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Opinion

Renewable Fuel Instead of Landfill and Incineration, A Novel Pyrolysis Technology for Waste Petrochemical Polymers

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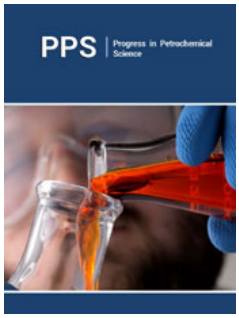

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Opinion

In the context of distributed energy systems, low-temperature pyrolysis would be a viable method for producing renewable fuels. Low-temperature pyrolysis produces fuels on a small scale closer to where energy is used, which helps reduce the need from a large, centralized energy supply and increases energy security. The use of small low-temperature pyrolysis modules in waste treatment can reduce the Greenhouse Gas (GHG) emissions of economic activity by reducing the need for transportation and large-scale land use. Additionally, the use of locally sourced materials produces minimal GHG emissions compared to traditional fossil fuel production methods. Because low-temperature pyrolysis technology can reduce waste treatment costs and remove the generation of harmful toxicants, the availability of mixed waste as an energy feedstock reduces the overall environmental impact and improves the resilience of the energy system. In Taiwan, a small and densely populated island known for its semiconductor industry in East Asian, the collaboration of academia, industry and social enthusiasts has proposed a new circular economy framework to address the growing waste problem while improving the energy security and the global sustainable demand Hung et al. [1]. Thermal desorption is commonly used in environmental restoration technology to treat contaminated soil. The choice of treatment temperature depends on the physical characteristics of organic pollutants. Generally, petroleum hydrocarbons such as gasoline, diesel or kerosene are polluted because of their low boiling point, high volatility and other characteristics, so low-temperature thermal desorption can be used; if Pollutants Are Refractory Organic Compounds (POPs), PCBs, pesticides, etc., because of their high boiling point and low volatility, the treatment temperature It must be improved to convert the adsorbed pollutants into a gaseous state for separation. However, a Low-Temperature Pyrolysis (LTP) module will be an effective solution that is more environmentally friendly and cost-effective for pollutants such as non-soil and other fixed and difficult-to-move sites, such as ocean waste and agricultural waste. LTP uses anaerobic heating to convert organic polymeric substances (cellulose, lipids, and plastics) into liquid pyrolysis oils (WPO). Regenerated WPO can be used as energy source in distributed energy systems. The WPO uses locally renewable materials to product fuels and mitigated GHG emissions as a sustainable idea, compared to traditional productions of fossil fuel. The pyrolysis fuel from biomass resources can be used to reduce dependence on fossil fuels. The use of LTP to produce fuels can further improve their sustainability by reducing dependence on centralized energy systems and improving energy security. Additionally, utilizing waste as a feedstock can reduce waste disposal costs and reduce overall environmental impact. The proposal to use LTP is a promising approach that could help meet humanity's growing demand for renewable energy and support the transition to more sustainable systems. The LTP process is carried out in the temperature range of 300-450 °C, which is lower than the traditional pyrolysis process. This results in

less coke and more WPO. One of the advantages of LTP is that it can be used to convert a variety of feedstocks, including woody biomass, agricultural residues and even municipal waste, into fuels. This helps reduce dependence on fossil fuels and increases the use of locally sourced renewable energy. Another benefit of LTP is the co-production of other valuable products such as biochar, a carbon-rich material that can be used as a soil amendment, or syngas, a combination of carbon monoxide and hydrogen that can be used as a fuel or chemical feedstock mixture.

The European Union (EU) has long used waste-to-energy as a way to generate electricity while reducing the amount of waste sent to landfills. In recent years, however, the EU has begun to exclude waste-to-energy from financial support and shift the focus to more sustainable waste management options such as recycling and composting. Major European financial institutions exclude waste-to-energy from financial support Makavou [2], is low-temperature pyrolysis still a good sustainable technology? Waste incineration is a carbon-intensive process that undermines efforts to reduce and neutralize carbon. Furthermore, the transition to a circular economy is compromised. Since both non-recyclable and recyclable waste can be used as raw material for waste incinerators, it fails to attract consumers' attention to waste reduction and recycling, and at the same time tends to produce more and more waste over time. Therefore, Europe Financial institutions are now choosing to support less carbon-intensive and higher-waste alternatives, keeping waste-to-energy out of their sustainability agenda. The construction of new waste incinerators was cited as not complying with DNSH principles and threatening the transition to a circular economy as it could "lead to a significant increase in the generation, incineration or disposal of waste, with the exception of the incineration of non-recyclable hazardous waste", contrary to taxonomy regulations (Article 17(1) d(ii), 2021, EU taxonomy) [3]. This policy shift could have implications for the development of LTP energy proposal, which may be more difficult to compete in terms of cost and access to funding. However, it should be noted that LTP should be considered a more sustainable option compared to waste-to-energy, as it converts biomass and petrochemical waste into directly usable fuels (heat and power generation) , and also produce other valuable products such as biochar and syngas. If LTP can get financial support for its friendliness and attainable environmental benefits. It is important for the renewable energy industry to demonstrate the environmental benefits and potential to reduce GHG emissions of its technology. Changes in energy and sustainability policies may have a negative impact on the market demand and reduce investment in LTP. But it may also promote more advanced and environmentally friendly waste disposal, contributing to environmental protection and sustainable development (CEAP, 2020).

The LTP module can be a beneficial technology for increasing production of biomass energy to reduce reliance on centralized energy systems for supply stability. Sustainable proposals for the use of LTP should focus on using the process in conjunction with other renewable energy sources, such as solar or wind, to create more reliable and resilient energy systems. LTP holds great potential for disaster relief in rural, remote areas, or extreme climates where access to conventional or centralized energy systems is limited. The LTP process can turn waste that would otherwise be discarded or landfilled into valuable biofuel, reducing waste volumes, and potentially reducing the landfills. The initiative to use LTP systems in decentralized energy systems offers a promising option for meeting energy needs in an environmentally sustainable and socially responsible manner.

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