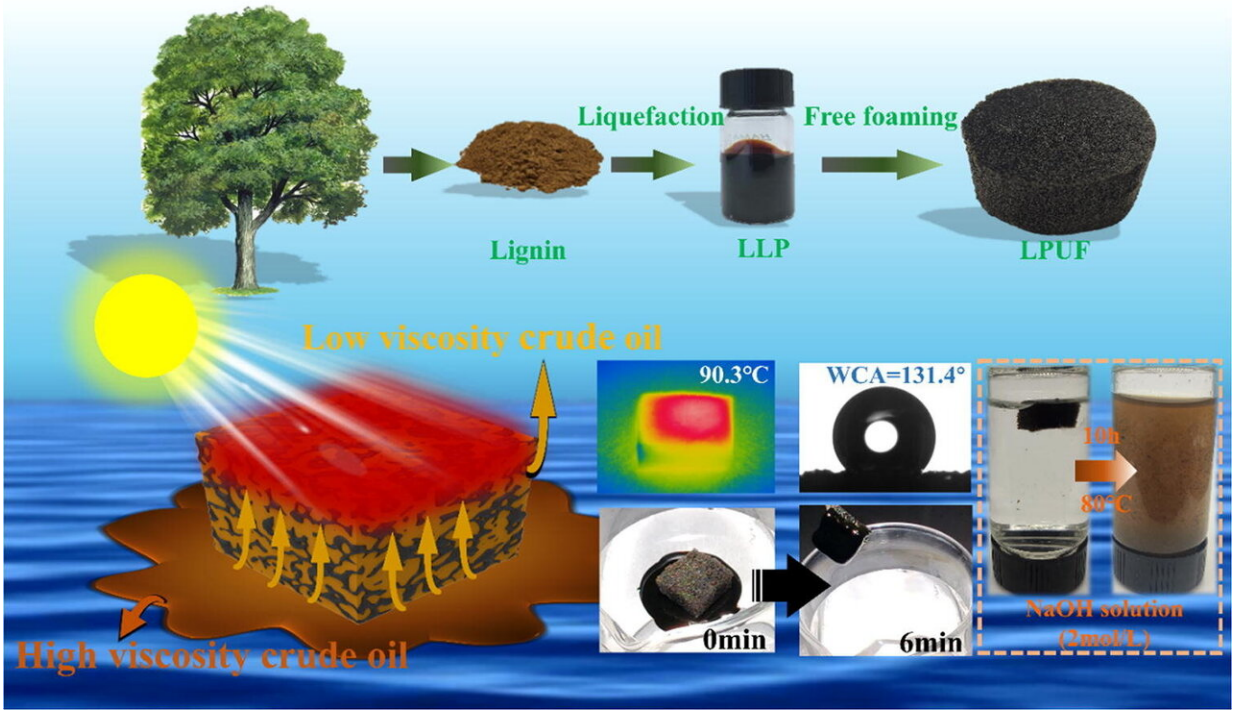
Degradable lignin-based polyurethane adsorbent for efficient crude oil cleanup

March 15 2021, by Liu Jia



Graphical abstract. Credit: *Chemical Engineering Journal* (2021). DOI: 10.1016/j.cej.2021.128956

A research group led by Prof. Zhu Jin at the Ningbo Institute of Materials Technology and Engineering (NIMTE) of the Chinese Academy of Sciences (CAS), has synthesized a high-efficiency carbon nanotube (CNT) modified lignin-based polyurethane adsorbent for crude

oil spill remediation, in cooperation with Prof. Chen Tao's group at NIMTE and Prof. Yan Ning's group at the University of Toronto (U of T). The study was published in the Chemical Engineering Journal.

In recent years, the leakage of crude oil or organic chemicals has led to economic losses, petrochemical resource waste and severe environmental pollution, posing great threats to the marine ecosystem and human health. However, existing methods for crude oil cleanup are unable to combine excellent remediation performance with environmental protection.

Researchers at NIMTE employed the photothermal effect triggered by sunlight as the energy source to heat the heavy oil components, thus significantly reducing their inherent high viscosities to achieve a fast and efficient crude oil cleanup.

Through a simple polyurethane foaming process, they prepared lignin-based polyurethane foams. As a photothermal sorbent, the prepared polyurethane foam was doped with carbon nanotubes (CNTs) and showed excellent sunlight absorption of 97% for heavy oil with their surface temperature even exceeding 90 ℃ after 500 s of exposure under one sunlight. The modified foams adsorbed more than six times of its weight of crude oil within six min under one sun illumination.

In addition, the lignin-based foam adsorbents were degradable in alkaline environments with the degradation efficiency reaching 88.03% and the degradation rate of 6.25 mg/h in 2 mol/L NaOH aqueous solution at 80℃ for 10 h. Meanwhile, CNTs can be recovered from the same condition.

This work has not only provided an efficient and eco-friendly approach for heavy crude oil spill remediation and recovery, but also shed light on the high-value utilization of dark-colored bio-based polymers.

More information: Xiaozhen Ma et al. Mechanically robust, solar-driven, and degradable lignin-based polyurethane adsorbent for efficient crude oil spill remediation, *Chemical Engineering Journal* (2021). DOI: 10.1016/j.cej.2021.128956

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