Fractional Distillation Within Thermal Depolymerization to Synthesize Oil from Waste Products

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Introduction

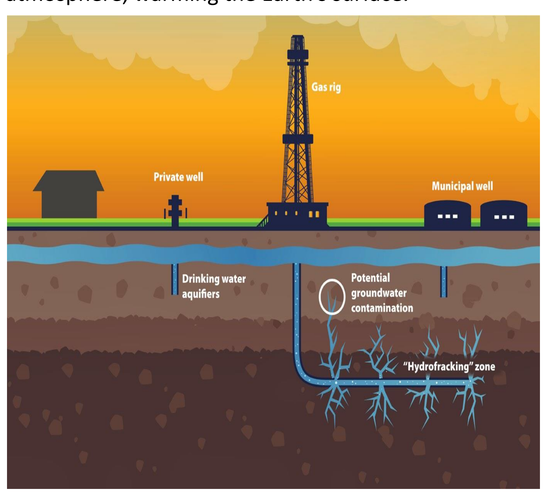
Oil has long been the main source of power for the United States of America. About half of this oil is obtained through conventional oil drilling, while the other half comes from unconventional drilling, also known as hydraulic fracturing, or fracking. Despite its widespread use, oil drilling—especially fracking—is extremely detrimental to humans and the environment. As natural oil supplies dwindle, more sustainable methods of obtaining oil are becoming increasingly necessary. One of these processes—thermal depolymerization—involves creating synthetic oil from waste products. This method of obtaining oil could potentially create a much healthier, more sustainable world through the reduction of harmful gas emissions as a result of drilling and landfill waste.

Drilling and its Detrimental Effects

Conventional oil drilling involves drilling around 6,000 feet below the Earth into underground oil reservoirs. The oil is then pumped up to the surface for human consumption. Unconventional oil drilling (fracking) is similar to conventional drilling but with one caveat: after the vertical drilling is complete, horizontal drilling begins. A mixture of water, sand, and harmful chemicals are shot at the rock to crack it and release the oil trapped inside.

Although drilling is currently the most prevalent way to obtain oil, it is very harmful to the environment. Oil drilling releases methane and carbon dioxide gas into the air, which largely contributes to global warming as the sun's heat gets trapped in the atmosphere, warming the Earth's surface.

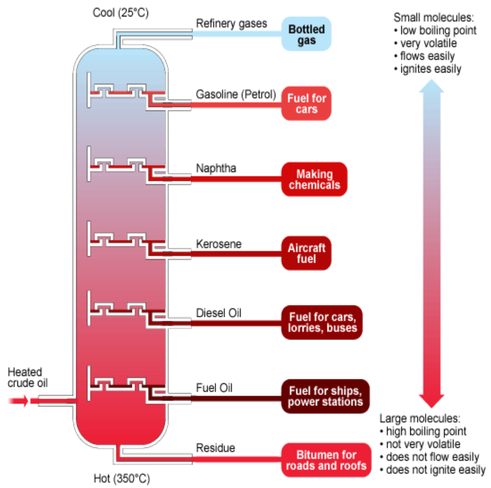
Drilling is also detrimental to humans as it can contaminate drinking water supplies and cause breathing problems. In addition, the natural oil supply is decreasing rapidly, and is expected to be extinct within the next 50 years. Because of this, conventional and unconventional drilling will soon be obsolete, creating a need for new oil-obtaining methods.



Thermal Depolymerization (TDP)

The Process

Thermal depolymerization is a process that involves creating oil from organic materials such as plastic and animal waste. The first step of TDP takes hydrocarbon-containing plastics or organic waste and grinds them up with water. This mixture, also called the feedstock, is heated to between 200 and 300 degrees Celsius. The heated mixture evaporates some of the water, creating steam. The steam then puts the mixture under high pressure, similar to a pressure cooker. These conditions are held for around 15 minutes. The second step involves rapidly decreasing the pressure of the feedstock, allowing the water and the hydrocarbons to separate. These separated hydrocarbons are the crude oil. The final step in thermal depolymerization is called fractional distillation.



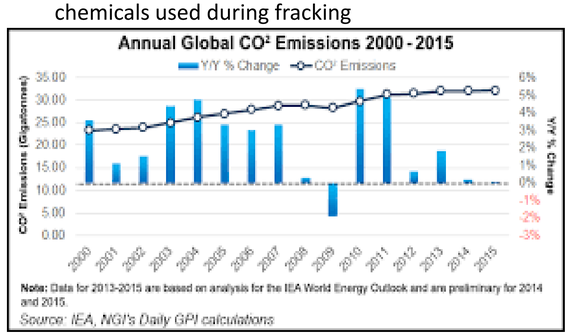
Fractional Distillation

- Fractional distillation heats the separated hydrocarbons, breaking them into usable products such as gasoline and jet fuel
- These hydrocarbons are different sizes, giving them unique chemical properties
- The most significant property is that the molecules have different boiling points
- The molecules are placed in a heated column, and as elevation increases in the column, the temperature decreases
- The molecules are then evaporated and travel up the column
- When the evaporated hydrocarbons reach a temperature at which they can no longer stay in vapor form, they condense into liquid
- The liquid is then collected in trays and pumped out of the column, ready for human consumption

Benefits and Drawbacks

Benefits of Thermal Depolymerization

- TDP combats methane emissions from landfill waste by using the harmful waste products to create useful oil
- TDP has the potential to replace drilling, eliminating the harmful gases released into the air during the drilling process
- TDP would also eliminate the need for detrimental chemicals used during fracking



The Challenge of Thermal Depolymerization

Currently, the biggest challenge that comes along with the thermal depolymerization process is the high cost of performing it, which stems from the large amount of energy it takes to heat up and break down the organic waste materials. This challenge can be overcome by companies such as Renewlogy, who have come up with patented depolymerization processes that are designed to use less energy while also producing zero toxic emissions.

In addition to new methods, catalysts can be added to reduce the overall amount of heat energy needed to run the thermal depolymerization process. These catalysts also increase the oil yield once TDP is completed.

Applications of TDP

One current example of the TDP process in action is a company called Renewlogy. Founded by Priyanka Bakaya, an Australian-American entrepreneur who studied at the Massachusetts Institute of Technology (MIT), Renewlogy has made efforts to combat the high cost of TDP and make it more financially sustainable over long periods of time. This is done through a patented catalytic depolymerization process that turns plastic from landfills into usable oil. Renewlogy's website claims, "Renewlogy's process is sustainable, resulting in low-sulfur fuel, high energy payback and zero toxic emissions. It costs roughly $30 per barrel to sell fuel which can be sold for $70 per barrel."

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