

Scientists say date palm surface fibers can produce bio-oil and support bio-energy applications

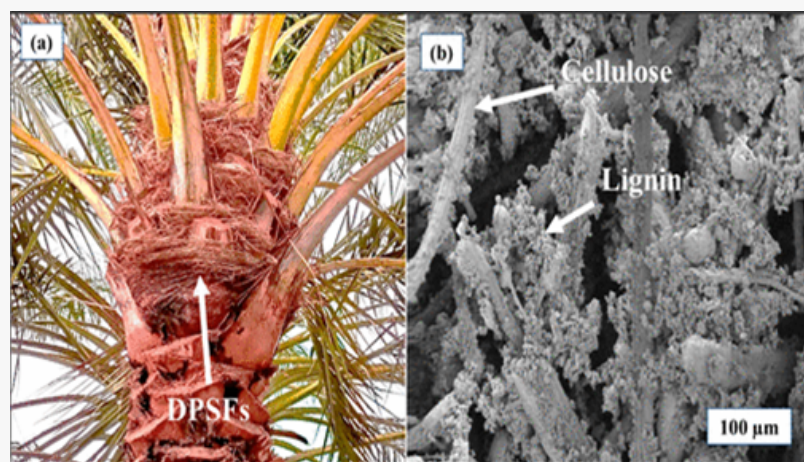
Scientists have developed a new method to produce bio-oil and bioenergy applications using the surface fiber waste of date palm trees.

SHARJAH, EMIRATE OF SHARJAH, UNITED ARAB EMIRATES, April 12, 2026 /EINPresswire.com/ -- Researchers have developed a method to extract bio-oil from the surface fiber waste of date palm trees, an abundant, low-cost, and sustainable biomass resource generated by an estimated 150 million date palm trees worldwide.

The findings are presented in a recent article published in the journal ACS Omega. In the study, the researchers examine the conversion-dependent pyrolysis behavior, kinetic analysis, and qualitative composition of bio-oil derived from date palm surface fibers (DPSFs). These fibers are abundantly available as municipal and agricultural biomass wastes from date palm trees in the United Arab Emirates (UAE), where the research was conducted.

The authors report that DPSFs show strong potential as bioenergy feedstock. As a lignocellulosic biomass rich in cellulose, hemicellulose, and lignin, the fibers are particularly suitable for thermochemical energy conversion processes. The material was analyzed “using thermogravimetric analysis at non-isothermal heating rates of 10–40 °C/min at a temperature range of 20–750 °C.”

To better understand the thermal degradation behavior of the fibers, the researchers calculated activation energy values, using “model-free kinetics approaches, including the Ozawa–Flynn–Wall (OFW), Kissinger–Akahira–Sunose (KAS), and Starink (STK) methods.” According to the authors, the cultivation energy analysis helped them shed light on the relationship between “degradation



Each of the nearly 150 million palm trees worldwide is assessed to produce 20 kilograms of lignocellulose biomass waste annually in the form of date fruit seeds, leaves, fronds, and surface fibers. Credit: ACS Omega (2026). DOI: <https://doi.org/10.1021/ac>

behavior as a function of the conversion and fragmentation of cellulose, hemicellulose, and lignin.”

Promising results

The research team, affiliated with the University of Sharjah, United Arab Emirates University, Abu Dhabi Polytechnic University, Muscat University in Oman, and Universiti Kebangsaan Malaysia, report promising results that underscore the feasibility of using date-palm surface fibers as a renewable bioenergy source.

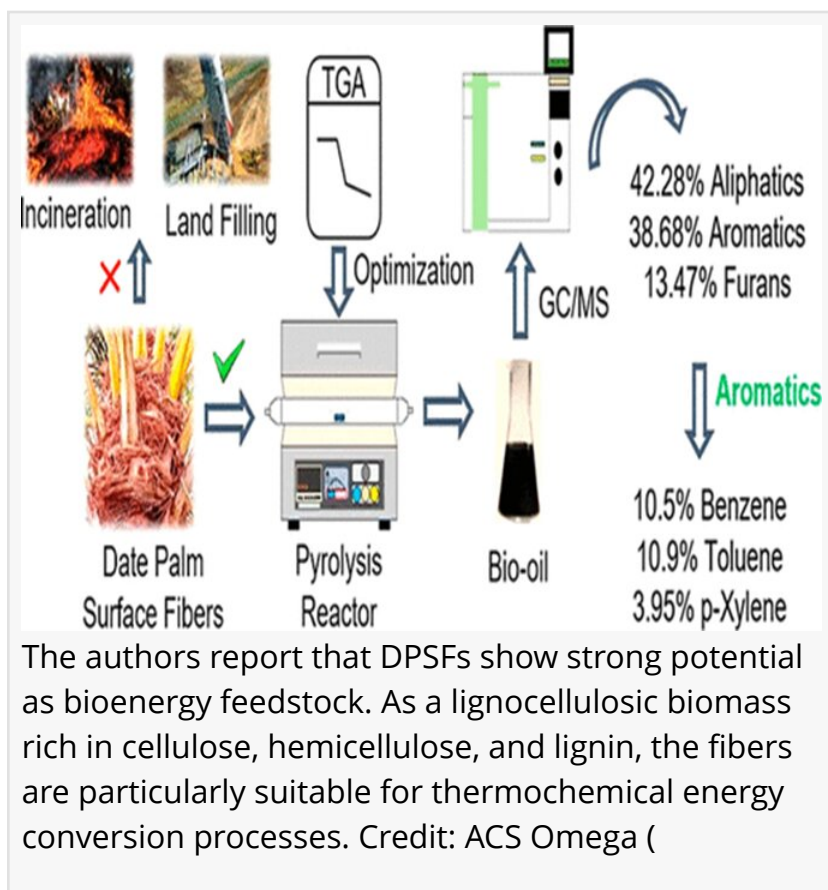
A qualitative assessment of the resulting bio-oil revealed that it consists primarily of aliphatics (42.28%), aromatics (38.68%), and furans and other oxygenates (13.47%), the three major classes of hydrocarbons and their derivatives commonly found in bio-oil, an outcome that, the researchers argue, strengthens the case for utilizing date palm biomass waste as a viable feedstock for the production of sustainable energy.

The authors use pyrolysis technology, a thermochemical decomposition process, to convert DPSF, low-value biomass waste, into energy applications. They write, “The information on the DPSF pyrolyzed bio-oil suggests that the aromatic-rich nature will lead to targeted recovery of BTX/phenolic compounds, as well as bioenergy applications.”

The authors emphasize that their method offers several advantages over prevalent approaches for converting biomass waste into biofuel. They argue that the process they have designed is potentially carbon-neutral, as it releases only the carbon that the palm trees absorb from the atmosphere during photosynthesis over their growth cycle.

In terms of economic feasibility, the study identifies operating labor costs, nitrogen consumption, and feedstock availability as key factors influencing the unit production costs of bio-oil derived from palm tree fibers. It is essential, the authors note, particularly for scaling up production and fostering the technology’s viability, to fully understand and optimize the cost drivers.

Untapped renewable resource



The findings offer welcome news for the environment, date-palm farmers, and renewable-energy stakeholders. Each of the nearly 150 million palm trees worldwide is assessed to produce 20 kilograms of lignocellulose biomass waste annually in the form of date fruit seeds, leaves, fronds, and surface fibers. There are countries in the Middle East that are home to millions of tons of DPSFs. One can readily imagine the enormous volume of DPSFs, which countries such as the UAE, with approximately 45 million date palm trees; Saudi Arabia, with 32 million; Iraq, with 22 million; and Egypt, with 15 million, must manage every year.

DPSFs are a form of lignocellulosic waste that grows on the exterior of date palm trees. They are fibrous, lightweight, and rich in lignin and cellulose, qualities that make them well suitable as a feedstock for pyrolysis to produce bio-oil and biochar.

“Suitable disposal of these millions of tons of lignocellulosic biomass waste requires an expensive waste management system. If not handled correctly by the municipalities, the incineration or burning in the field causes environmental dangers of greenhouse gases such as CO₂ and nitric oxides (NO_x),” the authors note. “Utilizing lignocellulosic waste also aligns with the holistic philosophy of permaculture, where nothing is considered a waste, instead a feedstock for a new product.”

Sustainable management of palm tree biomass, such as the approach proposed in the study, requires an expensive infrastructure system, advanced technology, and coordinated structure. At present, biomass waste in the UAE alone is estimated to approach one billion kilograms annually, based on conservative assumptions that each of the country’s nearly 45 million date palm trees generates approximately 20 kilograms of biomass per year.

Farmers burn much of this enormous waste in their fields. The burning releases particulate matter and harmful gaseous pollutants, which harm the environment, generate smog, and contribute to the prevalence of respiratory diseases.

This context highlights the significance of the authors’ findings and the novel approach they propose to convert waste into clean energy. The method enables recovering bio-oil and bioenergy from billions of kilograms of palm surface fibers discarded annually worldwide, while at the same time addressing environmental concerns and enhancing sustainable energy solutions.

Original Source URL: <https://doi.org/10.1021/acsomega.5c11064>

LEON BARKHO
University Of Sharjah
+971 50 165 4376
[email us here](#)

This press release can be viewed online at: <https://www.einpresswire.com/article/905275170>

EIN Presswire's priority is source transparency. We do not allow opaque clients, and our editors try to be careful about weeding out false and misleading content. As a user, if you see something we have missed, please do bring it to our attention. Your help is welcome. EIN Presswire, Everyone's Internet News Presswire™, tries to define some of the boundaries that are reasonable in today's world. Please see our Editorial Guidelines for more information.

© 1995-2026 Newsmatics Inc. All Right Reserved.