

Landfill Conversion to Bioethanol By A Three Step Bioprocess

Douglas J. Cork*

Department of Biological, Chemical and Physical Sciences, Illinois Institute of Technology, USA

***Corresponding Author:** Douglas J. Cork, Department of Biological, Chemical and Physical Sciences, Illinois Institute of Technology, 3101 S. Dearborn, Chicago, Illinois 60616, USA.

Received: July 24, 2015; **Published:** July 31, 2015

Landfill waste disposal bioprocessing has elicited a number of important applications of acetogenic microorganisms scaled up in such critically important bioecogreen cities such as Vero Beach, Florida. In this review I will describe a critically important bioprocess, patented by INEOS Corporation.

Herein, landfill waste is typically converted to ethanol by a three step, single stage, gasification, double stage, clostridial fermentation bioprocess. Therefore the process for the production of ethanol, consisting of both gasification and fermentation reactions, utilizes the landfill as the non biomass feedstock, chemically converting it into CO, CO₂ and H₂ by an oxygen mediated redox controlled gasification stage. The biomass feedstock is fermented to acetate. The gas stream of CO, CO₂ and H₂ along with the alternative liquid acetate can be converted to ethanol by wild type strains of *Clostridium jungdahl* in a gas to liquid phase bioreactor of defined mass transfer coefficient, K_La.

There are a number of bioprocess changes dynamically taking place that are undergoing stringent patent protection, according to Dr. James Kruegar, Patent lawyer for Ineos Corp., and former Ph.D. student of Dr. Doug Cork, Professor, The Illinois Institute of Technology.

The scaling up of this completely closed system depends on dynamically mixing small amounts of oxygen at defined pressure and redox potential in the gasification step. The gas phase oxygen in the hydroprocessing / gasification stage is quenched by inorganic reducing power, including H₂ and H₂S. The H₂S must be immediately removed in the anaerobic fermentation step; otherwise the cartridges of immobilized whole cells would be inhibited. Orthorhomic sulfur must be settled and removed; and the CO and H₂ are swept into the immobilized whole cell cartridges of *Clostridium jungdahl* at deined pH dependents on the pK_a's of H₂S, H₂CO₃, HCO₃, the redox potential and pressures in the various reactors in the three stages. Remarkably it is a relatively pure culture, withouth the need for expensive sterilization techniques and the ethanol can be easily distilled.

As Floridians gamble with the global effects of large scale build up of CO₂, this process will significantly mitigate the Floridian atmosphere's contribution to greenhouse cases produced over Vero Beach. Sulfur and Ethanol are valuable products, landfill is removed in a closed system that never interacts with the Floridians. Congratulations to the Bioengineers of Ineos Corporation and the foresighted scientists in Florida that saw this biotechnology coming down the pipeline. This technology has it roots in the wonderful research conducted by Dr. Gaddy and coworkers at the University of Arkansas, the basic research results of the C1 Microbiologists over the last 50 years, and the two step, single stage anaerobic bioconversion processes developed by many scientists including Dr. Douglas Cork in the late seventies.

Volume 2 Issue 1 June 2015

© All rights are reserved by Douglas J. Cork