



Tall Oil vs. Plant Oils in Asphalt Rejuvenation

Performance Summary Based on 2023 NCAT / TRB Study

2023 study by the **National Center for Asphalt Technology (NCAT)** at Auburn University, published in the Transportation Research Record, evaluated five bio-based asphalt rejuvenators. Four were vegetable or plant-oil-based (corn, soy, and mixed plant extracts), and one product-RA5- was derived from crude **tall oil**, a by-product of the paper industry. Each product was tested for it's ability to restore aged asphalt, reduce cracking 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 (ΔT_c)	Higher (less negative) $\Delta T_c \rightarrow$ superior resistance to embrittlement	Lower (more negative) $\Delta T_c \rightarrow$ increased cracking potential
Aging Stability (G-R Parameter)	Lower G-R ratios $\rightarrow$ less stiffness growth and oxidation	Higher G-R ratios $\rightarrow$ significant hardening during aging
Molecular Stability (GPC)	Slower formation of large, brittle molecules; maintains binder integrity	Faster molecular growth; promotes early stiffening
Oxidation Resistance (FTIR)	Lower oxidation product formation (carbonyl/sulfoxide groups)	Higher oxidation and faster degradation
Overall Field Performance	Long-lasting rejuvenation, balanced flexibility & durability	Short-term softening only, rapid performance loss

Key Takeaways

While both plant oils and tall oil can initially soften asphalt, the tall-oil-based rejuvenator delivers measurable, long-term restoration. Tall oil maintains ductility, flexibility, and oxidation resistance even after simulated years of field aging-whereas plant oils oxidize rapidly, harden, and lose rejuvenating power over time.

In-short Plant Oils = Temporary Softening Tall Oil = Lasting Rejuvenation & Superior Performance