Isolation of Corncob Xylan-Degrading Fungi and Its Application in Xylobiose Production

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ABSTRACT

In this present study, a potential corncob xylan-degrading fungal strain as xylanase producer was isolated and screened from soil, and identified as *Fusarium oxysporum* (HM210091.1). The production of xylanase by *F. oxysporum* under solid state fermentation using corncob powder as the solid substrate reached the maximum xylanase activity when using particle size of substrate of 60 mesh, water content ratio of 2 mL/g substrate, incubation temperature of 30^{o}C, initial pH of 6, amount of inoculum of 5x10^{7} spore/3 g substrate, and incubation time of 2 days. The xylanase activity increased about 4 times up to 7.92 U/mL after optimization.

The crude xylanase was partially purified using ammonium sulphate precipitation (30-70%) followed by dialysis and resulting purification factor of 1.64 fold as well as yield of 62.91%. The relative activity of partial purified xylanase towards alkali-extracted corncob xylan was found 37.58% with respect to commercial beechwood xylan. The xylanase activity was optimum at pH 5.5 and temperature 50^{o}C, and the most stable at pH 6 and temperature 30^{o}C after 1 h of incubation at optimum pH and temperature.

The potential application of partial purified xylanase of *F. oxysporum* in hydrolyzing alkali-extracted corncob xylan to produce xylobiose was also demonstrated. Hydrolysis of 6% of corncob xylan using 100 U/g substrate of enzyme loading under optimum pH and temperature conditions (pH 5.5 and 50^{o}C, respectively) achieved the yield of xylobiose up to 28.71 g/100 g pure xylan after 12 h incubation. The purification of hydrolysate could retain 91.08% of xylobiose. Further separation step using activated charcoal column chromatography was able to get a pure xylobiose, but could only recover 59.29% of xylobiose.

Keywords: corncob, fungal strain, *Fusarium oxysporum*, isolation, solid state fermentation, xylan, xylanase, xylobiose, xylooligosaccharides

Isolasi Jamur Pendegradasi Xilan Tongkol Jagung dan Aplikasinya untuk Produksi Xilobiosa

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INTISARI

Penelitian ini berhasil mengisolasi dan menskrining isolat jamur potensial pendegradasi xilan tongkol jagung yang diidentifikasi sebagai *Fusarium oxysporum* (HM210091.1). Produksi xilanase oleh *F. oxysporum* melalui fermentasi substrat padat dengan menggunakan tongkol jagung sebagai substratnya mampu menghasilkan aktivitas xilanase maksimum pada kondisi ukuran partikel substrat 60 mesh, rasio kadar air 2 mL/g substrat, suhu inkubasi 30^{o}C, pH awal 6, jumlah inokulum 5x10^{7}/3 g substrat, dan waktu inkubasi 2 hari. Aktivitas xilanase meningkat sekitar 4 kali hingga mencapai 7.92 U/mL setelah optimasi.

Xilanase ekstrak kasar yang dimurnikan secara parsial melalui presipitasi amonium sulfat (30-70%) yang dilanjutkan dengan dialisis menghasilkan faktor pemurnian sebesar 1.64 kali lipat dan rendemen sebesar 62.91%. Aktivitas relatif xilanase pada xilan tongkol jagung terhadap aktivitas xilanase pada xilan *beechwood* komersial adalah sebesar 37.58%. Xilanase memiliki aktivitas optimum pada pH 5.5 dan suhu 50^{o}C, dan memiliki kestabilan paling tinggi pada pH 6 dan suhu 30^{o}C setelah 1 jam inkubasi pada pH dan suhu optimum.

Proses hidrolisis xilan tongkol jagung dengan konsentrasi 6% oleh xilanase sebanyak 100 U/g substrat pada kondisi pH dan suhu optimum xylanase (pH 5.5 dan suhu 50^{o}C) mampu menghasilkan xilobiosa sebesar 28.71 g/100 g xilan murni setelah 12 jam inkubasi. Proses pemurnian hidrolisat dapat mempertahankan 91.08% jumlah xilobiosa. Xilobiosa murni berhasil diperoleh melalui tahap separasi lebih lanjut dengan menggunakan kromatografi kolom arang aktif, namun pemulihannya hanya sebesar 59.29%.

Kata Kunci: fermentasi substrat padat, *Fusarium oxysporum*, isolasi, isolat jamur, tongkol jagung, xilan, xilanase, xilobiosa, xilooligosakarida