

Continuous-flow Hydrothermal Liquefaction Process (Patented)

Advanced Biorefinery Technologies Ltd

At the heart of Advanced Biorefinery Technologies Ltd. lies our patented Continuous-Flow Hydrothermal Liquefaction (HTL) technology. This groundbreaking process is designed to convert organic waste and biomass into high-value bio-crude oil, offering a sustainable solution for waste management and renewable energy production.

How HTL Works

The HTL process uses high-temperature and high-pressure conditions to break down wet organic matter, such as food waste, sewage sludge, and agricultural residues, into bio-crude oil and other valuable byproducts. Unlike traditional methods, HTL efficiently processes feedstocks with over 80% water content without requiring energy-intensive drying steps, making it highly cost-effective and environmentally friendly.

Key Features and Benefits

High Conversion Efficiency

Achieves over 90% conversion of organic matter into valuable products. Produces bio-crude oil with a higher heating value (25–35 MJ/kg), significantly outperforming pyrolysis oils.

Scalability and Cost Efficiency

The continuous-flow design allows for seamless scalability, from pilot-scale plants to industrial facilities. Reduces operational costs by eliminating drying and utilizing wet feedstock directly.

Diverse Feedstock Compatibility

Capable of processing various organic wastes, including food waste, sewage sludge, forestry residues, and agricultural byproducts.

Environmental Impact

Supports carbon neutrality by reducing CO₂ emissions and diverting waste from landfills. Produces clean energy in the form of biofuels, which can replace fossil fuels in aviation and marine industries.

End Products and Applications

Bio-Crude Oil

Can be upgraded to bio-jet fuels and marine biofuels for use as drop-in replacements for traditional fuels. Provides a cleaner alternative to reduce greenhouse gas emissions in transportation.

Hydro-Char and Other Byproducts

Hydro-char for soil improvement and carbon sequestration. Biogas and other renewable energy sources for industrial use.

Why HTL is a Game-Changer

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The HTL technology represents a significant advancement in sustainable waste-to-energy solutions. By converting waste into renewable energy and valuable materials, it addresses critical global challenges such as waste management, carbon emissions, and resource efficiency. This technology not only aligns with global carbon neutrality goals but also contributes to a circular economy by transforming waste into resources.

With our HTL technology, we aim to lead the transition towards a sustainable, waste-free future, empowering industries to adopt greener practices while creating long-term economic and environmental value.

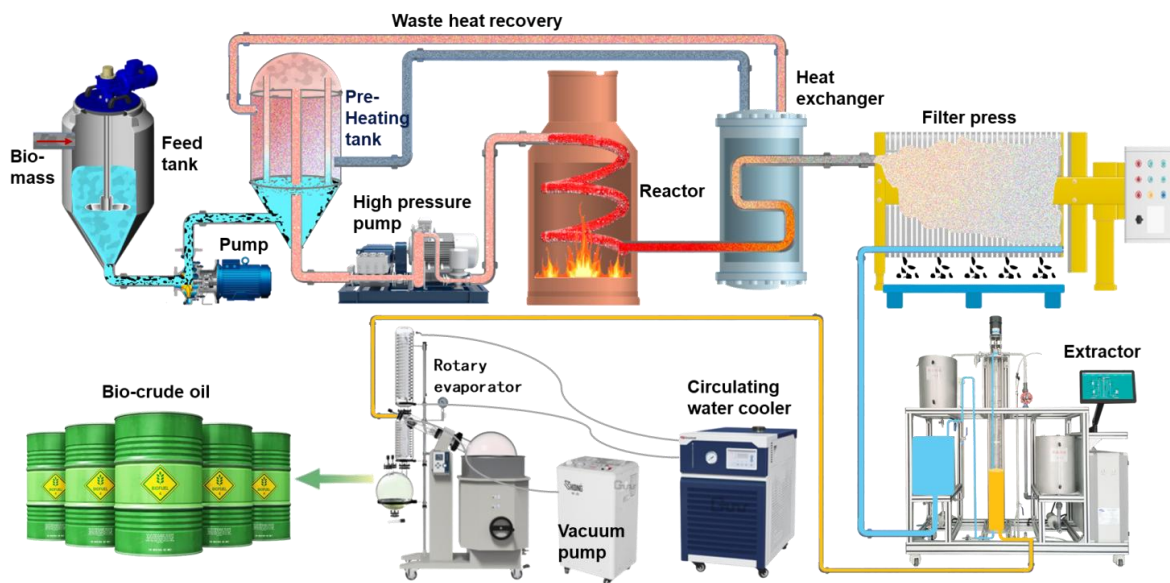


Fig. 1 Diagram of the Continuous-Flow Hydrothermal Liquefaction (HTL) Process



Fig. 2 100 kg/h pilot HTL facility

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(12) United States Patent Xu et al.

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(54) **HYDROTHERMAL LIQUEFACTION CO-PROCESSING OF WASTEWATER SLUDGE AND LIGNOCELLULOSIC BIOMASS FOR CO-PRODUCTION OF BIO-GAS AND BIO-OILS**

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(58) **Field of Classification Search**
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(Continued)

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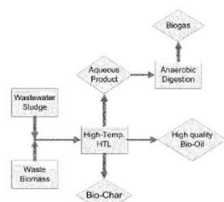
International Search Report dated Jul. 26, 2017, in PCT/CA2016/051239 filed Oct. 27, 2016, 4 pages.
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(57) **ABSTRACT**

This disclosure provides a process based on hydrothermal liquefaction (HTL) treatment for co-processing of high-water-content wastewater sludge and other lignocellulosic biomass for co-production of biogas and bio-crude oil. The mixture of waste activated sludge and lignocellulosic biomass such as birchwood sawdust/composts/MSW was converted under HTL conditions in presence of KOH as the homogeneous catalyst. The operating conditions including reaction temperature, reaction time and solids concentration were optimized based on the response surface methodology for the maximum bio-crude oil production. The highest bio-crude oil yield of around 34 wt % was obtained by co-feeding waste activated sludge with lignocellulosic biomass at an optimum temperature of 310° C., reaction time of 10 min, and solids concentration of 10 wt %. The two by-products from this process (bio-char and water-soluble products) can be used to produce energy as well. Water-soluble products were used to produce biogas through Bio-methane Potential Test (BMP) and were found to produce around 800 mL bio-methane cumulatively in 30 days
(Continued)



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(12) United States Patent Xu et al.

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(54) **HYDROTHERMAL LIQUEFACTION OF LIGNOCELLULOSIC BIOMASS TO BIO-OILS WITH CONTROLLED MOLECULAR WEIGHTS**

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C07C 29/80 (2006.01)
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See application file for complete search history.

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Primary Examiner — Cepha D Toomer

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(57) **ABSTRACT**

The disclosed invention is a process for liquefaction of hydrolysis residue of lignocellulosic biomass, original lignocellulosic biomass or municipal solid waste in alcohol-water media at alkaline conditions, for the production of low-M_w bio-oils. The disclosed process is characterized in that it works for the direct liquefaction of the biomass, and operates under mild conditions (<300° C. and <10 MPa) employ-
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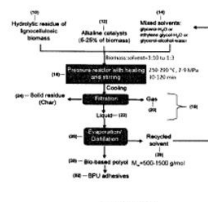


Fig. 3 United States Patents for Hydrothermal Liquefaction (HTL) Technology

These United States patents demonstrate the innovative breakthroughs behind our HTL technology, highlighting its ability to efficiently convert high-moisture organic waste and lignocellulosic biomass into bio-crude oils with controlled properties. Our patented processes form the backbone of our sustainable and scalable solutions for waste-to-energy conversion