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Degradation of cellulose by bacteria isolated of soil from different district of Uttar Pradesh

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Abstract
Cellulose is a linear polysaccharide of glucose residues with β-1, 4-glycosidic linkages. Abundant availability of cellulose makes it an attractive raw material for producing many industrially important commodity products. The soil samples of 21 district of U.P., The maximum degradation of cellulose was observed by *Bacillus*.

Keywords: Cellulose, glycosidic linkage, microflora, polysaccharides and pseudomonas

Introduction
Cellulose is a linear polysaccharide of glucose residues with β-1, 4-glycosidic linkages. Abundant availability of cellulose makes it an attractive raw material for producing many industrially important commodity products. Sadly, much of the cellulosic waste is often disposed of by biomass burning, which is not restricted to developing countries alone, but is considered a global phenomenon. With the help of cellulolytic system, cellulose can be converted to glucose which is a multiutility product, in a much cheaper and biologically favourable process.

Cellulolysis is basically the biological process controlled and processed by the enzymes of cellulase system. Cellulase enzyme system comprises three classes of soluble extracellular enzymes: 1, 4-β-endoglucanase, 1, 4-β-exoglucanase, and β-glucosidase (β-D-glucoside glucohydrolase or cellobiase). Endoglucanase is responsible for random cleavage of β-1, 4-glycosidic bonds along a cellulose chain. Exoglucanase is necessary for cleavage of the nonreducing end of a cellulose chain and splitting of the elementary fibrils from the crystalline cellulose, and β-1, 4-glucosidase hydrolyses cellobiose and water-soluble cellodextrin to glucose (Shewale, 1982 and Woodward and Wiseman 1983) [9, 12]. Only the synergy of the above three enzymes makes the complete cellulose hydrolysis to glucose (Ryu and M. Mandelsor, 1980, Samdhu and S. Bawa 1993) [6] a thorough mineralization to H_2O and CO_2 possible.

Source for cellulase system extraction is best suitable from microbial system found in the gut of organisms thriving on cellulosic biomasses as their major feed. Insects like termites (Isopteran), bookworm (Lepidoptera), and so forth, are found to have syntrophic symbiotic microflora in their guts responsible for cellulosic feed digestion. Many microorganisms have been reported with cellulosic activities including many bacterial and fungal strains both aerobic and anaerobic. Chaetomium, Fusarium Myrothecium, Trichoderma. Penicillium, Aspergillus, and so forth, are some of the reported fungal species responsible for cellulosic biomass hydrolysation. Cellulolytic bacterial species include Trichonympha, Bacillus, Pseudomonas, Clostridium, Actinomycetes, Bacteroides succinogenes, Butyrivibrio fibrisolvens, Ruminococcus albus, and Methanobrevibacter ruminantium and fungal species Fusarium, Pseudomonas, Trichoderma and Rhizopus (Milala *et al.* 2005; Schwarz, 2001) [4, 8]. The present work concentrates on the isolation of cellulose-degrading bacteria of soil sample from different district of Uttar Pradesh.

Fig 1: Figures showing the view of growth of cellulose degradation by *Bacillus*

Material and method

Sample collection

Soil samples were collected from twelve district of Uttar Pradesh namely, Azamgarh, Baharaich, Balia, Chandauli, Faizabad, Jaunpur, Kannauz, Kanpur, Meerut, Mirzapur, Sultanpur and Unnaw. The soil texture was slit, pH in the range of 7.5 to 8.5 and temperature was 30 to 32 °C.

Isolation and screening of cellulose-degrading bacteria

The macerated gut of the collected organisms was inoculated in a basal salt media ($NaNO_3$ 2.5 g; KH_2PO_4 2 g; $MgSO_4$ 0.2 g; NaCl 0.2 g; $CaCl_2 \cdot 6H_2O$ 0.1 g in a liter) containing filter paper (Whatman filter paper no. 1 of area 70.541 cm^2) for the isolation of cellulolytic bacteria. These cultures were incubated for 7 days in a shaker incubator at 37°C at 100 rpm. Bacterial colonies capable of utilizing cellulose as sole source of carbon were isolated on cellulose agar media composed of KH_2PO_4 0.5 g $MgSO_4$ 0.25 g cellulose 2.0 g agar 15 g gelatin 2 g and distilled water lL and at pH 6.8-7.2.

Confirmation of cellulose-degrading ability of bacterial isolates was performed by streaking on the cellulose Congo-Red agar media with the following composition: KH_2PO_4 0.5 g, $MgSO_4$ 0.25 g, cellulose 2 g, agar 15 g, Congo-Red 0.2 g, and gelatin 2 g; distilled water 1 L and at pH 6.8–7.2. The use of Congo-Red as an indicator for cellulose degradation in an agar medium provides the basis for a rapid and sensitive screening test for cellulolytic bacteria. Colonies showing discoloration of Congo-Red were taken as positive cellulose-degrading bacterial colonies, and only these were taken for further study (Lu *et al*., 2004) [3].

Result and discussion

Isolation and screening of cellulose-degrading bacteria

Among the soil samples of 21 district of U.P., The maximum degradation of cellulose was observed by *Bacillus*. Cellulose degrading bacteria were enriched and isolated by inoculating filter paper in liquid medium with soil sample. All bacterial culture showed growth as the medium turned cloudy and the filter paper became macerated. Cellulolytic bacteria were also isolated from soil sample by Dillon and Dillon, 2004; Wenzel *et al*., 2002; Delalibera *et al*., 2005, and Ramrn *et al.* 2008 [2, 11, 1, 5].

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