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INTISARI

Kajian mengenai penurunan produktivitas sintesis selulosa oleh inokulum *G. xylinus* TP1 pada medium air kelapa statis telah dilakukan. Penelitian diawali dengan isolasi, purifikasi dan karakterisasi strain dari inokulum *G. xylinus* TP1 komersial produktif (PR) dan inokulum TP1 komersial non produktif (NPR) serta isolat dari habitat alami buah nanas (*Ananas comosus*). Pengujian penurunan produktivitas dilakukan pada medium air kelapa cair dengan periode subkulturisasi sebanyak 15 kali. Perbedaan sifat fisiologis antara isolat PR dan NPR dilakukan melalui pengujian kecepatan pertumbuhan, penggunaan sukrosa, laju sintesis selulosa, dan profil protein terlarut melalui metode SDS-PAGE. Peningkatan produktivitas isolat dilakukan melalui metode penghambatan enzim fosfodiesterase dengan cara suplementasi nikotinamida dan kafein serta metode seleksi dengan suplementasi etanol dan antibiotik. Isolasi inokulum PR menghasilkan 10 strain dan inokulum NPR menghasilkan 20 strain serta isolasi dari buah nanas menghasilkan 11 strain yang semuanya berhasil diidentifikasi sebagai anggota genus *Gluconacetobacter*. Pengujian produktivitas antar strain menunjukkan bahwa strain nonproduktif (NPR) memiliki keragaman produktivitas yang lebih besar dan rerata produktivitas lebih rendah daripada strain produktif (PR), sedangkan strain yang berasal dari buah nanas memiliki produktivitas yang lebih tinggi dari inokulum NPR namun masih lebih rendah daripada strain produktif (PR). Pengujian produktivitas setelah proses 15 kali subkulturisasi menunjukkan bahwa strain M5 (NPR) mengalami penurunan sebesar 20% sedangkan strain M10 (PR) sebesar 21%. Perbandingan fisiologis antara strain M5 dan M10 menunjukkan bahwa strain NPR memiliki kecepatan pertumbuhan, konsumsi substrat, dan laju sintesis selulosa yang lebih lambat, serta kerapatan sel maksimum lebih rendah. Pengujian keragaman profil protein terlarut menunjukkan bahwa strain M5 (NPR) tidak memiliki 3 macam protein dengan berat molekul 79,15 ; 82,8 dan 80,6 kDa. Pita protein dengan berat 79,15 dan 82,6 kDa berdasarkan berat molekulnya diperkirakan masing-masing berupa subunit *bcsA* dan *bcsB* yang merupakan subunit protein penyusun kompleks enzim selulosa sintase, sedang protein dengan 80,6 kDa belum dapat diperkirakan identitasnya. Suplementasi nikotinamida dan kafein sampai dengan konsentrasi 12 mg/l tidak menunjukkan pengaruh yang signifikan terhadap kuantitas produksi selulosa oleh isolat M5 dan M10, sedangkan metode seleksi dengan penambahan etanol sampai dengan konsentrasi 4% (v/v) pada medium pertumbuhan menunjukkan peningkatan yang nyata. Pengujian perbandingan resistensi terhadap antibiotik menunjukkan bahwa strain M10 (PR) memiliki resistensi yang lebih tinggi terhadap kloramfenikol dan tertrasiklin dibandingkan strain M5 (NPR). Adanya keterkaitan antara sensitivitas terhadap antibiotik dan penurunan produktivitas sintesis selulosa oleh strain M5 (NPR), menunjukkan bahwa penurunan produktivitas kemungkinan disebabkan oleh proses kehilangan plasmid R pada proses subkulturisasi.

Kata kunci : *G. xylinus*, selulosa bakteri, protein, antibiotik, subkulturisasi.

THE STUDY OF REDUCTION IN CELLULOSE PRODUCTION BY *Gluconacetobacter xylinus* TP1

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ABSTRACT

Study of reduction in cellulose production by *G. xylinus* strains in static medium was done. Experiments were started by isolation, purification, and characterization of *G. xylinus* strains isolated from commercial productive (PR) inoculum TP1, non productive (NPR) inoculum as well as from natural habitat pinnapple fruit (*Ananas comosus*). The stability to produce cellulose was examined by subculturing the NPR and PR strains for 15 times. Differences in physiological characters between PR and NPR strain was examined by measuring its growth rate, sucrose consumption, cellulose synthesis rate, and soluble proteins profile using SDS-PAGE method. An efforts to increase strains productivity was conducted by inhibition of phosphodiesterase enzyme with addition of nicotinamide and caffeine to medium and selection method with supplementation ethanol and antibiotics. Result of experiments showed that 20 strains were successfully isolated from NPR inoculum, 10 strains from PR inoculum, and 11 strains from *Ananas comosus* which were identified to be member of the genus *Gluconacetobacter*. Cellulose synthesis ability test during 15 times of subculturing process showed that cellulose production by M5 (NPR) and M10 (PR) decreased significantly up to 20% and 21%, respectively. Comparison of cellulose production assays between productive strains (PR) and non productive strains (NPR) showed that non productive (NPR) strains had lower productivity but all of the cells were still able to synthesize celluloses, whereas pinnapple-origin strains productivity was higher than non productive strains (NPR) though still lower than productive strains (PR). Further result showed that NPR strains had lower growth rate, sucrose consumptions rate and lower maximum cells density. Soluble proteins profile analysis indicated that nonproductive strain (NPR) was lacking of protein with molecular mass of 79.15 ; 82.8 and 80.6 kDa which based on their molecular mass were predicted as subunit bcsA and bcsB which are members of bacterial cellulose synthase enzyme, whereas the 80.6 kDa protein was not yet identified. An effort to increase cellulose productions by non productive strains indicated that additions of nicotinamide and caffeine up to 12 mg/l (w/v) had no significant effect, whereas selection method with ethanol addition up to 4% (v/v) was able to increase cellulose production. Furthermore, antibiotics sensitivity test showed M10 (PR) had higher resistance to chloramphenicol and tetracycline than M5 (NPR). Based on relationship between reduction in cellulose production and decrease of antibiotics resistance, it could be concluded that reduction in cellulose production was due to plasmid lost during subculturing process.

Key words: *G. xylinus*, bacterial cellulose, proteins, antibiotics, subculturing.