

Bio-Derived Phytol Chemical Herders

High-performance marine oil spill response technology

Value Proposition

This bio-based chemical herder from Los Alamos National Laboratory rapidly compacts oil slicks to enable effective in-situ burning or recovery, delivering high performance while minimizing the environmental persistence and bioaccumulation concerns of conventional petroleum-derived products.

Technology Readiness Level 4

IP Information for S-191484

U.S. Patent pending

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Overview

Chemical herders are surfactants applied to the water surface surrounding an oil slick. By reducing water surface tension and creating interfacial spreading pressure, herders drive thin oil films into thicker slicks that can be more readily burned or mechanically recovered. This approach is especially valuable for remote spills where physical recovery methods are impractical.

Bio-Derived Phytol Chemical Herders from Los Alamos National Laboratory introduces a new family of surfactants built from two renewable components: (1) phytol, a long-chain alcohol and major component of chlorophyll, used as the hydrophobic tail; and (2) sugar alcohols, used as the polar head group. These compounds have been demonstrated as effective



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chemical herders and shown to compete with commercially available/approved herders such as ThickSlick 6535 and Siltech OP-40. The synthesis is described as operationally simple and high-yielding, supporting practical scale-up and manufacturing transfer.

Advantages

- Bio-based surfactant platform using renewable phytol and sugar alcohol headgroups
- Designed to reduce environmental impact relative to non-biodegradable, bioaccumulative commercial herders
- Demonstrated effectiveness as a chemical herder in laboratory evaluations
- Competitive performance versus ThickSlick 6535 and Siltech OP-40
- Higher herding rates than a prior phytol-derived herder example
- Operationally simple, high-yield synthesis (supports manufacturability)
- Platform may extend to broader surfactant markets (cleaning, formulations, delivery systems)

Technology Description

Bio-Derived Phytol Chemical Herders covers a family of amphiphilic molecules engineered for interfacial activity at the oil–water boundary.

Continued on reverse

Each molecule combines:

- a **hydrophobic chain derived from phytol** (a chlorophyll-associated long-chain alcohol), and
- a **hydrophilic sugar alcohol headgroup** to impart polarity and water affinity.

Upon application to the water surface adjacent to an oil slick, these surfactants preferentially spread at the air–water interface, lowering local surface tension and generating a lateral driving force that compacts the oil layer into a thicker slick. The invention emphasizes renewable sourcing and reduced ecological burden relative to legacy herders that are known to be non-biodegradable and prone to bioaccumulation.

These phytol–sugar alcohol surfactants have been demonstrated as effective chemical herders, with performance competitive with commercial benchmarks and with improved herding rate relative to earlier phytol-based approaches. The family nature of the chemistry provides room to tune headgroup identity and amphiphile balance to optimize spreading behavior and operational performance, while keeping the overall design within a renewable, environmentally considerate chemical space.

Market Applications

- Oil & Gas Industry
- Environmental Remediation & Spill Response
- Government & Public Sector Agencies
- Marine & Maritime Industry
- Chemical & Specialty Surfactant Manufacturers
- Industrial & Institutional Cleaning