Environmental Engineering and Management Journal *March 2012, Vol.11, No. 3, Supplement, S77*
http://omicron.ch.tuiasi.ro/EEMJ/

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INDUSTRIAL BY-PRODUCTS AS A SOURCE OF VOLATILE FATTY ACIDS BY ANAEROBIC DIGESTION

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Abstract

Nowadays the economy is mainly dependent on fossil fuels. Pollution, climate changes and eminent exhaustion of natural resources (fossil fuels) are the main consequences of this dependence. Anaerobic Digestion (AD) has shown great potential in using renewable resources such as management residues from agriculture, industry and also from forestry. AD is a biological process by which organic matter is transformed into methane and carbon dioxide in the absence of oxygen. It is a complex microbiological process involving several trophic groups coordinated. The digestion process begins with bacterial hydrolysis of the input materials in order to break down insoluble organic polymers, such as carbohydrates, and make them available for other bacteria. Acidogenic bacteria then convert sugars and amino acids into carbon dioxide, hydrogen, ethanol and volatile fatty acids (VFAs). VFAs can be used to produce other compounds chemically or biologically.

HSSL (Hardwood Spent Sulfite Liquor) is a by-product of the paper industry, rich in lignocelluloses that with appropriate pre-treatment provides carbon substrates as acetic acid, xylose, glucose and other sugars. HSSL has a high biochemical oxygen demand (BOD), about 2500 to 5000 ppm, which constitutes an environmental problem. HSSL can serve as substrate for yeast like *Pichia stipitis* to produce ethanol. At the end of this process the fermentative medium still contains a high amount of sugars that can act as substrate in an AD step to produce added value products like hydrogen, ethanol or VFAs. Therefore, the main objective in this work is not only to valorise HSSL but also apply AD (with methanogenesis suppressed) to the fermentative medium after *P. stipitis* ethanol production. The final goal of this project is the integration of the different processes in a biorefinery based in a pulp industry.

In tests with HSSL were studied parameters such as inoculum concentration and organic load rate, verifying an increasing of 100% of the amount of formed VFAs when the load was increased from 30 to 60 gCOD/L with acetic acid as main acid formed.

The metanogenesis suppression with specific inhibitors (BES) and not specific like High Pressure (HP) and temperature was also studied. An increase of 50% in total VFAs formed (acetic and butyric acid in the same proportions) and 30% (mainly acetic acid) was observed with BES and HP, respectively. In the test with HP, no propionic acid was produced.