

Dialogue

An information service from the Lignin Institute

Lignin and the Environment

Lignins have been used for many years on road surfaces, in pesticide formulations, in animal feedstock, and other products that contact food. As a consequence, lignin manufacturers have performed extensive studies to test lignin's impact on the environment. Results show that lignins are safe for the environment and not harmful to plants, animals and aquatic life when properly manufactured and applied.

Lignin is a naturally occurring substance in woody plants. About one-quarter of dry wood is lignin, making it the second most prominent component of the wood part of a tree, with cellulose being the principal component. In the pulp mill process, cellulose is separated from lignin and recovered for use in a variety of different products.

Lignosulfonate, a lignin product recovered from the sulfite pulping process, is of special interest in considering environmental issues. It has been used as a treatment for dirt roads in Europe and North America since the 1920's. Extensive scientific research and the historical use of this product without reported complaints of plant damage or serious problems support the conclusion that lignosulfonates are environmentally friendly and non-toxic.

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A 1960's study at Industrial Bio-Test Laboratories to determine subacute and chronic toxicity from lignosulfonate noted no abnormalities in blood studies, urinalysis, food consumption, behavior or autopsies of treated laboratory rats. Studies at the WARF Institute in 1976 on sodium lignosulfonate again showed that product to be non-toxic in acute oral toxicity studies using white rats. In a 1986 study published in the *International Journal of Environmental Studies*, vegetation and growth of fir trees were not significantly affected at normal and above normal application rates of lignosulfonates. Toxic levels

of lignosulfonates in surface water have been established, and confirm that concentrations must be relatively high before fish and other organisms are affected.

A series of toxicological tests using laboratory animals were performed more recently (1988-1990) on lignosulfonates at Stanford Research Institute International in California. Careful analysis of the data confirmed earlier conclusions. Lignosulfonates were found to be essentially non-toxic and not irritating, not mutagenic or genotoxic, and safely used in animal and human food contact products.

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Lignosulfonates have been approved for use in animal feed, various food contact materials and pesticide formulations by the U.S. Food and Drug Administration, the regulatory agency charged with ensuring the safety of the food supply. Lignosulfonates have been used for nearly 40 years in animal feed. No chronic toxicity problems have been recorded to date, either from applications involving human food contact or animal consumption.

Last year, lignin manufacturers formed the Lignin Institute to promote the quality and safe use of lignins. LI members are developing voluntary quality standards for lignin products used on road surfaces and in animal feedstock. The standards will identify important quality assurance considerations and guidelines for determining appropriate amounts of components in lignin products.

Guidelines for the proper application of lignin products to road surfaces are being outlined, which include instruction to applicators to give prudent consideration to weather, soil and surface water conditions. The importance of transporting finished products in clean vehicles and using clean equipment free of foreign residues is emphasized.

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Lignins: A Safe Solution for Roads

Lignosulfonates have a long history of use on roads as a method for dust control and surface stabilization. Lignosulfonate road products are derived from the lignin that naturally binds cellulose fibers together to give trees and plants firmness. These products are a safe and economical alternative to petroleum and salt-based products that are also applied to road surfaces.

The original method of applying lignosulfonates to road surfaces for dust control was very simple: dilute raw lignosulfonate solutions were sprayed in light applications onto dirt roads. Over time, road surfaces began to show an improved stabilization, increasing the appeal of using lignosulfonates. Lignosulfonate is well suited for a variety of uses where pavement is too costly and dust conditions become intolerable, such as parking lots, driveways, and road shoulders.

Lignosulfonates have a natural adhesive property when moist. When applied to dirt roads, the lignosulfonate solution coats individual road particles with a thin adhesive-like film that binds the particles together. It acts as a dispersant, allowing the particles to pack closer together for a stronger surface. Consequently, water uptake by the road bed surface is greatly reduced and the binder is less likely to be washed away by rain.

Benefits of Lignosulfonates for Road Applications

- **Creates a Denser, Firmer Road Cap** – Lignosulfonate treatment eliminates the sliding hazards of loose dirt and gravel by binding it to a hard, skid-resistant surface.
- **Safe for the Environment** – Lignosulfonates are non-toxic when properly applied, making them safe for foliage and surface water surrounding roadways. Lignosulfonates are not corrosive like other dust control products and can be applied without special equipment or clothing.
- **Improves Safety** – By controlling dust clouds, visibility on dirt roads is significantly increased, adding to driving comfort and safety.
- **Improves Efficiency** – Vehicles can travel over roads treated with lignosulfonates almost immediately, eliminating the need to re-route traffic. Dust is less likely to enter engine parts, reducing equipment maintenance requirements.
- **Reduces Road Repairs** – Hardened road surfaces are less likely to suffer the ribbed "washboard" effect common with untreated gravel or dirt roads. As a result, frequent grading can be reduced or eliminated.

Commercial lignosulfonate products meet the specifications of the U.S. Forest Service Administration, General Service Administration and local and regional government standards. Lignosulfonate use on roads has been endorsed by various agencies for decades.



Recommendations for Effective Application

Lignosulfonates for road applications are usually shipped in a concentrated solution and diluted with water on the job site to about 25 percent solids content. Road conditions and climate can affect the application rate. However, as a general rule for dust control, a diluted solution of lignosulfonate is applied at a rate of one-half gallon per square yard. Stabilization of the road surface normally requires one gallon of lignosulfonate solution per square yard applied to a depth of six inches.

The Lignin Institute has developed recommendations for the safe and effective application of lignin products to road surfaces.

The Lignin Institute Recommends That:

- Equipment used to transport lignin products should be clean and free of any contaminating residue.
- Water used to dilute lignin should not contain residues or other contaminants.
- The extent of dilution and the application rate should be carefully considered for the intended function.
- Prudent consideration should be given to weather, soil and surrounding conditions.

The Lignin Institute has also established voluntary product quality standards for lignin products (including calcium, ammonium and sodium lignosulfonate) used for road and soil stabilization. Lignin products must also meet all applicable regional, state and federal requirements for products applied to road surfaces. The standards, which list recommended maximum levels of various components used in lignosulfonate solutions, are available by contacting The Lignin Institute.

