Roof Maxx
Soy Methyl Ester's Functionality

Written by Airable Research Lab, January 2020

The primary component of Roof Maxx is soybean oil methyl esters, also known as alkyl C16-C18-methyl esters. These esters are obtained through the transesterification of soybean oil. This chemistry offers an excellent non-toxic and biodegradable substitute for petroleum-based solvents. Soybean-based methyl esters are the green choice for a number of solvents because of their high performance; however, the use of soy methyl esters as a roof rejuvenator is a novel application, and it takes advantage of many of the unique aspects of the chemistry.

The chemistry, and in particular the choice of surfactants (i.e., cationic) used, offers excellent water dispersion. The soybean oil makes the Roof Maxx product highly hydrophobic, enhancing its use as a water sealant. Indeed, researchers at Purdue University studied soy methyl ester– polystyrene sealant's (SME-PS's) effectiveness as a concrete sealant [1], and the experimental results show that SME-PS reduces water absorption up to 75%, as well as reducing damage caused by freezing and thawing up to 66%. Concrete is also susceptible to chloride ingress, or the penetration of chloride ions from salt, and the alkali–silica reaction, a swelling sometimes termed "concrete cancer"—both of which result from moisture seepage. The study found that SME-PS reduces chloride ingress depth by up to 50% and slows the rate of the alkali-silica reaction by 50%. (For more details about this study, please consult Reference 1.)

Asphalt is of a construction similar to concrete, although it is petroleum-based and tends to deteriorate more quickly. SME is therefore equally effective as an asphalt sealant and contributes significantly to asphalt's prolonged durability.

In addition to serving as a sealant, Roof Maxx extends roofing material's life by reducing the surface energy and shrinkage that limits expansion and contraction of the asphalt shingles. As the petrochemical oils evaporate and the shingles begin to dry out, they lose their elasticity, crumble, and eventually leak. The bio-based oils replace the petrochemical oils that have been degraded over time. Soy-Fusion Technology allows millions of microdroplets of oil to quickly penetrate the brittle

protective top coating and saturate the weathering asphalt layer. This infusion rejuvenates the asphalt, restoring its flexibility and pliability.

Again, we turn to Purdue, whose researchers have studied "organic rejuvenators" (vegetable oils such as soybean oil) and their effectiveness in improving the properties of asphalt binders [2]. The study results show that soybean-oil-based products are more effective at reducing the hardness of aged asphalt binders than petroleum-based rejuvenators. Rejuvenators are designed to restore original properties to aged asphalt binders by restoring the original ratio of asphaltenes to maltenes.

Asphaltenes are asphalt "filler"—solid compounds with a large molecular structure; maltenes are the fluid substance that provides ductility. As asphalt binders oxidize and dehydrate, they form more of the solid structures, reduce their compatibility in the maltenes, and increase the size of the asphaltene agglomerates. The bio-based rejuvenator modifies the asphalt's structure by reducing the size of the large asphalt molecules and increasing the resin and aromatic contents of the maltene phase (i.e., restoring the asphaltenes-to-maltenes ratio). With the original ratio restored, the asphalt regains its flexibility and softness. (For more details about this study, please consult Reference 2.)

Roof Maxx treatment also enhances adhesion of the shingle's protective mineral granules, which work like sunscreen to reflect the sun's ultraviolet rays. These ultraviolet rays are one of the key factors that cause shingles to dry out, crack, buckle, and split. By improving the granules' adhesion, the sealer further extends the life of the shingles.

Works Cited

[1] Michael Ryan Golias. "The Use of Soy Methyl Ester-Polystyrene Sealants and Internal Curing to Enhance Concrete Durability." Purdue University, January 2010. Purdue e-Pubs. docs.lib.purdue.edu/dissertations/AAI1490651/.

[2] A. Behnood. "Application of rejuvenators to improve the rheological and mechanical properties of asphalt binders and mixtures: A review." *Journal of Cleaner Production* 231 (2019): 171–182.