PO-6

Biodegradation of Cellulose for Biofuel Production Using Microbial Biofilms

K.M.D. Gunathileke[1], R.R. Ratnayake[1,*], S.A. Kulasooriya[1], D.N. Karunaratne[2]

[1] *Institute of Fundamental Studies, Kandy, Sri Lanka*
[2]*Department of Chemistry, University of Peradeniya, Peradeniya, Sri Lanka*
E-mail: renukar@ifs.ac.lk

Producing biofuel from plants often consumes more energy than it produces and this is one of the major problems in biofuel industry. The crystalline structure of cellulose makes it difficult to hydrolyze into simple sugars. Development of microbial consortia or microbial enzymes which can be used for this purpose is a major concern. Biofilms may have a potential to improve efficiency of this process. The main objective is to develop and test biofilms that could effectively degrade lignocelluloses.

Cellulose degrading microorganisms were isolated from soils, composts and leaf litter layers using a specific medium which contained cellulose as its sole source of carbon. The isolates were screened for most efficient cellulose degrading bacteria and fungi by inoculating each isolate into cellulose broth in which the initial simple sugar content had been measured by phenol-sulphuric method. After incubating for 20 days the final sugar content was measured. Among fungi the three organisms which recorded the highest simple sugar content in decreasing order, by their given code numbers were F23, F12 and F15. Bacteria in decreasing order were B90, B91 and B89. The identification of the above mentioned isolates is yet to be completed. The screening revealed that fungi are 2-3 times more efficient than bacteria. Fungal-bacterial biofilms were prepared by growing desired fungi and bacteria separately in general media and then by mixing to get desired combinations. Each combination was incubated for a couple of weeks and observed microscopically once in every 3 days. Bacterial attachments along the fungal mycelium were taken as biofilms. These biofilms, combinations of several biofilms and single microbial cultures were inoculated into cellulose broth. The simple sugar content in each culture was measured once a week. During the period of 5-6 weeks of incubation, the cultures in cellulose broth had shown fluctuations in sugar concentration. Most of the cultures showed elevated sugar concentration in 2^{nd}-3^{rd} week followed by a drop down in the following week. Fluctuations may be due to negative feedbacks by the organisms. At high sugar concentrations the organisms may have stopped cellulase secretion and started utilizing the available sugars for their metabolism. The highest recorded simple sugar concentration has been produced by the fungus F23. The fungal-bacterial biofilms which have been tested so far are less efficient compared to F23 fungus.