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Patent Released for Method Improving Producer Gas Fermentation

Additional submitted attachment is included below.

Patent Released for Method Improving Producer Gas Fermentation

September 21, 2018 -- During gasification, biomass is converted into producer gas or syngas, which consists of carbon monoxide (CO), hydrogen (H2), and carbon dioxide (CO2). Syngas can be fermented to liquid fuels and chemicals using microorganisms such as acetogenic bacteria (acetogens).

Gasification-fermentation technology used in converting biomass to alcohols is still an emerging technology. Two of the critical bottlenecks that reduce alcohol productivity and lower syngas conversion efficiency are low microbial cell density and gas-liquid mass transfer limitations. Optimum fermentation conditions are achieve d when gas supply matches the kinetic capability of the active microbial cells. In addition, extending microbial cell activity, improving energy conservation and selectivity of the desired product are critical for stable continuous syngas fermentations.

Consequently, Dr. Hasan Atiyeh, Associate Professor, Department of Biosystems and Agricultural Engineering (BAE) at Oklahoma State University (OSU) in collaboration with Drs. Randy Phillips (White Dog Labs, Inc., New Castle, Delaware), Randy Lewis (Department of Chemical Engineering, Brigham Young University), and Ray Huhnke (BAE, OSU) developed and obtained a U.S. patent (10,053,711) on a novel method to sustain culture activity, gas uptake, and improve selectivity for ethanol production during syngas fermentation in the continuous stirred tank reactor.

The research team added a commercially available activated carbon to the fermentation broth to alter the mass transfer of the gas to the acetogen, thus, improving ethanol production.
“The addition of activated carbon sustained the acetogen’s activity, prolonged the fermentation process, and resulted in a very high specificity for and high concentration of ethanol produced”, Atiyeh said. “The increased ethanol production and fermentation stability was attributed to the effect of carbon in altering the mass transfer and presumably in retaining the nutrients to sustain fermentation activity.”

The newly patented method resulted in the production of twenty-six times the ethanol concentration compared to the conventional method. Overall, the operation of syngas fermentation with activated carbon exhibited higher stability, selectivity, and energy conservation than in previously reported results. The operational stability and selectivity of the acetogen for ethanol as the preferred product provided by the activated carbon is needed for potential commercial biofuel production. The activated carbon can be produced fro m the biochar made during syngas production by gasification. “Our research efforts will impact conversion efficiency, cost of production, reactor design, and process development of the hybrid conversion technology for implementation in sustainable biorefin eries in the nation and in the world,” Atiyeh said.

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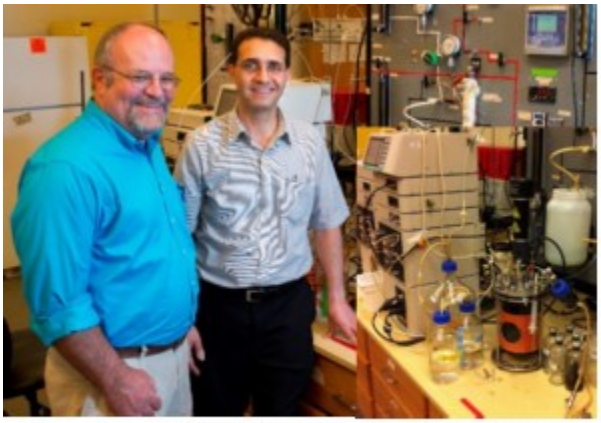

Hasan Atiyeh (right) and Randy Phillips (left) shown here with a set-up showing syngas fermentation in a CSTR containing carbon particles (close-up photo).

Extracted November 6, 2018 by Joseph Degenfelder cc: California Energy Commission