

Tall Oil vs. Plant Oils in Asphalt Rejuvenation

Performance Summary Based on 2023 NCAT / TRB Study

A 2023 study conducted by the National Center for Asphalt Technology (NCAT) at Auburn University and published in the Transportation Research Record evaluated five bio-based asphalt rejuvenators.

Four products were derived from vegetable and plant oils including corn, soy, and mixed plant extracts. One product — RA5 — was derived from crude tall oil, a by-product of the paper industry.

Researchers evaluated each product for its ability to restore aged asphalt, reduce cracking, maintain flexibility, and resist long-term oxidation.

Performance Findings

Category	Tall Oil (RA5)	Plant / Vegetable Oils (RA1–RA4)
Durability After Aging	Maintains flexibility and elasticity after long-term oxidative aging.	Becomes brittle and loses ductility quickly.
Cracking Resistance (ΔTc)	Higher (less negative) ΔTc values indicate superior resistance to embrittlement.	Lower (more negative) ΔTc values increase cracking potential.
Aging Stability (G-R Parameter)	Lower G-R ratios result in less stiffness growth and oxidation over time.	Higher G-R ratios indicate significant hardening during aging.
Molecular Stability (GPC)	Slower formation of brittle molecules helps maintain binder integrity.	Faster molecular growth promotes early stiffening.
Oxidation Resistance (FTIR)	Lower oxidation product formation improves long-term durability.	Higher oxidation rates lead to faster degradation.
Overall Field Performance	Provides long-lasting rejuvenation with balanced flexibility and durability.	Provides short-term softening with rapid performance decline.

Key Takeaways

While both plant oils and tall oil can initially soften asphalt, tall-oil-based rejuvenators provide measurable long-term restoration.

Tall oil maintains ductility, flexibility, and oxidation resistance even after simulated years of field aging, while plant oils tend to oxidize rapidly, harden, and lose rejuvenating effectiveness over time.

Plant Oils = Temporary Softening | Tall Oil = Lasting Rejuvenation & Superior Performance

Source: 2023 NCAT / Transportation Research Record Study on Bio-Based Asphalt Rejuvenators.