Study of Enzymatic Complexes in Termites and their Common Symbionts: GC×GC-TOFMS Analysis of Metabolites Produced by Termites on Different Diets

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The main challenges of lignocellulose biomass conversion are to improve enzymatic efficiency and reduce costs for industrial application. Termites, notorious for their wood cravings, may provide the key to greener fuels and chemicals from cellulosic materials. Up to now, a lot of studies on termites have focused mostly in the genetic and microbiological fields. There is an interest to extend investigations to proteomic and metabolomic studies with the emergence of new techniques, and to achieve a functional understanding of the microsymbionts-termite host association to use cellulose from wood.

Comprehensive two-dimensional gas chromatography (GC×GC) coupled to time-of-flight mass spectrometry (TOFMS) is used to study metabolite profiles in termites. The aim of the study is to develop a powerful analytical method to challenge the detection, separation and identification of compounds released in the 1µL termite fluid gut volume.

Reticulitermes santonensis De Feytaud were collected on Oleron Island, France. The culture was maintained in a laboratory on wet wood at 27°C and 70% humidity. Only adult workers were selected for experiments and washed in a 70% ethanol solution before removing the entire gut. Sets of 1 to 10 guts were collected and homogenized using a piston pellet (Eppendorf) in methanol/water and kept at -80°C until derivatization and GCxGC-TOFMS analysis.

Hundreds of peaks were detected with a 1µL injection volume of extracts with reduced number of collected guts. Samples from termites fed during 4 months on wood or cellulose powder diets were analyzed and compared. Interesting compounds like sugars and modified sugars were investigated to identify and understand metabolic strategy pathways used by termites and their symbionts to produce efficient energy from cellulose.