

Biochemical Properties and Application of Purified Alkaline Xylanase from *Bacillus Licheniformis* in Kraft Pulp Biobleaching

Sharad Kumar^{1,2}, Jyoti Prakash² and Abhay Raj^{*1}

¹Environmental Microbiology Laboratory, Environmental Toxicology Group, CSIR-Indian Institute of Toxicology Research (CSIR-IITR), Vishvighyan Bhavan 31, Mahatma Gandhi Marg, Lucknow-226001, Uttar Pradesh, India

²Amity Institute of Biotechnology, Amity University, Lucknow Campus, Malhaur, Near Railway Station, Gomti Nagar Extension, Lucknow-226028, Uttar Pradesh, India
E-mail: *kumarsharad2009@gmail.com

Abstract—Xylanase has important industrial applications but most extensively is utilized in pulp and paper industry as a bio-bleaching agent. In this study, we characterized a xylanase from *Bacillus licheniformis* strain AX1 and its application in kraft pulp bleaching. SDS-PAGE analysis revealed one band with estimated molecular mass of ~46kDa and with optimal activity at pH 9.0 and 60°C. Enzyme showed good activity retention (75%) after 2h incubation at 60°C and pH 10.0. The metal ions Mn²⁺, Fe²⁺ and Ca²⁺ enhanced xylanase activity, while the ions Hg²⁺, Zn²⁺, and Cu²⁺ were strong inhibitors of the enzyme. Further, it also showed good tolerance to phenolics (2mM) in the presence of syringic acid (95%), cinnamic acid (85%), benzoic acid (83%) and phenol (94%) activity retention. Pulp (kappa number, viscosity and brightness) and effluent properties (COD, colour, residual activity and toxicity) were determined after each bleaching stage. Higher reduction of kappa number was observed in the presence of xylanase + laccase. Scanning electron microscopy studies of oven dried pulp after xylanase treatment observes morphological changes, including holes, cracks, filament forming and peeling. In summary, present xylanase shows good pulp-bleaching activity, good tolerance to phenolics, lignin and metal ions and is amenable to its increase the thermostability in presence of polyols.

Keywords: *B. licheniformis*, xylanase, purification, thermostability, kappa number.