revealed two independent bands (62.4 and 22 kDa). The optimum activity was obtained at pH 8.0 and 30°C. The enzyme retained around 86% of its activity for 60 min between 30 and 100°C. The enzyme also presented the alkali-stable properties with a residual activity around 57% between pH 7.0 and 12.0 at 30°C for 24 h. The enzyme showed 60% activity in 15% NaCl concentration. Enzyme activity was enhanced in the presence of H_2O_2 (%75), $MnCl_2$ (%65) and β-mercaptoethanol (%149). On the other hand, EDTA, PMSF, $CaCl_2$, $ZnCl_2$, NaCl, $BaCl_2$, urea, Triton X-100 and SDS decreased the original activity to 33%, 26%, 31%, 29%, 33%, 30%, 43%, 47% and 47%, respectively.

According to these results, the enzyme shows mesophile, alkaliphile, halotolerant, thermostable, inhibitor resistance and alkaline-stable characteristics. Therefore, X6 cellulase-free xylanase is a useful candidate for bio-bleaching applications, paper and pulp industry, clarification processes of fruit juice and bleaching processes in textile industry.

Keywords: *Bacillus* sp.; Cellulase-free xylanase; Thermostable; Bio-bleaching; Inhibitor resistant

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Poster 1.5.56

Study of intraparticle diffusion-reaction of substrate for Michaelis–Menten kinetics in a porous slab catalyst

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The effect of internal diffusion on the overall reaction rate in a biocatalyst having slab geometry containing an immobilized enzyme or cells have been investigated theoretically. Zero-order, first-order and Michaelis-Menten kinetics were studied. The exact solutions for zero-order and first- order reactions were studied to verify our numerical algorithm which was later used to obtain solution for the Michaelis-Menten kinetic. The concentration profiles within the catalyst slab were obtained as a function of Thiele modulus which in turn were used to evaluate effectiveness factor. The exact solutions for zero and first order reactions can be obtained analytically. However one has to resort to numerical solution for Michaelis Menten kinetics as the resulting nonlinear differential equation cannot be solved analytically for the exact solution. Thus, for the Michaelis–Menten kinetics, the diffusion-reaction equation is solved using numerical method employing an explicit finite difference scheme which proved to be stable and accurate. A simple third order polynomial solution to the differential equation is also proposed. The approximate solution shows close agreement (error about less than 10%) with the numerical solution within the range of parameters of practical significance such as Thiele modulus values up to 8. Thus the approximate solution obtained in this work gives quite satisfactory results for a wide range of Thiele modulus compared to that reported in the literature. The nutrients diffuse deeper into the pellet with decreasing Thiele moduli for the three rate kinetics studied. The effectiveness factor decreases with increasing Thiele moduli which is in agreement with the trend in concentration profile for all the cases investigated and the range of parameters studied.

Keywords: Diffusion-reaction; Michaelis–Menten kinetics; Immobilized slab biocatalyst; Finite difference method; Approximate solution

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Poster 1.5.57

Assessment of extracellular activities of novel microorganisms for biodegradation of palm oil mill effluent (POME)

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Palm oil mill effluent (POME) constitutes 60% of the wastes generated in typical palm oil mill and its environmental impact has been identified to be harmful to aquatic lives. This project examined the potential of degrading POME with microorganisms that are indigenous to POME. Thus, two microorganisms were isolated from POME using serial dilution (10^{-1} to 10^{-10}) procedure on solid plates containing Potato Dextrose Agar (PDA), *Sabouround* Dextrose Agar (SDA) and Malt Extract Agar (MEA), respectively. The two microorganisms (TRQ1 and TRQ2) that consistently appeared on the three media plates were quantified and subjected to extracellular enzymatic activities such as amylolytic, gelatinolytic, cellulolytic and lipolytic. The two isolates, TRQ1 and TRQ2, showed negative response to amylolytic test and this confirmed that they are not fungi; however they are Gelatinolytic and Cellulolytic. TRQ1 showed low lipolytic activity while TRQ2 did not show any. The diameter covered by TRQ1 and TRQ2 on gelatin media were 8.5 and 8.0 cm respectively, while the spread on cellulose media were 3.5 and 3.25 cm, respectively, on the seventh day. Furthermore, TRQ1 covered a diameter of 1.65 cm while TRQ2 retained its initial diameter. These results show that TRQ1 and TRQ2 contain gelatinolytic and cellulolytic enzymes and can be utilized for the degradation of cellulosic substrates present in POME, in particular. The cheap and wide availability of the material (POME) used as source for the production of these microorganisms indicates their economic importance for industrial applications and environmental sustainability, particularly in converting waste to wealth.

Keywords: Biodegradation; Cellulolytic; Gelatinolytic; Lipolytic; Microorganisms; POME

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