# Non-Petroleum Oil Spills

## Definition

Non-petroleum oils include vegetable oils (e.g., soybean oil, palm oil, rapeseed oil, sunflower oil) and animal fats (e.g., beef tallow oil). These oils are regulated under 40 CFR 112 and have similar spill-planning requirements as petroleum oils.

Vegetable-based oils can be used as lubricants in dredges and other marine equipment.

## Properties

- Many vegetable oils are liquids, lighter than water (specific gravity of 0.90-0.97), and will float and form slicks initially. Over time, their behavior can vary widely, depending on oil type, volume, wave energy, temperature, presence of floating debris, etc.
- Some vegetable oils are solid at ambient temperatures and are heated during shipping; thus, they can solidify once spilled depending on ambient temperatures.

## Environmental Behavior

- Containment and removal by skimming or vacuum is similar to light petroleum oils.
- There is little to no loss by evaporation or natural dispersion. They can form unstable emulsions under turbulent conditions.
- When fresh, vegetable oils can penetrate into porous sediments; most have viscosities less than 100 cSt at 20°C (similar to olive oil).
- Floating oil can sorb onto suspended particulates and sink to the bottom; this behavior was reported for a spill into a shallow wetland.
- They can polymerize (components cross link), thus they can form solids that are resistant to degradation and can persist for years.

## Environmental Effects

- The greatest hazard of vegetable oil spills to biological resources, particularly in their liquid form, is smothering. They can cause physical effects by coating animals and plants with oil. Wildlife that becomes coated with animal fats or vegetable oils could die of hypothermia, dehydration and diarrhea, starvation, or suffocation from clogging of nostrils, throat, or gills.
- They will foul shorelines, clog water treatment plants, and burn when ignition sources are present.
- After polymerization, oxidation, or mixing with debris, vegetable oils can become denser than water and sink, forming an impermeable cap on the sediments and smothering benthic resources.
- Large spills of vegetable oils that have polymerized have been described as:
  - Soybean oil: Spill to a freshwater river that formed milky material and hard crusts on the shoreline, as well as stringy, rubbery masses that sank.
  - Unrefined sunflower oil: Marine spill that sank and formed a cap on benthic habitats, as well as concrete-like lumps in intertidal sandy sediments that persisted for >6 years.
- All non-petroleum oils can rapidly deplete the oxygen levels in sediments and isolated water bodies because of the high biochemical oxygen demand (BOD). Thus, aquatic life can suffocate.

- Birds may not be able to detect or avoid slicks of vegetable oil on water. Relatively small spills have killed hundreds of birds.
- Vegetable oils lack chemical compounds that are acutely toxic to aquatic organisms. However, vegetable oils can form toxic intermediate products during oxidation and microbial degradation that have been shown to be toxic to microorganisms, algae, plankton, mussels, and amphipods. Despite this, toxicity to aquatic resources from vegetable oils is primarily driven by oxygen depletion and asphyxiation.
- They will produce rancid odors; thus, residues could become an attractant to animals, such as bears, which could then increase their risk of human encounters or vehicle strikes when crossing roads to access the spill site.
- Unpolymerized vegetable oils in sediments rapidly and completely biodegrade, even under anaerobic conditions, particularly when the concentrations are below 2% by weight. Higher sediment concentrations will take longer, up to several months.
- Little is known about the properties and behavior of animal fats, which tend to be more solid at ambient temperatures. A spill of 15,000 gallons of beef tallow into the Houston Ship Channel in 2011 formed thick patties that were corralled using fish nets and removed using pitchforks. Animal fats would likely pose fouling risks to animals and plants, have a high BOD, produce rancid odors, and biodegrade slowly.

## Key References


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