

Genome Sequence of *Pseudomonas* sp. Strain PAMC 25886, Isolated from Alpine Glacial Cryoconite

Seung Chul Shin,^a Su Jin Kim,^b Soon Gyu Hong,^{a,c} Do Hwan Ahn,^{a,c} Yung Mi Lee,^a Hyoungseok Lee,^a Jungeun Lee,^a and Hyun Park^{a,c}

Korea Polar Research Institute, Yeonsu-gu, Incheon, South Korea^a; College of Life Sciences and Biotechnology, Korea University, Seongbuk-gu, Seoul, South Korea^b; and University of Science & Technology, Yuseong-gu, Daejeon, South Korea^c

Pseudomonas spp. have shown characteristics of efficiently metabolizing environmental pollutants and also producing exopolysaccharides known as biofilms. Here we present the draft genome sequence of *Pseudomonas* sp. strain PAMC 25886, which was isolated from glacier cryoconite in the Alps mountain permafrost region and which may provide further insight into biodegradative and/or biofilm-producing mechanisms in a cold environment.

The genus *Pseudomonas* contains strictly aerobic, Gram-negative, rod-shaped, and motile (by means of a single polar flagellum) bacteria and is commonly found in soil and water. Some species of the genus *Pseudomonas* are able to metabolize chemical pollutants in the environment and, as a result, can be used for bioremediation (5–7), and a number of cells can also produce exopolysaccharides known as biofilms (3). This bacterium is an opportunistic pathogen, meaning that it exploits some break in the host defenses to initiate an infection (9). *Pseudomonas* sp. strain PAMC 25886 was isolated from glacier cryoconite in the Alps mountain range in Austria (47°04'N, 12°41'E).

The genome of Pseudomonas sp. PAMC 25886 was analyzed using a combined approach with the 454 GS FLX Titanium system (Roche Diagnostics, Branford, CT) with an 8-kb paired-end library (203,820 reads) and the Illumina GAIIx (San Diego, CA) with a 500-bp paired-end library (2,300,862 reads). The 454 GS FLX sequencing achieved about 12.1-fold coverage, while 30.6fold read coverage was achieved by Illumina paired-end sequencing. The reads generated by the Illumina GAIIx and the 454 GS FLX Titanium were assembled using Celera assembler 6.1 (4). Gene prediction and annotation were carried out using Glimmer3 (2), the rapid annotations using subsystems technology (RAST) annotation server (1), and the NCBI clusters of orthologous groups (COG) database (8). The draft genome sequence of Pseudomonas sp. PAMC 25886 was approximately 7.02 Mb long and comprised 7 scaffolds containing 95 contigs. The $N_{\rm 50}$ contig size was approximately 245 kb, and the N_{50} scaffold size was 4,183 kb. The G+C content was 59.9%. A total of 5,830 protein-encoding genes, 50 tRNA-encoding genes, and 1 rRNA operon were predicted in the draft genome. Approximately 85.2% of nucleotides were predicted as protein-coding regions, and 4,731 bp (81.1%) of the open reading frames were annotated with known proteins. Comparison with genome sequences available in the RAST server showed that Pseudomonas fluorescens SBW25 (score, 527), P. fluorescens PfO-1 (score, 501), and P. fluorescens Pf-5 (score, 477) were the closest neighbors of strain PAMC 25886. The availability of the genome sequence of Pseudomonas sp. PAMC 25886 will allow further analysis and understanding of biodegradative and/or biofilmproducing mechanisms in a cold environment.

Nucleotide sequence accession numbers. This Whole Genome Shotgun project has been deposited at DDBJ/EMBL/GenBank under the accession number AHHC00000000. The version described in this paper is the first version, AHHC01000000.

ACKNOWLEDGMENT

This work was supported by a Functional Genomics on Polar Organisms grant (PE12020) funded by the Korea Polar Research Institute (KOPRI).

REFERENCES

- 1. Aziz RK, et al. 2008. The RAST Server: rapid annotations using subsystems technology. BMC Genomics 9:75.
- Delcher AL, Harmon D, Kasif S, White O, Salzberg SL. 1999. Improved microbial gene identification with GLIMMER. Nucleic Acids Res. 27:4636– 4641.
- 3. Hassett DJ, et al. 2002. Anaerobic metabolism and quorum sensing by Pseudomonas aeruginosa biofilms in chronically infected cystic fibrosis airways: rethinking antibiotic treatment strategies and drug targets. Adv. Drug Deliv. Rev. 54:1425–1443.
- 4. Myers EW, et al. 2000. A whole-genome assembly of Drosophila. Science 287:2196.
- Nam IH, Chang YS, Hong HB, Lee YE. 2003. A novel catabolic activity of Pseudomonas veronii in biotransformation of pentachlorophenol. Appl. Microbiol. Biotechnol. 62:284–290.
- O'Mahony MM, Dobson ADW, Barnes JD, Singleton I. 2006. The use of ozone in the remediation of polycyclic aromatic hydrocarbon contaminated soil. Chemosphere 63:307–314.
- Onaca C, Kieninger M, Engesser KH, Altenbuchner J. 2007. Degradation of alkyl methyl ketones by *Pseudomonas veronii* MEK700. J. Bacteriol. 189: 3759.
- Tatusov RL, et al. 2001. The COG database: new developments in phylogenetic classification of proteins from complete genomes. Nucleic Acids Res. 29:22–28.
- 9. Wooldridge K. 2009. Bacterial secreted proteins: secretory mechanisms and role in pathogenesis. Caister Academic Press, Norfolk, United Kingdom.

Received 12 January 2012 Accepted 19 January 2012 Address correspondence to Hyun Park, hpark@kopri.re.kr. Copyright © 2012, American Society for Microbiology. All Rights Reserved. doi:10.1128/JB.00057-12