Advanced **Hardwood Biofuels** Northwest

Infosheet no. 6

Acetic Acid From Poplar

Advanced Hardwood Biofuels Northwest (AHB) is a consortium of university and industry partners developing a system to produce renewable liquid biofuels and bio-based chemicals from sustainably-grown hybrid poplar trees.

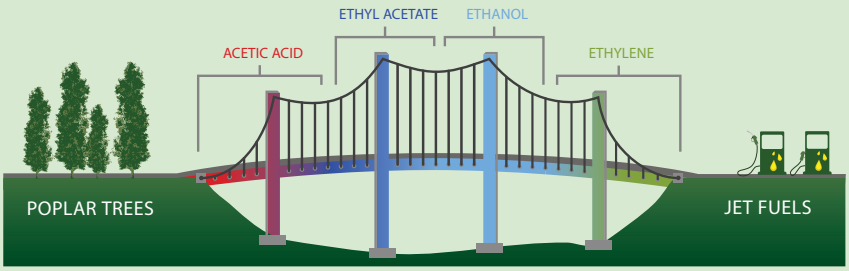
Acetic Acid Overview

Acetic acid is an important industrial chemical used to make plastics, wood glue, paint, ice melting salts, synthetic fibers and fabrics, and as a household cleaner. It is also known as vinegar.

Petroleum Acetic Acid

The global demand of acetic acid is around 6.5 million metric tons per year. Almost 90% of acetic acid is made from petroeum derivatives. The most common method of making acetic acid is through a reaction of methanol and carbon monoxide. In this reaction, two poisonous chemicals are converted into every day vinegar. Although the vinegar made from petroleum derived chemicals is identical to vinegar made from biological methods, many food purity laws stipulate that vinegar used in foods must be of biological origin.

BRIDGE TO BIOFUELS



One of the most financially promising bio-based chemicals that could be produced in the AHB process is acetic acid. It is the building block for making ethanol, ethylene, and jet fuel. Not only is it produced with the highest yields out of all the potential biochemicals, but it also has one of the highest selling prices. Configuring the biorefinery to produce this first allows for both market flexibility and the ability to upgrade the acid to other chemicals and fuels. With the technology developed in AHB, there exists the potential to produce the bulk of the acetic acid in the United States.

Poplar Acetic Acid

AHB's process is of biological origin. Poplar trees are cut into wood chips and broken down into sugars through hydrolysis. The sugars are then fermented into acetic acid by the bacteria *Moorella thermoacetica* commonly found in compost piles and the stomachs of termites .

The acid is turned into potassium acetate, a commonly used environmentally friendly deicing salt that could be used on runways and bridges across the Pacifc Northwest. The salts are separated and converted back to a high concentration of acetic acid, which is then distilled to make a 99.8% pure acidic acid that can be sold to make vinyl acetate, paint, plastic, or adhesives.

Poplar De-icing Salts

Imagine turning trees into salts. That may not seem to make logical sense, but the AHB team has figured out a way to turn trees into de-icing salts to keep airplane runways, roads, and bridges safe and less slippery. As bacteria ferment the wood sugars into acid, potassium hydroxide is added as a buffer to keep the pH from getting too acedic and killing the bacteria. The result is potassium acetate, which is an environmentally friendly option to conventional sodium chloride de-icing salts. It has the advantages of not being corrosive and less toxic to plants and animals.

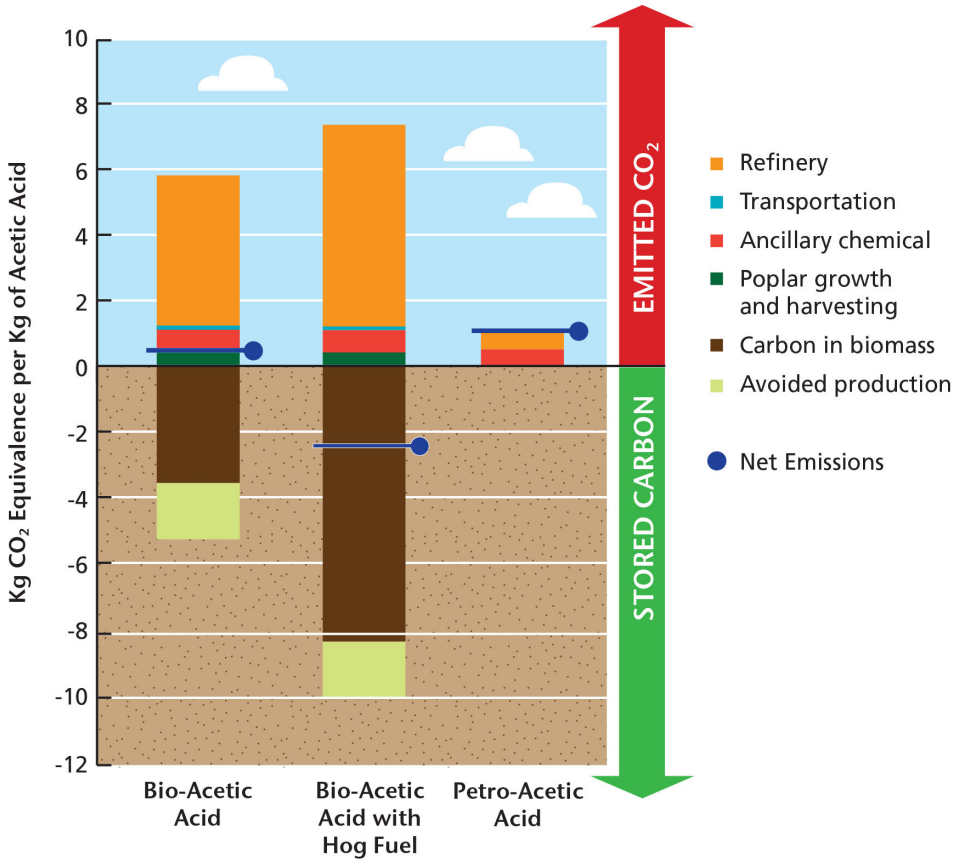
Truck spraying potassium acetate de-ing salts on airport runway.

Reducing CO_2 emissions

In the production of acetic acid through the AHB process, the biggest contributer to CO_2 emissions is the fuel used for the boiler in the refinery. Either natural gas or wood chips called hog fuel can be burnt for the heat used in the process.

In either case, when comparing poplar acetic acid to the conventional production from fossil fuels, there can be anywhere from a 41–340% reduction in greenhouse gas emissions depending on what heat source is used.

Comparision of CO_2 Emissions Between Bio-Acetic Acid and Petroleum Produced Acetic Acid



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USDA United States Department of Agriculture National Institute of Food and Agriculture