Field Testing and Optimization of Soy Based Dust Control Agents

by

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Summary

• The need for better road dust control agents

• Development of soy-based dust control at NDSU

• Field test results

• Current and future projects
The Problem

- Fugitive road dust is **hazardous** to people, livestock and crops

- Current widespread use of **magnesium and calcium chloride** create environmental concerns and cause corrosion to vehicles and infrastructure

- Chlorides typically require two applications per year and fail in low humidities
Soy-Based Benefits

• Non-corrosive, non-toxic, and biodegradable
• Drop-in replacement for chlorides- *can use existing trucks*
• Does not accumulate in lakes and streams
• Can reduce gravel road maintenance costs by stabilization
• Increased demand for midwestern agricultural products
Material Description

Glycerol + Soy Biodiesel or oil $\rightarrow$ Mono, Di and Triglycerides
Mode of Action

- Aged material has >10x increase in molecular weight due to cross-linking
- Binds dust particles together
- Remains pliable, does not harden
Early Lab Development

Synthesize           Emulsify in Water           Treat Gravel                 Measure Dust
Road Test Prep

Dual Reactors

Emulsification

3x Water Added

1,100 gallons of product
Road Test Application

Application day 0.5 gal/yd²

Eight days later after 2 inches of rainfall
No visible run-off
Application Day
Road Test Results

A Untreated Gravel-RAP

B 30 Minutes After Treatment

C After 6 Weeks

D Close up of the treated road surface
Real Time Dust Meter

DUSTTRAK II AEROSOL MONITOR 8532
Road Dust Measurement
September 8 Road Dust Data
70 deg F, 30% Relative Humidity, PM 4

Calcium Chloride Section Avg = 1.1 mg/m³
Soy Avg = 0.07 mg/m³

30 mph for 1 mile
AVERAGE ROAD DUST
mg/m³

Calcium Chloride Treated Section
Soy Treated Section
Crop Toxicity Testing

Pre-emergent application

Post-emergent application

No toxicity compared to control

No toxicity due to wind drift

Crops tested: Wheat, Oat, Canola, Lentil, Soybean, and Sunflower

STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY  NDSU
Preliminary Findings

- Minimal road dust after 10 months
- Stabilizes the road base and retains fines
- Does not wash away in the rain
- Performs better than calcium chloride
- Doesn’t kill plants
- Winter carryover
- Rejuvenates reclaimed asphalt
Road Surface in March (10 Months)
Current Research

North Dakota Soybean Council – *Study RAP rejuvenation*

- Test the properties of soy treated RAP in the lab
- Partnering with Dr Ying Huang, NDSU Civil Engineering
- Obtain data to allow for a field test in the future
Current Research

United Soybean Board - *Scale up the manufacturing and reduce costs*

- Optimize the synthesis using low cost, raw materials
- Identify bulk material suppliers
- Scale up batch size to 5,000 gallons
- 1-2 year project
Current Research*

ND DoT Transportation Innovation Program – *Road test to optimize application*

- Perform a road test on gravel road (no RAP)
- Optimize the rate of application
- Measure performance against chloride

* TRIP project delayed 2 years until a qualifying section of road is available
Conclusions

• Our soy-based product has shown great promise in early testing
• A market survey revealed a lot of interest from people in the industry
• More work needs to be done to optimize the manufacturing
• Additional field demonstrations are planned (locations TBD)
• Future field trial for treated RAP is desirable
• Cooperation from state and local DoT officials necessary for success
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Our World Is Growing.

United Soybean Board™

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