

# Kemampuan Degradasi Xylan dan Karakterisasi Actinobacteria Termofilik Potensial dari Tanah di Kawasan Geotermal Cisolok, Jawa Barat = Xylan-Degrading Ability and Characterization of Potential Thermophilic Actinobacteria from Soil in Cisolok Geothermal Area, West Java

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## Abstrak

Penelitian ini bertujuan untuk memperoleh isolat Actinobacteria termofilik potensial dari tanah di sekitar geiser Cisolok yang dapat mendegradasi xylan dan mengetahui hubungan kekerabatannya dengan taksa terdekat dari Actinobacteria penghasil xylanase. Tujuh belas isolat Actinobacteria termofilik diisolasi dari tanah di sekitar geiser Cisolok, Jawa Barat. Penapisan kemampuan 17 isolat Actinobacteria dan type strain *Actinomadura keratinilytica* NBRC 105837T mendegradasi xylan dilakukan menggunakan medium Minimal (Mm) padat dengan penambahan substrat xylan 0,5, inkubasi selama 7 hari. Pewarnaan dengan Congo red 0,2 (b/v) menunjukkan terbentuknya zona bening di sekitar koloni isolat Actinobacteria yang dapat mendegradasi xylan 0,5 pada suhu 45 C (15 isolat), 50 C (14 isolat), 55 C (4 isolat), dan 60 C (3 isolat). Type strain NBRC 105837T dapat mendegradasi xylan 0,5 pada suhu 45 C hingga 60 C. Tiga isolat (SL1-2-R-2, SL1-2-R-3, dan SL1-2-R-4) yang mendegradasi xylan 0,5 hingga suhu 60 C dipilih sebagai isolat potensial. Tiga isolat potensial dan type strain NBRC 105837 dapat mendegradasi substrat Remazol Brilliant Blue R-xylan (RBB-xylan) 0,1 pada medium Mm padat setelah 3 hari inkubasi pada suhu 45 hingga 60 C. Tiga isolat potensial telah diidentifikasi pada penelitian sebelumnya sebagai *Actinomadura keratinilytica* berdasarkan karakter genotip dan fenotip. Crude enzyme dari tiga isolat potensial dan type strain NBRC 105837 dapat mendegradasi xylan 0,5 dan RBB-xylan 0,1 pada medium Mm padat setelah 24 jam inkubasi pada suhu 45 hingga 60 C. Berdasarkan analisis filogenetik sequence gen 16S rRNA menggunakan metode neighbor-joining, minimum evolution, dan maximum likelihood, 3 isolat potensial membentuk clade yang monofiletik dengan dua spesies *Actinomadura* termofilik yang dapat mendegradasi xylan (*A. keratinilytica* dan *A. miaoliensis*). Tiga isolat potensial membentuk clade yang monofiletik dengan empat spesies *Actinomadura* termofilik (*A. keratinilytica*, *A. miaoliensis*, *A. rubrobrunea*, dan *A. viridilutea*). Tiga isolat potensial menghasilkan miselium substrat yang bercabang dan tidak berfragmen, serta miselium aerial yang menghasilkan spora pada medium modified Bennetts padat setelah 14 hari inkubasi pada suhu 45 C. Penelitian ini memberikan informasi tambahan mengenai kemampuan typestrain *A. keratinilytica* NBRC 105837 mendegradasi xylan.

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The aims of this study were to obtain the potential xylan-degrading thermophilic Actinobacteria isolates from soil of Cisolok geysers and to understand their relationship with the closely related taxa of xylanase-producing Actinobacteria. Seventeen thermophilic Actinobacteria isolates were isolated from soil collected around Cisolok geysers, West Java. Xylan-degrading ability of 17 Actinobacteria isolates and type strain *Actinomadura keratinilytica* NBRC 105837T were screened by using Minimal (Mm) agar medium with the addition of 0.5 xylan substrate, incubated for 7 days. Clear zone was formed around the colony of Actinobacteria isolates which showed xylan-degrading ability at 45 C (15 isolates), 50 C (14 isolates), 55 C

(4 isolates), and 60 C (3 isolates) after staining by 0.2 (w/v) Congo red. Type strain NBRC 105837T was able to degrade 0,5 xylan at 45 to 60 C. Three isolates (SL1-2-R-2, SL1-2-R-3, dan SL1-2-R-4) that showed xylan-degrading ability at 45 to 60 C were chosen as potential isolates. Three potential isolates and type strain NBRC 105837T were able to degrade 0,1 Remazol Brilliant Blue R-xylan (RBB-xylan) substrate on Mm agar after 3 days incubation at 45 to 60 C. In the previous study, these potential isolates were identified as *Actinomadura keratinilytica* based on genotypic and phenotypic characters. Crude enzyme of 3 potential isolates and type strain NBRC 105837T were able to degrade both 0.5 xylan and 0.1 RBB-xylan on Mm agar after 24 hours at 45 to 60 C. Phylogenetic analyses based on 16S rRNA gene using neighbor-joining, minimum evolution, and maximum likelihood methods showed the 3 potential isolates formed monophyletic clade with two thermophilic xylan-degrading Actinobacteria species (*A. keratinilytica* and *A. miaoliensis*). Three potential isolates formed monophyletic clade with four thermophilic Actinobacteria species (*A. keratinilytica*, *A. miaoliensis*, *A. rubrobrunea*, and *A. viridilutea*). These isolates produced non-fragmented branched substrate mycelia and spores produced from aerial mycelia after 14 days incubation at 45 C. This study reports a new information regarding the xylan-degrading ability of *A. keratinilytica* NBRC 105837.