ECRONICON OPEN ACCESS

EC MICROBIOLOGY
Opinion

Anaerobic Digestion of Wastewater Aiming Butanol Production

Ariovaldo José da Silva*

University of Campinas, School of Agriculture Engineering, Avenida Cândido Rondon, Barão Geraldo, CEP 13083-875, Campinas-SP, Brazil

***Corresponding Author:** Ariovaldo José da Silva, University of Campinas, School of Agriculture Engineering, Avenida Cândido Rondon, Barão Geraldo, CEP 13083-875, Campinas-SP, Brazil.

Received: February 05, 2017; **Published:** February 16, 2017

Definitions

ABE fermentation: a solventogenic process producing a mixture containing acetone, butanol and ethanol.

COD and BOD: Chemical oxygen demand and biochemical oxygen demand.

Agriculture wastes are susceptible to anaerobic digestion due to presence of carbohydrate, mainly reducing sugar and fatty volatile acids that are easily fermentable in the acidogenic phase. The understanding of the metabolic pathways and of the microorganisms is very important for lead the process to butanol production by means of ABE fermentation. Thus, rather only reduce COD or BOD from agriculture wastes, is possible recover biofuels with the biological treatment.

Some agriculture wastes, as cassava wastewater and vinasse, have physical and chemical composition very complex. This is one of the main challenges to use anaerobic treatment process.

For each 1000 kg of cassava pressed are generate 343 liters of cassava wastewater, denominated *manipueira* in the Brazil. Studies about the *manipueira's* characteristic indicate a changing in COD values between 10.5 e 60.0 g l^{-1} [1-3].

In the Brazil, the plants apply vinasse in agriculture lands as fertilizer for sugar cane culture, but environmental agencies restrain this practice due to potential of soil salinization and emission of greenhouse gases. For each one cubic meter of vinasse in the soil results in the emission of around 0.5 kg equivalent CO_2 [4]. Groundwater from Valle del Cauca in the Colombia had an increase in the sodium and potassium concentration after six-year treating vinasse in the soil [5].

Therefore, there are excess of waste that need be treated and disposal carefully in the environment. We assayed the butanol producing from vinasse in anaerobic batch reactors. The volatile acid production using vinasse as substrate was 59% more than sucrose as from initial carbohydrate concentration of 20 g l^{-1} [6].

As compared to sucrose the butyric acid production from vinasse was 95.6% more, 6.4 g l^{-1}. The inoculum was a mixed culture of non-producers spore microorganisms were was predominated *Clostridium* sp. (relative abundance of 40.2%). Among the bacteria identified the relative abundance of *C. pasteurianum* was counted 21.8%, but, these microorganisms are reported as poor butanol producers [7].

These results indicate that is possible the butanol production from vinasse, but we should to use adequate inoculum, for example, a pure culture of *C. acetobutylicum* or *C. beijerinckii* which are commonly used in industrial production of butanol by fermentative processes.

In ABE fermentation, the acidogenic phase occurs during exponential grow and the transition to solventogenic phase is result of a drastic change in the genetic expression of the microorganisms. The process is intimately linked to sporulation and is regulated by transcription factor SpoOA which is present in *C. acetobutylicum* [8]. In the practice the solventogenesis can be governed by increase of carbon/nitrogen ratio and reducing the pH of the fermentation broth [9].

The major challenge is direct the metabolic route of carbohydrate fermentation to butanol production from acetil-CoA. This involves seven specific enzymes.

Conflict of Interest

There is any conflict of interest exist.

Bibliography

1. Intanoo P., *et al*. "Optimization of separate hydrogen and methane production from cassava wastewater using two-stage upflow anaerobic sludge blanket reactor (UASB) system under thermophilic operation". *Bioresouce Technology* 173 (2014): 256-265.

2. Sun L., *et al*. "Anaerobic biological treatment of high strength cassava starch wastewater in a new type up-flow multistage anaerobic reactor". *Bioresource Technology* 104 (2012): 280-288.

3. Damasceno S., *et al*. "Production of volatile compounds by Geotrichum fragrans using cassava wastewater as substrate". *Process Biochemistry* 39 (2003): 411-414.

4. Oliveira BG., *et al*. "Soil greenhouse gas fluxes from vinasse application in brasiliam sugarcane areas". *Geoderma* 200-201 (2013): 77-84.

5. Ortegón GP., *et al*. "Vinasse application to sugar cane fields:effect on the unsaturated zone and groundwater at Valle del Cauca (Colombia)". *Science of the Total Environment* 539 (2016): 410-419.

6. Santos GM., *et al*. "Biological alcohols production from sucrose and vinasse medium by anaerobic mixed culture". In: XI Taller y Simposio Latinoamericano de Digestión Anaerobia, Havana (2014).

7. Berezina OV., *et al*. "Microbial Producers of Butanol". *Applied Biochemistry and Microbiology* 48.7 (2012): 625-638.

8. Lee SY., *et al*. "Fermentative butanol production by clostridia". *Biotechnology and Bioengineering* 101.2 (2008): 208-228.

9. Welch RW., *et al*. "Purification and characterization of the NADH-dependent butanol dehydrogenase from Clostridium acetobutylicum (ATCC 824)". *Archives of Biochemistry and Biophysics* 273.2 (1989): 309-318.

Volume 6 Issue 1 February 2017