**Idiomarina homiensis** sp. nov., isolated from seashore sand in Korea

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A halophilic, aerobic bacterium, designated PO-M2T, was isolated from seashore sand, from Pohang, Korea and characterized on the basis of physiological and biochemical features. Phylogenetic analysis of 16S rRNA gene sequences revealed a clear affiliation of the novel strain with members of the genus *Idiomarina*. Sequence similarities between strain PO-M2T and the type strains of species belonging to the genus *Idiomarina* ranged from 94.3 to 95.5%. Cells of strain PO-M2T were straight or slightly curved rods and formed light-yellow colonies on marine agar medium. The major isoprenoid quinone was ubiquinone (Q-8) and the predominant cellular fatty acids were C₁₅:₀iso (19.3%), C₁₇:₁ω9c iso (11.9%), C₁₇:₀ iso (10.9%), C₁₈:₁ω7c (10.4%), C₁₆:₁ (9.0%) and C₁₆:₁ω7c and/or C₁₅:₀ iso 2-OH (7.2%). The G+C content of the DNA was 45.1 mol%. Based on physiological, biochemical and chemotaxonomic traits and comparative 16S rRNA gene sequence analysis, it is demonstrated that the isolate represents a novel species of the genus *Idiomarina*, for which the name *Idiomarina homiensis* sp. nov. is proposed. The type strain is PO-M2T (≡KACC 11514T ≡DSM 17923T).

The genus *Idiomarina* was first proposed by Ivanova et al. (2000) to accommodate two marine bacteria, *Idiomarina abyssalis* and *Idiomarina zobellii*. Since the description of the genus, the names of the species *Idiomarina baltica* (Brettar et al., 2003), *Idiomarina loihiensis* (Donachie et al., 2003), *Idiomarina fontislapidosi* (Martínez-Cánovas et al., 2004), *Idiomarina ramblicola* (Martínez-Cánovas et al., 2004) and *Idiomarina seosinensis* (Choi & Cho, 2005) have been validly published. Features that distinguish members of the genus *Idiomarina* from other marine bacteria are their high content of iso-branched fatty acids and their physiological properties, in particular their ability to grow within a broad range of temperatures, pH values and NaCl concentrations (Martínez-Cánovas et al., 2004). In this study, we report on the taxonomic characterization of a novel *Idiomarina* bacterial strain, PO-M2T, which was isolated from Homi Cape, near Pohang, Korea.

Strain PO-M2T was isolated from a seashore sand sample by using a dilution plating technique on marine agar 2216 (MA; Difco). Colonial properties were observed on MA medium. Cell morphology was observed using light microscopy and transmission electron microscopy (TEM) (Fig. 1). Flagellum type was also determined by TEM. Gram staining, KOH test and l-alanine aminopeptidase assay were performed according to the manufacturer’s instructions by using a Gram stain kit (Difco), 3% (w/v) KOH (Buck, 1982) and Bactident aminopeptidase (Merck), respectively. Phenotypic tests were performed using standard procedures (Smibert & Krieg, 1994). Hydrolysis of carboxymethylcellulose (0·1%; Sigma), alginic acid (0·5%, w/v), chitin from crab shells (1%, w/v), pectin (0·5%, w/v) and tyrosine (0·5%, w/v) was also tested. Growth at different salinities was tested in 0, 1, 3, 5, 7, 10, 15, 20 and 25% NaCl in half-strength marine broth. The temperature range for growth was assessed at 4, 10, 15, 20, 25, 30, 35, 40, 45, 50 and 55 °C on MA. Marine broth adjusted to initial pH values of 4, 5, 6, 7, 8, 9 and 10 with citrate/phosphate buffer or Tris/HCl buffer (Breznak & Costilow, 1994) was used to test the ability of the strain to grow at different pH values. API 20NE, API 50 CH and API ZYM test strips (bioMérieux) were used according to the manufacturer’s instructions. To investigate the utilization of carbon substrates, Biolog GN2 plates were used with both 0·85% NaCl solution and artificial seawater for cell suspension.

The following chemotaxonomic characteristics were analysed: isoprenoid quinone (as described by Groth et al., 1996), fatty acids (according to the standard protocol of the...
Strain PO-M2\textsuperscript{T} had a 16S rRNA gene sequence similarity range of 94.3–95.5\% with sequences of the type strains of species within the genus \textit{Idiomarina}, with the highest sequence similarities to \textit{I. loihiensis} L2-TR\textsuperscript{T} (95.5\%) and \textit{I. fontislapidosi} F23\textsuperscript{T} (95.5\%). The phylogenetic tree clearly showed that strain PO-M2\textsuperscript{T} formed a robust clade separate from other related genera, which was supported by a high bootstrap value (Fig. 2). A maximum-parsimony tree also confirmed the stable positioning of strain PO-M2\textsuperscript{T} within the genus \textit{Idiomarina} (data not shown).

Cells of strain PO-M2\textsuperscript{T} were aerobic, Gram-negative, motile, straight or slightly curved rods, 0.4–0.6 μm in width and 0.7–2.0 μm in length. Colonies formed on MA medium were light-yellow and convex. The strain was oxidase- and catalase-positive. It did not grow anaerobically. Strain PO-M2\textsuperscript{T} grew at 4–45°C, with optimum growth occurring at 25–30°C. The pH range for growth was 6.0–9.0. Strain PO-M2\textsuperscript{T} was also positive for the KOH test and hydrolysis of tyrosine, gelatin, DNA and Tween 80. H\textsubscript{2}S was produced from cysteine. Growth occurred in MA medium containing 15\% (w/v) NaCl. Details of various characteristics that differentiated strain PO-M2\textsuperscript{T} from phylogenetically related species are given in Table 1; other characteristics determined are given in the species description.

The major respiratory lipoquinone of strain PO-M2\textsuperscript{T} (Q-8) supported the affiliation of the strain to the genus \textit{Idiomarina}. The fatty acid profile and DNA G+C content of strain PO-M2\textsuperscript{T} were similar to those of other species of the genus \textit{Idiomarina}. The predominant fatty acids of strain PO-M2\textsuperscript{T} were iso-branched fatty acids, which is characteristic of the genus \textit{Idiomarina} (Table 2). The detailed fatty acid profile was C\textsubscript{15:0} iso (19.3\%), C\textsubscript{17:1} \textit{\alpha}9 iso (11.9\%), C\textsubscript{17:0} iso (10.9\%), C\textsubscript{18:1} \textit{\alpha}7 \textit{\alpha}c (10.4\%), C\textsubscript{16:0} (9.0\%) and C\textsubscript{16:1} \textit{\alpha}7 \textit{\alpha}c and/or C\textsubscript{15:0} 2-OH (7.2\%). The G+C content of the genomic DNA was 45.1 mol\%. The chemotaxonomic results supported the phylogenetic analysis, indicating that strain PO-M2\textsuperscript{T} belongs to the genus \textit{Idiomarina}. 

Fig. 1. Electron micrograph of a negatively stained cell of PO-M2\textsuperscript{T}. Bar, 500 nm.

Fig. 2. Neighbour-joining tree showing the position of strain PO-M2\textsuperscript{T} and some other related taxa on the basis of 16S rRNA gene sequences. Numbers at branch points indicate bootstrap confidence values (% of 1000 resamplings; only values greater than 60\% are shown. Bar, 0–01 substitutions per nucleotide position.
Table 1. Characteristics that distinguish *Idiomarina homiensis* sp. nov. from other *Idiomarina* species


<table>
<thead>
<tr>
<th>Characteristic</th>
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<th>6</th>
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<td>Cell morphology</td>
<td>Straight or slightly curved rod</td>
<td>Straight or slightly curved rod</td>
<td>Rod</td>
<td>Rod</td>
<td>Curved rod</td>
<td>Straight or slightly curved rod</td>
<td>Slightly curved rod</td>
<td>Slightly curved rod</td>
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<tr>
<td>Cell size (μm)</td>
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<td>1-0-1-9 x 0-3-0-6</td>
<td>1-1-8 x 0-7-0-9</td>
<td>1-1-8 x 0-7-0-9</td>
<td>0-7-1-6 x 0-4-0-7</td>
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<td>Single, polar</td>
<td>Single, polar</td>
<td>Single, polar</td>
<td>Single, polar</td>
<td>Single, polar or subpolar</td>
<td>Single, polar</td>
<td>Single, polar</td>
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<td>0-8-10a</td>
<td>0-5-20a</td>
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<td>7-10</td>
<td>3-6</td>
<td>3-6</td>
<td>3-6</td>
<td>7-5-10</td>
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<td>4-30</td>
<td>4-30</td>
<td>8-46</td>
<td>4-46</td>
<td>4-45</td>
<td>15-40</td>
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<td>Temperature optimum (°C)</td>
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<td>ND</td>
<td>ND</td>
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<td>−</td>
<td>+</td>
<td>ND</td>
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<td>Propionate</td>
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<td>L-Alanine</td>
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<td>L-Serine</td>
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<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
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<tr>
<td>DNA G+C content (mol%)</td>
<td>45-1</td>
<td>45-0</td>
<td>50-4</td>
<td>48-0</td>
<td>49-7</td>
<td>47-4</td>
<td>46-0</td>
<td>48-7</td>
</tr>
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<td>Habitat</td>
<td>Seashore sand, Korea</td>
<td>Hypersaline water, Korea</td>
<td>NW Pacific Ocean (depth)</td>
<td>NW Pacific Ocean (depth)</td>
<td>Central Baltic Sea (surface)</td>
<td>Hydrothermal vent, Hawaii</td>
<td>Saline wetland (soil), Spain</td>
<td>Saline rambla (water), Spain</td>
</tr>
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</table>

*a*, NaCl concentration; *b*, sea salt concentration.
Table 2. Fatty acid composition of *Idiomarina homiensis* sp. nov. and other *Idiomarina* species

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<th>Fatty acid</th>
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<th>5</th>
<th>6</th>
<th>7</th>
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<tr>
<td>C16:0</td>
<td>9.0</td>
<td>8.9</td>
<td>6.3</td>
<td>4.6</td>
<td>4.8</td>
<td>7.6</td>
<td>11.7</td>
<td>7.4</td>
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<tr>
<td>C18:0</td>
<td>4.8</td>
<td>3.9</td>
<td>1.8</td>
<td>0.8</td>
<td>0.9</td>
<td>1.6</td>
<td>4.9</td>
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</tr>
<tr>
<td>C11:0 iso</td>
<td>1.8</td>
<td>3.2</td>
<td>–</td>
<td>–</td>
<td>2.5</td>
<td>2.0</td>
<td>2.8</td>
<td>3.4</td>
</tr>
<tr>
<td>C15:0 iso</td>
<td>19.3</td>
<td>17.1</td>
<td>33.7</td>
<td>40.6</td>
<td>36.9</td>
<td>32.6</td>
<td>26.8</td>
<td>24.7</td>
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<td>C15:1 isoF</td>
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<td>2.3</td>
<td>1.6</td>
<td>1.5</td>
<td>1.3</td>
<td>1.5</td>
<td>1.9</td>
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<tr>
<td>C17:0</td>
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<td>15.2</td>
<td>11.9</td>
<td>12.5</td>
<td>11.2</td>
<td>11.0</td>
<td>8.8</td>
<td>12.9</td>
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<tr>
<td>C16:0t07c</td>
<td>7.2*</td>
<td>2.5*</td>
<td>7.0</td>
<td>8.3</td>
<td>8.4</td>
<td>6.0</td>
<td>11.3*</td>
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<td>C17:1t06c</td>
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<td>3.4</td>
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<td>C17:1t06c iso</td>
<td>11.9</td>
<td>8.8</td>
<td>–</td>
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<td>10.0</td>
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<td>1.3</td>
<td>–</td>
<td>–</td>
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<td>3.3</td>
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<tr>
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<td>4.5</td>
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</table>

C16:1t07c/C15:0 iso 2-OH.

On the basis of phylogenetic, biochemical and physiological data, we propose that isolate PO-M2^T_+ should be classified as representing the type strain of a novel species, *Idiomarina homiensis* sp. nov.

**Description of Idiomarina homiensis sp. nov.**

*Idiomarina homiensis* (ho.mi.en’is.sis. N.L. fem. adj. homiensis referring to the Homi Cape in Korea, where the type strain was isolated).

Cells are aerobic, straight or slightly curved rods, approximately 0.4–4.0 μm in width and 0.7–2.0 μm in length. Motile by means of a single polar flagellum. On MA solid medium, colonies are light-yellowish, round and convex. Growth occurs within the temperature range 4–45 °C (optimum growth at 25–30 °C) and at pH values between 6 and 9. Growth occurs in 1–15% (w/v) NaCl (optimum growth at 3–5%). Does not grow anaerobically. Cells are Gram-negative by Gram-stain test, KOH test and aminopeptidase test. Positive for oxidase, catalase, KOH test, production of H₂S from cysteine and hydrolysis of tyrosine, DNA, gelatin and Tween 80. Negative for indole production, Voges–Proskauer test, phenylalanine deamination and hydrolysis of casein, starch, chitin, lecithin, cellulose, pectin and urea. Does not degrade alginic acid. In API 20NE tests, cells are positive for nitrate reductase activity and hydrolysis of aesculin, but negative for other reactions. In API ZYM tests, cells are positive for acid and alkaline phosphatase, esterase (C4 and C8), leucine arylamidase, valine arylamidase, cysteine arylamidase, trypsin, α-chymotrypsin and naphthol phosphohydrolase activities, but negative for α-galactosidase, β-galactosidase, β-glucuronidase, α-glucosidase, β-glucosidase, N-acetyl-β-glucosaminidase, α-mannosidase and α-fucosidase activities. No reactions are observed in API 50 CH and Biolog tests. The DNA G+C content is 45.1 mol%.

The type strain is PO-M2^T_+ (=KACC 11514^T_+ =DSM 17923^T_+), which was isolated from seashore sand in Pohang, Korea.

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**References**


Idiomarina abyssalis sp. nov. and Idiomarina zobellii sp. nov. Int J Syst Evol Microbiol 50, 901–907.


