latex coated concrete samples were tested in water and 15% NaCl solution for 21 days. In this study, commercially available silane and latex were used. The structural concrete had a unit weight of 146 pcf. The silane reduced the water and NaCl solution uptake by 39 % and 17 % respectively compared to the uncoated concrete. The latex reduced the water and NaCl solution uptakes by 9 % and 19 % respectively compared to the uncoated concrete.

1. Introduction:

Concrete is the most widely used construction material for civil infrastructures including bridges. Concrete bridge structures are undergoing accelerated deterioration caused by corrosion of the embedded reinforcing steel. This deterioration can affect all the bridge members including piles, walls, piers, caps, girders as well as the top and bottom surfaces of the bridge decks. The corrosion is caused primarily by the gradual intrusion of chloride ion into the concrete from salt water exposure in the coastal regions. The steel corrosion is accelerated when the protective concrete cover over the embedded bars is inadequate and when there are cracks in the concrete. Several methods are used in protecting concrete surfaces by coating the concrete. Coating materials used in protecting concrete from corrosive environments include epoxies, methacrylate, urethane, silicate, siloxane and silane.

2. Objective:

The main objective of this study was to investigate the effectiveness of a commercially available silane coating material, with and without a latex overcoat, in reducing the water and salt solution uptake of structural concrete used for bridge columns.

3. Materials and Testing Program:

The concrete specimens used were cylinders of 3 inch diameter and 6 inch height. The concrete specimens were classified as Class F concrete by the Texas DOT. The average strength of concrete after 7 and 28 days were 7816 psi and 10412 psi respectively. Specimens were water blasted at 1500 psi before coating. The specimens were weighed accurately to 0.01 gms and a total of 32 specimens were used in this study. The specimens were dried at room condition for one day before spraying the silane coating. After applying silane coating, the specimens were left to cure for about 5 days before applying the latex. The latex was applied using a roller. The coating was white in color. The application temperature was 65°F.

The coated specimens were cured at room condition for 21 days before immersing in water and 15 % NaCl solution. Based on the manufacture's literature, the silane used had a specific gravity 0.95, flash point 77 F, coating V.O.C 2.63 lb/gal, and was characterized as a clear yellow liquid soluble in water.

Specimens were used in duplicates as the change in weight with immersion time is shown in figs. 1 and 2. It can also be noted that the largest change in weight occurred after one day of immersion.

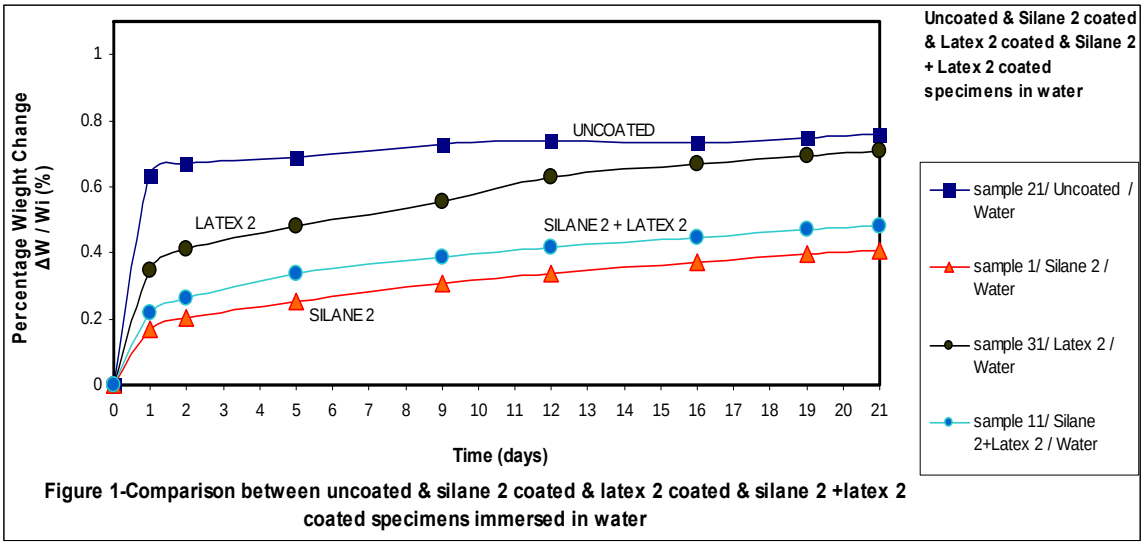

Figure 1-Comparison between uncoated & silane 2 coated & latex 2 coated & silane 2 +latex 2 coated specimens immersed in water

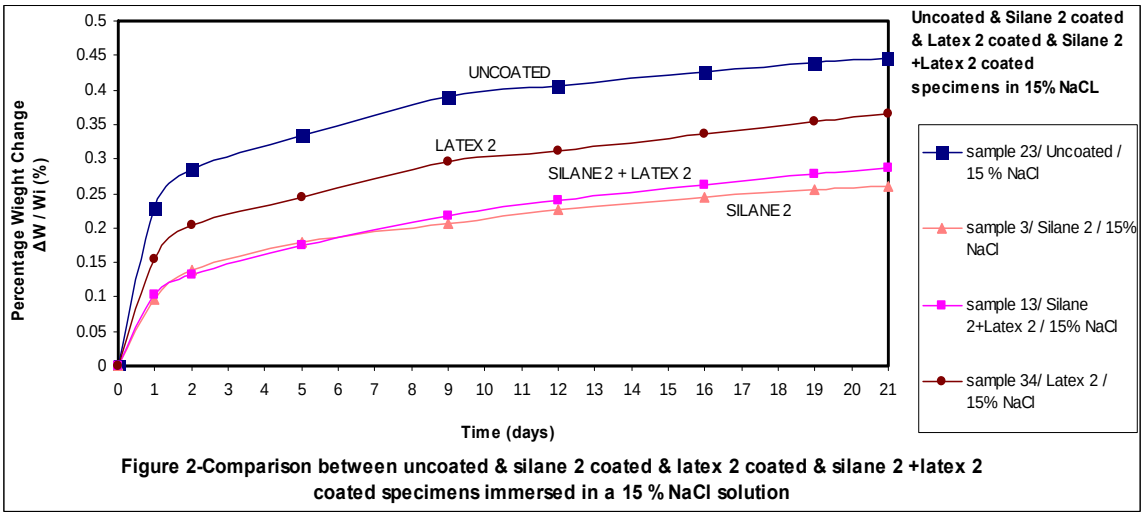

Figure 2-Comparison between uncoated & silane 2 coated & latex 2 coated & silane 2 +latex 2 coated specimens immersed in a 15 % NaCl solution

4. Results and Discussions:

The silane reduced the water and 15% NaCl solution uptakes by 39 % and 17 % respectively compared to the uncoated concrete. The latex reduced the water and 15% NaCl solution uptakes by 9 % and 19 % respectively than uncoated concrete. Figures 1 and 2 show the difference between the silane coating and latex coating in reducing the water and salt solution uptake by the structural concrete used for supporting bridges.

5. Conclusions:

A commercially available silane coating, with and without latex, was effective in reducing the water and 15% NaCl uptake by the structural concrete.

6. Acknowledgement:

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7. Reference:

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3- Texas Dot Material Specifications; Section 5. DMS-8110, Coatings for Concrete, Section 9. DMS-8140, Concrete Surface Treatment (Penetrating)