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# New polymer bounces into sorbent market

By Kimberly A. Roy

Spectacular spills like the Exxon Valdez capture headlines and dominate conversation, but most releases involve quantities too small to attract media attention. For these spills, companies often rely on sorbents to collect the oil and dispose it. These devices come in a variety of shapes, sizes and absorbent materials, including a new generation of products that offers solid results — literally.

The Solidifier™ absorbs oil, as well as chlorinated solvents, hydrocarbons and PCBs, and, as the name implies, solidifies into a rubber-like material. A polymer used extensively in the rubber industry is the key to the sorbent's success, says Bill Gannon, executive vice president of Liquid Waste Technologies Inc. (LWT; Las Cruces, N.M.). Oil and other contaminants, he says, act like catalysts. They dissolve into the polymer, causing its molecules to bond together and form a rubber-like mass, he explains. No. 2 diesel fuel oil, he adds, can be bounced on the floor after it solidifies.

LWT

LWT Executive Vice President Bill Gannon, right, sprays particulate Solidifier™ on oil-contaminated water at a recent demonstration.

Product development began in 1984 in Texas after Gannon and company President Frank Hoff discovered the polymer's possible applications in spill cleanup. They formed LWT in August 1985, based on a polymer product that had several limitations, Gannon relates. Because of its powdered form, he explains, it "blew everywhere" during application and had a 30-month shelf life, so "we began developing an oil solidifier."

The resulting Solidifier™ looks like "ground-up erasers," Gannon says, and has far fewer limitations than the original product. Because "it is heavier," he continues, "it doesn't blow in outside conditions, it works on land surfaces as well as it does on water, and it has a storage life of around five years." A patent on the final formula was filed in December 1989 and is pending.

Solidification, Gannon says, begins shortly after the boom, pillow or particulate is placed on a spill. "Within a half-hour, you can pick up the boom without leaking, but there will be a film on your hand," he says. "Within two hours, there's no problem."

According to Gannon, no reactions occur when the hydrophobic polymer contacts water, acids or alcohols. This, he asserts, makes the products ideal for use outside, where they may be exposed to rain or snow, or for surface-water spills. "Once contaminants are locked up, they stay that way," he says.

LWT's products are superior to conventional booms for surface-water applications, says Louis Phillippe Roy, scientific adviser to the vice president of the environment at Hydro-Quebec (Montreal), the province's utility company. Roy was one of 54 people from Canadian industry and government who attended a product demonstration there in late September. "Conventional booms," Roy notes, "can contain oil for a short period of time, but in a current of 3 to 4 knots," there is the problem of oil escaping.

According to LWT officials, their products remain floating after solidification for "an indefinite period of time," and do not "stick to rocks or sink into beach areas. . . . (They) work on calm waters, or if slightly rough water is present, their effectiveness is enhanced," because agitation increases contact between the oil and the polymer.

"It's the only product that will absorb oil and solidify it into a rubbery mass that floats without leaching back into the environment," claims Hoff. Solidifier™ products, say company officials, "are different from viscosity enhancers that only bind the oil into a film that is then sucked from the water surface with a vacuum truck. The solidifiers actually change the oil into solid pieces of rubber that can be removed by skimmers, nets or other mechanical means."

Temperature and oil viscosity determine how much product is needed to immobilize a spill. For example, "No. 2 diesel fuel oil at 60 degrees will be absorbed and start solidifying in 10 minutes using about 1 pound of particulate to 1 gallon of oil," according to company literature. At 32 degrees, tests indicate 30 minutes are required to achieve the same results.

In other tests conducted by LWT, fresh Prudhoe Bay crude oil was absorbed from 32-degree water and started to solidify in 10 minutes, using 1½ pounds of particulate to 1 gallon of oil. Laboratory-aged Prudhoe Bay crude, with the volatiles evaporated off, required 2½ pounds of particulate per gal-

lon of oil and 15 minutes to begin solidification in water temperatures of 32 degrees. The products, Gannon says, were tested successfully in Alaska on light aromatic oils in air temperatures of 55 below zero.

Once solidified, the material can be landfilled or incinerated. "Disposal depends on what is picked up," Gannon relates. "For example, a PCB-contaminated transformer oil is still a PCB waste. In that case, you have two options. If it contains less than 500 ppm PCB, it can be sent to an approved PCB landfill. If not, it can be sent to an approved PCB incinerator and will leave less than 1 percent ash content." Solidified material, he adds, can pass the 50 pound-per- square-inch or greater pressure test required by EPA for landfilling.

Another benefit, Gannon says, is a reduction of a contaminant's flammability. "If the spilled liquid is flammable, like gasoline, the Solidifier™ eventually will decrease its flammability over time, making it safer," he says. Fulton Williams, environmental supervisor for AMTRAK's (Wilmington, Del.) Bear, Del., facility, confirms Gannon's claim. AMTRAK, he relates, first contacted LWT because it had numerous drums whose contents made them unacceptable for shipping. Employees used particulate Solidifier™ to stabilize the drum contents and "found it was excellent," he says. "It also drastically changes the flash point of some materials to the point that they don't ignite. . . . We tried to ignite a solidified ball of diesel fuel and it wouldn't."

The Solidifier™ is listed under the National Contingency Plan (NCP) as a nontoxic cleanup option for oil spills. To make the list, technologies and products must pass EPA's toxicity test, which requires exposure of two species of marine life, small minnows and brine shrimp, to a concentration of the product alone and a mixture of product and No. 2 fuel oil.

Toxicity is expressed as the lethal concentration, 50-percent kill (LC50), which indicates the amount of a material that kills 50 percent of a test species during the exposure period. In this case, toxicity is determined by counting the number of brine shrimp killed in 48 hours and the number of small minnows killed in 96 hours.

No. 2 fuel oil has a toxicity LC50 of 1,585 ppm (higher ppm readings indicate less toxic material). Test results showed the solidifier products have an LC50 greater than 32,000 ppm for shrimp and 4,000 ppm for minnows. After they are mixed with No. 2 fuel oil, the products' toxicity increases to 2,700 ppm for minnows and 13,500 for shrimp.

LWT

**A Solidifier™ boom holds oil at bay during a demonstration.**

Because it met specified criteria, LWT officials took the Solidifier™ products to Alaska after the Exxon Valdez spill. "We tried getting our product tested in Alaska," Gannon says, "but didn't get anywhere, primarily because it wasn't pre-approved (listed in the NCP). . . . We proposed it as a method to prevent oil from moving back into the water. By the time we got our act together and got up there, most of the oil had already reached the beaches. . . . All in all, it didn't work out too badly, because we received exposure to other oil companies operating in Alaska and on the North Slope. Some of them are now customers."

Like most products, the Solidifier™ has limitations. The most important factor in its effectiveness is the viscosity, or pour point, of the oil, Gannon relates. "It works very well with chlorinated solvents, lighter fuel oils and less viscous oils," he continues. "It doesn't work well with high-viscosity oils, like No. 6 fuel oil. For example, with the boom form, if the oil coats the outside but can't get inside to the polymer, it would be ineffective." In this instance, he concludes, the particulate form would be more appropriate. Also, he adds, "it doesn't work well with straight motor oil; it can't lock up the additives and detergents."

Besides the oil industry, the company plans to target electric utilities, railroads, airports, port authorities, aircraft manufacturers, marinas and the military. "We'll target large-spill emergency response applications, but we're focusing on industries that need products for ongoing maintenance operations," Gannon says. "Sometimes you have to wait a long time for a major spill."

Solidifier™ products are more expensive than conventional sorbents, Gannon concedes. A 50-pound bag of clay, sand or dirt might cost $8, he says, while a 25-pound drum of the Solidifier™ costs $225. However, he notes, a single drum can handle about 18 gallons of fuel, while the same spill might require 10 bags of cheaper material. Also, he says, "clay, sand or dirt still has to be swept up, transported and disposed. They're much more labor intensive." Conventional booms of other materials also are less expensive, but the difference is "not as drastic," he says.

In 1990, LWT expects sales of about $400,000, relates Hoff. "We can look forward to between four and five times that in growth next year," he adds. In some instances, he concedes, "it (higher costs) may affect us. So far, however, companies don't seem to be overly concerned."

"It is more expensive, but we think it's worth it," says Gregory Kowalczyk, environmental operating analyst at the United Illuminating Co. (New Haven, Conn.), where employees use the Solidifier™ as a spill cleanup tool. "We find it much better than conventional (sorbents) like sawdust. There's no drippage; it makes a nice neat package."

This thought is echoed by L. Michael Flaherty and Julie M. Jordan of the Engineering Systems Division of the Analysis Group Inc. (Rockville, Md.) in their report, *Sorbent Performance Study for Crude and Refined Petroleum Products.* They write: "It is our belief that the newer developed materials, such as the new polymer absorbents that solidify into a rubber-like mass, are part of a new family of products for the future. Their price is approximately the same as normal absorbent booms or snakes, and they currently meet landfill regulations. But they allow for much broader application and disposal. Any new materials that can reduce the larger labor-intensive requirement in retrieval and disposal will be greatly sought after."

"Whenever we meet with companies, they're really impressed," Gannon confirms. "At first, all we got were oohs and aahs, but as the regulations get more stringent, genuine interest increases. I think we have a very good potential of growth. What we really need is exposure."

Kowalczyk predicts the products will "have a major impact on the cleanup industry. It's a definite breakthrough in oil cleanup. There are other companies out there, but Liquid Waste Technologies is the first we've run across, and we feel this product is satisfactory for our needs."

AMTRAK's Williams concurs. At AMTRAK, "we also use the Solidifier™ booms to ensure runoff and effluent do not contaminate a nearby creek. The oil Solidifier™ boom . . . lasted longer than other companies'. . . . They seem to be able to take more abuse. We've reviewed others and think this product is the best on the market." ▼