

# KARAKTERISASI DAN PENGUKURAN LAJU REDUKSI NITRAT BAKTERI AEROBIK PADA AIR TANAH DI SLEMAN, YOGYAKARTA SEBAGAI POTENSI BIOREMEDIATOR *IN SITU*

Abigail Yemima

21/474728/BI/10715

Dosen Pembimbing: Prof. Dr. Endah Retnaningrum, S.Si., M.Eng.

## INTISARI

Pencemaran air tanah oleh nitrat umum terjadi di daerah padat penduduk akibat tingginya pembuangan limbah domestik dan aktivitas pertanian yang intensif. Akibatnya, nitrat adalah salah satu polutan yang umum ditemukan dalam sistem air tanah yang terdampak. Kapanewon Ngemplak di Sleman, Yogyakarta secara khusus rentan terhadap pencemaran nitrat pada air tanah karena adanya ekspansi permukiman dan aktivitas pertanian yang berjalan berdampingan. Konsentrasi nitrat yang tinggi dalam air tanah menyebabkan banyak dampak buruk terhadap lingkungan dan kesehatan manusia. Oleh sebab itu, penelitian ini dilakukan dengan tujuan mengukur kapasitas bakteri pereduksi nitrat aerobik *indigenous* yang ditemukan pada air tanah di Kapanewon Ngemplak sebagai potensi bioremediator *in situ*. Sebanyak 19 bakteri *indigenous* diisolasi dari sampel air tanah dan diuji kemampuan reduksi nitratnya. Dua isolat bakteri yang paling efisien dalam mereduksi nitrat secara aerobik kemudian diukur laju reduksi nitratnya pada inokulasi secara tunggal maupun kultur campuran setiap 24 jam selama 3 hari waktu inkubasi. Kedua isolat bakteri tersebut kemudian dikarakterisasi secara fenotipik melalui pengamatan morfologi sel, pengamatan morfologi koloni, dan pengujian biokimiawi. Dari dua isolat tersebut, isolat A dengan karakter fenotipik menyerupai *Pseudomonas stutzeri* memiliki hasil reduksi nitrat paling efisien dengan penghilangan nitrat sebanyak 95,38% dan laju reduksi nitrat  $40,67 \text{ mgL}^{-1}\text{jam}^{-1}$ . Isolat B memiliki karakter fenotipik menyerupai *Flavobacterium denitrificans* dan memberikan aktivitas reduksi nitrat yang lebih lemah. Ketika keduanya diinokulasikan dalam kultur campuran, efisiensi reduksi nitrat hampir tidak mengalami peningkatan.

KATA KUNCI: bakteri pereduksi nitrat aerobik *indigenous*, laju reduksi nitrat, pencemaran air tanah

# CHARACTERIZATION AND MEASUREMENT OF NITRATE REDUCTION RATE OF AEROBIC BACTERIA IN GROUNDWATER IN SLEMAN, YOGYAKARTA AS A POTENTIAL FOR *IN SITU* BIOREMEDIATOR

Abigail Yemima

21/474728/BI/10715

Supervisor: Prof. Dr. Endah Retnaningrum, S.Si., M.Eng.

## ***ABSTRACT***

Pollution of groundwater by nitrate is common in densely populated areas due to the high discharge of domestic wastes as well as intense agricultural activity. As a result, nitrate is one of the pollutants that is commonly found within the affected groundwater system. The Ngemplak subdistrict in Sleman, Yogyakarta is especially vulnerable to nitrate pollution due to the co-occurrence of rapid urban expansion and agricultural activities. High nitrate concentration in groundwater leads to many adverse effects on the environment, as well as human health. Therefore, this research was conducted to measure the capacity of indigenous aerobic nitrate-reducing bacteria found within the groundwater in Yogyakarta as a potential agent for *in situ* bioremediation. A total of 19 indigenous bacteria were isolated from groundwater samples in Yogyakarta and were tested for their nitrate reduction capability. Two of the most efficient isolates in reducing nitrate aerobically were then measured for their nitrate reduction rate in single isolate cultures and mixed cultures every 24 hours within 3 days of incubation period. The phenotypes of the two isolates were characterized through the observation of cell morphology, observation of colony morphology, and biochemical tests. Out of the two isolates, single culture of isolate A with similar characteristics to *Pseudomonas stutzeri* was the most efficient in reducing nitrate, with 95,38% of total nitrate removed and at a rate of  $40,67 \text{ mgL}^{-1}\text{h}^{-1}$ . Isolate B had phenotypical characteristics resembling *Flavobacterium denitrificans* and provided a weaker nitrate reduction activity. When both isolates were inoculated in a mixed culture, it does not show any signs of improvement.

**KEYWORDS:** groundwater pollution, indigenous aerobic nitrate-reducing bacteria, nitrate reduction rate