Identification of a novel tailor-made chitinase from white shrimp fenneropenaeus merguiensis

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Abstract

Fenneropenaeus merguiensis (commonly named banana shrimp) is one of the most important farmed crustacean worldwide species for the fisheries and aquaculture industry. Besides its nutritional value, it is a good source of chitinase, an enzyme with excellent biological and catalytic properties for many industrial applications. In the present study, a putative chitinase-encoding cDNA was synthesized from mRNA from F. merguiensis hepatopancreas tissue. Subsequently, the corresponding cDNA was cloned, sequenced and functionally expressed in Escherichia coli, and the recombinant F. merguiensis chitinase (rFmCHI) was purified by His-tag affinity chromatography. The bioinformatics analysis of aminoacid sequence of rFmCHI displayed a cannonical multidomain architecture in chitinases which belongs to glycoside hydrolase family 18 (GH18 chitinase). Biochemical characterization revealed rFmCHI as a monomeric enzyme of molecular weight 52 kDa with maximum activity at 40 °C and pH 6.0 Moreover, the recombinant enzyme is also stable up to 60 °C, and in the pH range 5.0-8.0. Steady-state kinetic studies for colloidal chitin revealed KM, Vmax and kcat values of 78.18 μM, 0.07261 μM. min−1 and 43.37 s−1, respectively. Overall, our results aim to demonstrate the potential of rFmCHI as suitable catalyst for bioconversion of chitin waste.

Keywords

Marine organisms, Chitinolitic enzymes, Molecular cloning, Protein purification, Biochemical characterization

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