ABSTRACT

Kenaf (*Hibiscus cannabinus*) is a cheap and versatile fiber. Retting is the major problem in applying high grade kenaf fibers that separate kenaf bast and core fibers. Fungal isolates were screened for pectinase and ligninase production via qualitative and quantitative measurement and seven fungal isolates were found to be promising. The fungal were identified via morphological identification, molecular identification using ITS primers and phylogenetic tree by Neighbour Joining method, which leads to their identification as *Basidiomycota* sp. UMAS EN1, *Hypocrea lixii* UMAS PALM1, *Ceratocystis paradoxa* UMAS PG3, *Aspergillus nomius* UMAS MW16, *Aspergillus nomius* UMAS P3, *Aspergillus nomius* UMAS JA2 and *Pestalotiopsis olivacea* UMAS PUC1. Fungal isolates UMAS EN1, UMAS PALM1, UMAS PG3 and PP mixed culture of UMAS PALM1 and UMAS PG3 were further opted as inoculums for kenaf retting trial. Kenaf retting was found to be better using fungal plugs under static condition. The evaluation of kenaf retting efficiency was based on the removal rate of pectin and lignin, enzymatic profile during kenaf retting and study of kenaf surface via SEM. As a result, the highest removal rate of pectin and lignin in kenaf retting was 79.05 ± 0.4 % and 40.67 ± 2.6 %, respectively with pectinase recorded as the predominant enzyme with highest activity at 2.486 ± 0.14 U ml^{-1}. Besides, SEM revealed the removal of non-cellulosic components and separation of the bast fibers. PP mixed culture was further utilized in kenaf retting optimization. Physical retting factors of initial pH, temperature, retting period and inoculation size were selected and optimized using central composite design (CCD). CCD indicated that the initial pH and retting period had significant effects on pectin removal rate. Temperature of 25^{o}C, initial pH of 4.0, inoculation size of 4 plugs and retting time of 4 days were the optimized condition estimated by the reduced model which predict 95.20% pectin removal rate as compared to 79.05% pectin removal rate at standard condition. A validation run was

performed and pectin removal rate obtained was recorded as 91.00% which is comparable to maximum removal rate as predicted by the reduced model.

Key words: Pectinolytic fungi; pectinase; kenaf; retting.

ABSTRAK

Kenaf (Hibiscus cannabinus) adalah serat pelbagai guna yang murah. Kaedah retting adalah proses pemisahan kulit kenaf dan teras gentian dan merupakan masalah utama untuk menghasilkan gentian kenaf bergred tinggi. Kulat-kulat yang menghasilkan enzim pektinase dan ligninase disaring melalui kaedah kualitatif dan kuantitatif dan terdapat tujuh kulat berpotensi. Kulat-kulat dikenalpasti melalui kaedah pengenalan morfologi, pengenalan biologi molekul menggunakan primer ITS dan pokok filogenetik dengan kaedah Neighbour Joining. Kulat-kulat berjaya dikenalpasti sebagai Basidiomycota sp. UMAS EN1, Hypocrea lixii UMAS PALM1, Ceratocystis paradoxa UMAS PG3, Aspergillus nomius UMAS MW16, Aspergillus nomius UMAS P3, Aspergillus nomius UMAS JA2 dan Pestalotiopsis olivacea UMAS PUC1. Isolati kulat UMAS EN1, UMAS PALM1, UMAS PG3 dan kultur campuran PP yang terdiri daripada UMAS PALM1 dan UMAS PG3 telah dipilih untuk ujikaji percubaan retting kenaf. Kaedah retting kenaf didapati lebih baik dengan menggunakan blok kulat dan dalam keadaan statik. Penilaian kecekapan proses retting kenaf adalah berdasarkan kepada kadar degradasi pektin dan lignin, profil enzim semasa proses retting kenaf dan kajian permukaan kenaf melalui kaedah SEM. Hasilnya, kadar degradasi tertinggi pektin dan lignin selepas proses retting kenaf adalah 79.05 ± 0.4% dan 40.67 ± 2.6%, masing-masing dengan pektinase dicatat sebagai enzim utama dengan kadar aktiviti enzim tertinggi iaitu 2.486 ± 0.14 U ml^{-1}. Selain dari itu, kaedah SEM juga menunjukkan degradasi komponen bukan-selulosa dan

pemisahan gentian kulit. Kultur campuran PP terus digunakan dalam pengoptimuman proses retting kenaf. Faktor-faktor fizikal; pH awal, suhu, tempoh proses retting dan saiz inokulasi telah dipilih untuk dioptimumkan melalui reka bentuk komposit berpusat (CCD). CCD menunjukkan pH awal dan tempoh proses retting mempunyai kesan yang signifikan ke atas kadar degradasi pektin. Keadaan optimum proses retting dianggarkan pada suhu 25^{o}C, pH awal 4.0, saiz inokulasi 4 blok dan masa proses retting selama 4 hari dengan model yang dikurangkan dan meramalkan 95.20% kadar degradasi pektin berbanding dengan 79.05% kadar degradasi pektin pada keadaan proses retting kenaf yang biasa. Pengesahan telah dilakukan dan kadar degradasi pektin setinggi 91.00% telah diperolehi dan setanding dengan kadar degradasi maksimum seperti yang telah diramal oleh model yang dikurangkan.

Kata kunci: *Kulat pektinolitik, pektinase; kenaf; pengeretan.*