Oil spills caused by damaged oil rigs, ruptured pipelines, and tankers can cause immediate and long-term detrimental effects on marine systems and aquatic life. Herein we further developed the an oil spill recovery technique called oil herding.

Oil herder is an amphiphilic oil-collecting surfactant which is applied to spray around the oil spill areas and is able to retract oil slicks, transforming them from a large thin layer to a small thick bulk. This herding treatment greatly simplifies further in-situ burning and the recycle process.

The natural konjac glucomannan (KGM) material could be functionalized and examined here as an oil herder, which has the great advantage of nontoxicity, biocompatibility, and adaptability. Moreover, functionalized KGM is a non-ionic surfactant with no obvious Krafft temperature. The absence of Krafft temperature gives KGM surfactants the unique ability to retain surfactant ability at temperatures nearing 0 °C. It offers a new direction for efficient oil herders within a wide range of water temperatures in the offshore safety control, especially for oil spills treatment in Arctic area.

**Herding Mechanism**

Before herding surfactant was applied, oil on water surface system experienced with three forces, the oil-water surface tension (γ\text{O/W}), the oil-air surface tension (γ\text{O/A}) and the air-water surface tension (γ\text{W/A}). Water is a highly polar solvent and has high surface tension (γ\text{W/A}=72.5 mN/m). The Y\text{O/W} and Y\text{O/A} mainly depend on oil and water properties and the net sum value (γ\text{O/W}+γ\text{O/A}) is around 25 mN/m. Higher Y\text{O/W} made the oil slick quickly spread outside from center until Y\text{W/A} and (γ\text{O/W}+γ\text{O/A}) value are the same. At this moment, the oil slick became a very thin layer and reached the equilibrium state.

**KGM Herding**

Oil herding of KGM with various solvent in low temperature (1°C)

**Sustainable Amphiphilic Herders For Efficient Oil Spill Treatment**

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**Motivation**

large-scale oil spills resulted in huge socio-economic impacts and attracted negative media and public attention. Besides of larger oil spills, more than half of the oil spills incidents are smaller in magnitude and are commonly existing, which often evade attention and more difficult to clean up.

**Oil Spill Challenge**

World Map of 10 Largest Oil Spills in History and Sea Surface Temperature

**Experiment Analysis**

Experimental setup for oil herding process

Oil area analysis and pixel conversion

**KGM Surfactant**

Konjac Stem

Konjac Food

Konjac Powder (KGM) EMI Image

**Biocompatible Test**

Biocompatible sprouting test for MKGM herding surfactant

**References**


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