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Bioconversion of cellulosic biomass wastes by Azorean hot spring bacterial consortia

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Enzymatic hydrolysis of cellulose is a fundamental step in the carbon cycle and in the industrial bioconversion of biomass to biofuels. In nature cellulose hydrolysis is often catalysed by enzymes from complex microbial communities, nevertheless these studies are limited to a few isolates. Actually the production of biofuels from biomass became a necessity and novel pre-treatments are mandatory to be discovered. Thereby the study of cellulose hydrolysing bacterial communities is a step in achieving a sustainable future in biofuels development.

We propose the stabilization of an aerobic thermophilic bacterial consortia (BC) with the ability to adapt and hydrolyse different cellulose-rich wastes. Decaying cellulosic residues were sampled inside Azorean hot springs. Samples were enriched in cellulosic selective medium at 60ºC with growth monitored quantifying DNA. Hydrolysis efficiency was monitored and enzymatic activity was detected using xylan and carboxymetylcellulose (CMC). 16S rRNA hypervariable regions V3/V4 were amplified for phylogenetic characterization of BC using 454 pyrosequencing.

Selected BC was able to hydrolyse 50% of cellulose-rich plant mix material in 4 days. Besides hydrolysing low content lignin material as non-wood plants, newspaper and cardboard, the consortia was able to hydrolyse high lignin content material, with lower efficiency. Celulase and xylanase were present in BC and reducing sugars were shown to be higher, compared with control. The phylogenetic results showed a large diversity in the BC with *Thermobacillus* representing 44% of the consortia, followed by *Symbiobacterium* 25%, *Brevibacillus* 16%, *Geobacillus* 12% and *Hipomicrobium* 3%. Three *Geobacillus* species were identified; *G. stearothermophilus*, *G.thermodenitrificans* and *G.debilis*. Further work will comply the isolation of enzyme producing bacteria isolates from the consortia for the construction of new consortia taking in consideration the efficiency of cellulose rich wastes.

These results suggest that bacterial communities can be an alternative pre-treatment method of green wastes to obtain molecules to biofuels production.