



THE NEW BLACK GOLD —

Biofuel made from human excrement has become easier to produce

Wastewater treatment plants rejoice—you may have a hot commodity on your hands.

Megan Geuss - 12/6/2016, 12:12 PM

From the toilet to the tank—biofuels from sewage. *Credit: PNNL*

Researchers at Pacific Northwest National Labs (PNNL) have developed a new method for treating human sewage to create a biocrude oil product that can be refined into a fuel akin to gasoline, diesel, or jet fuels.

The process is called hydrothermal liquefaction (HTL), and it has been described as a sped-up version of the way the Earth naturally creates crude oil. Researchers apply a considerable amount of heat and pressure to wastewater, breaking down its chemical components into biocrude and an aqueous liquid in minutes.

Powerful crap: The quest to turn smelly sewage into sweet biodiesel

PNNL [says that wastewater treatment plants](#) handle approximately 34 billion gallons of sewage every day. In a [Reddit AMA held last week](#), Justin Billing, one of the scientists on the project, noted that sewage traditionally has three destinations—being turned into fertilizer or soil additive, going in a landfill, or being incinerated. Some wastewater treatment plants (though not all) will also use anaerobic digestion, which “reduce[s] the volume of solids and mitigates the toxic load while also producing methane that can be used for heat and power at the plant,” Billings says. But anaerobic digestion alone can’t solve the whole equation. “From a capital intensity perspective it is reasonable to consider a hydrothermal process like HTL when designing, upgrading, or expanding existing facilities,” he suggested.

Although sewage sludge [has been converted to biocrude](#) before, previous methods were considered uneconomical because the sludge had to be dried out before conversion. HTL, on the other hand, pressurizes the sludge to 3,000 pounds per square

inch and then heats it up to 660 degrees Fahrenheit (349 degrees Celsius), a process that's amenable to some liquid being present in the feedstock.

Corinne Drennan, a bioenergy technologies researcher at PNNL, said in a statement, "There is plenty of carbon in municipal wastewater sludge and interestingly, there are also fats. The fats or lipids appear to facilitate the conversion of other materials in the wastewater such as toilet paper, keep the sludge moving through the reactor, and produce a very high quality biocrude that, when refined, yields fuels such as gasoline, diesel, and jet fuels."

Using HTL, PNNL estimates that those 34 billion gallons of sewage a day could be theoretically turned into 30 million gallons of refined oil per year. Each American, on average, could generate two to three gallons of the unrefined biocrude per year. (In the future, grandmothers around the country could have another reason to push you to eat more: "You look too skinny! Do you eat? Think about American oil independence!" as another spoonful of casserole gets unloaded on your plate.)



The new method could be a big help to municipalities that have pledged to reduce their waste to meet sustainability goals. PNNL scientists have licensed their process to a Salt Lake City-based company called Genifuel, which is working with the Metro Vancouver group to build a demonstration plant in the Canadian city. Darrell Mussatto, chair of Metro Vancouver's Utilities Committee, said that the group will fund about half of the \$8 million to \$9 million CAD (\$6 million to \$6.8 million USD) that the demonstration plant is estimated to cost. Metro Vancouver will seek external funding for the other half of the money needed to fund the plant. If all goes to plan, the demonstration plant would come online in 2018.

Like everything, although the method shows promise, Billings cautioned in his AMA that there are still barriers to making the process commercially viable, namely scaling up the process in a cost-effective way and proving to refiners that the biofuel is useful and marketable.

The researchers are still working on the best ways to remove certain elements and compounds found in raw sewage from the processed sludge. On Reddit, Billings explained that the HTL process does create a solid waste product that contains phosphorous and heavy metals, which can be mined for other uses. "We use dilute

sulfuric and have had success in recovering bio-available phosphorous as phosphate,” Billings wrote. PNNL notes that this could be put toward fertilizer production.

As far as life-cycle CO₂ reduction, Billings says the biocrude represents a 50-75 percent reduction compared to petroleum. Although the burned biofuel still creates CO₂ like burning petroleum does, breaking down sludge that will either be decomposed in fertilizer production or a landfill or combusted in an incinerator offers some clear advantages to drilling for additional oil.

Listing image by Water Environment & Reuse Foundation



[Enlarge](#) / Biocrude oil, produced from wastewater treatment plant sludge, looks and performs virtually like fossil petroleum.