

Technical Bulletin

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Brown-Staining of Concrete Masonry Unit Wall Structures

Brown-staining of brick masonry surfaces is evidently well understood.^{1,2} Little information is available, however, to explain the origin of brown stains on standard concrete masonry unit (CMU) wall structures. An examination of two different foam-in-place insulations was conducted in an effort to explain occurrences of brown-stain efflorescence on buildings insulated with a specific brand of foam insulation.

The chemistry of certain aminoplast foams appears to be directly linked to occurrences of brown-stain efflorescence in CMU walls. Specifically, the presence of a particular ingredient in the foaming agent formula serves as a key indicator of whether or not the foam will contribute to brown-staining.

Resorcinol, or 1, 3 dihydroxybenzene, is a common chemical intermediate that finds utility in applications ranging from wood glue resins³ to leather dyes⁴ to permanent hair-coloring products.⁵ Resorcinol is also found in some, but not all, foam-in-place insulation formulations⁶ where it functions as a foam stabilizer, a formaldehyde absorbent and a cross linking agent that improves hydrolysis resistance of foams.⁷

Resorcinol is known for its propensity to change colors. Normally found as a white powder or crystalline substance, resorcinol changes to a deep, pink color upon exposure to light and air or when in contact with iron.⁸ This explains why foaming agent formulations that contain resorcinol typically have a dark reddish-brown hue while those without resorcinol have a lighter, greenish-gold appearance, as illustrated in this photo.

Resorcinol is also an ingredient of wood glues used in the furniture industry. These glues, known as resorcinol-formaldehyde adhesives, have a dark, reddish-brown color and are known for their propensity to stain light wood with a dark, reddish glue line.^{9,10} They also bleed through thin veneers in furniture resulting in dark, splotchy areas at the surface which are "very difficult to remove."¹¹ This same resorcinol-formaldehyde compound used as a wood glue is precisely what can be created inside CMU walls insulated with resorcinol-containing aminoplast foams. The chemical reaction occurs when resorcinol, a component of the foaming agent,⁶ comes in contact with small amounts of formaldehyde present in the resin. The result is a resorcinol-



formaldehyde compound with dark color that is characteristically insoluble and impervious to freeze-thaw cycles, boiling water and most solvents.¹¹ Moreover, the likelihood of the resorcinol-formaldehyde reaction occurring is heightened due to the catalytic effect of both low pH, found in the acidic foaming agent,⁷ and high pH, commonly found in CMU mortar joints,¹ both of which are known to significantly accelerate the reaction rate of resorcinol-formaldehyde compounds.¹¹

It's very important to note, though, that not all foam-in-place insulations are equal. Core Foam Masonry Foam Insulation, for example, is based on technology that offers a different approach than foams based on older, resorcinol-containing chemistry. In an independent laboratory study, Core Foam Foaming Catalyst was verified to contain no detectable levels of resorcinol while a sample of a competitive foaming agent had levels over 1000 mg/L. Core Foam Masonry Foam Insulation, as a result, will neither contribute to nor cause brown-staining of CMU wall structures due to reactions associated with resorcinol.

To insure product consistency, cfi FOAM manufactures its foaming catalyst at an ISO 9002-certified facility, the highest standard offered in the foam-in-place industry. Core Foam Masonry Foam Insulation is a "dry" foam that uses powdered resin made with innovative, proprietary spray-drying technology. The result is a resin with a reactivity profile ideally suited for producing consistent foam insulation with superior quality. When this resin is matched with Core Foam Masonry Foam Insulation's advanced foaming catalyst formula, a high quality plastic foam insulation is produced that, according to customer feedback, is equal to or better than any other foam-in-place insulation available today.

In summary, Core Foam Masonry Foam Insulation allows professional foam insulation contractors to offer a product that:

- ♦ Is a high-quality, dry foam
- ♦ Is reasonably priced
- ♦ Will not cause brown-stain efflorescence of CMU walls
- ♦ Offers consistent quality, reactivity and yield
- ♦ Has minimal shrinkage
- ♦ Has very low off-gassing
- ♦ Doesn't require additives like urea or resorcinol to consume excess formaldehyde

To learn more about Core Foam Masonry Foam Insulation please call 1-800-656-FOAM (3626) or email us at info@cfifoam.com.

¹"Rain Resistant Masonry Construction, The Efflorescence Problem," *The Northwest Masonry Guide*.

²"Efflorescence and Masonry: Causes, conditions and removal techniques." J. Meredith, Saver Systems.

³Spectrum Chemical Fact Sheet, "Resorcinol."

⁴ChemicalLand21.com, "Resorcinol."

⁵"What's That Stuff?...Hair Coloring" *Chemical & Engineering News*, Volume 78, Number 11, 2000.

⁶Analytical Industrial Research Laboratories, Inc., Lab Report Numbers 152043-152044.

⁷Widmann, US Patent 3,979,341. September, 1976.

⁸International Programme on Chemical Safety, Document 1033, "Resorcinol," 1999.

⁹DollYourself.com, "Adhesives and Bonding."

¹⁰DIYInfo, "Wood Glues."

¹¹"Resorcinolic Adhesives," *Handbook of Adhesives*, Skeist, 2nd Edition.

