

**ISOLATION OF MICROORGANISMS FROM LANDFILL SOIL AND  
THE PRODUCTION OF ENZYME**

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## ABSTRACT

Population growth with increasing consumption levels leads to abundant waste in Malaysia. In 2012, the average waste generation rate of Malaysia is 33,000 tons of waste per day with composition distribution of 46% food waste, 15% plastic, and 14% paper. Landfilling is the main solid waste management in Malaysia. However, the capacity of the existing landfill is decreasing as the waste generated is rapidly increasing. Waste disposed in landfill contains many types of bacteria with the potential to degrade the waste compound. The objectives of the study are to isolate and characterize the microorganisms from landfill soil and to produce the cellulase enzyme for waste degradation by culturing the isolated microbe. These enzymes are believed to have ability to accelerate the degradation of municipal solid waste in the biodegradation process. Soil samples for bacterial isolation were taken from Sungai Ikan Landfill in Terengganu. Characterization of bacteria was conducted via gram staining and morphology studies. In this study, screening tests with selective media demonstrated the ability of bacteria to produce cellulase. Bacteria with high  $I_{CMC}$  index from screening test were taken as potential bacteria to give high production of cellulase. The production of cellulase was conducted and observed through cellulase production profile, which was determined based on the measurement of total cell dry weight and cellulase production after every 12 hours. Microorganisms found in landfill soil were 51 different species of microorganisms which are 39 Gram positive and 12 Gram negative. Among these 51 species, 34 species were cellulolytic microorganisms and able to produce cellulase enzymes. 3 different isolates with high  $I_{CMC}$  index were analyzed for its enzymatic activity. Overall, the best microorganism was bacterial isolate D1 with optimum growth time of 24 h and highest cellulase activity (10.0716 U/mL).

## ABSTRAK

Pertumbuhan penduduk dengan tahap penggunaan yang semakin meningkat membawa kepada pembaziran sisa pepejal yang banyak di Malaysia. Pada tahun 2012, kadar penjanaan sisa purata di Malaysia adalah 33,000 tan sampah sehari dengan taburan komposisi sebanyak 46% sisa makanan, 15% plastik, dan 14% kertas. Tapak pelupusan ialah pengurusan sisa pepejal utama di Malaysia. Walau bagaimanapun, kapasiti tapak pelupusan yang sedia ada semakin berkurangan kerana sisa yang dihasilkan semakin meningkat dengan pesat. Sampah yang dibuang di tapak pelupusan mengandungi banyak jenis bakteria yang berpotensi untuk merendahkan kompaun sisa. Objektif kajian ini adalah untuk mengasingkan dan mengenalpasti mikroorganisma dari tanah tapak pelupusan dan untuk menghasilkan enzim *cellulase* untuk degradasi sisa oleh pengkulturan mikrob terpencil. Enzim ini dipercayai mempunyai keupayaan untuk mempercepatkan degradasi sisa pepejal perbandaran dalam proses biodegradasi. Sampel untuk pengasingan bakteria diambil dari tanah pelupusan Sungai Ikan di Kuala Terengganu. Pencirian bakteria telah dijalankan melalui gram pewarnaan dan bakteria morfologi kajian. Dalam kajian ini, ujian saringan dengan media terpilih telah digunakan untuk menunjukkan keupayaan bakteria untuk menghasilkan enzim *cellulase*. Pengeluaran *cellulase* enzim dilakukan dan diperhatikan melalui profil penghasilan *cellulase*, yang telah ditentukan berdasarkan ukuran daripada jumlah berat kering sel dan pengeluaran *cellulase* selepas setiap 12 jam. Mikroorganisma yang didapati di dalam tanah tapak pelupusan adalah sebanyak 51 jenis spesis yang mana sebanyak 39 spesis berciri Gram positif dan 12 spesis berciri Gram negatif. Daripada 51 spesis tersebut, 34 spesis adalah mikroorganisma *cellulolytic* dan dapat menghasilkan enzim *cellulase*. 3 spesis mikroorganisma *cellulolytic* yang berbeza dengan indeks I<sub>CMC</sub> yang tinggi telah dianalisis untuk aktiviti enzim. Hasil daripada analisis keseluruhan, mikroorganisma terbaik adalah bakteria D1 dengan masa pertumbuhan optimum pada jam ke 24 dan nilai aktiviti *cellulase* tertinggi (10.0716 U/mL).