

**FATTY-ACID COMPOSITIONS OF MARINE ISOLATES
OF THE ACTINOBACTERIA *Nocardiopsis umidischolae*
KMM 7036 AND *Streptomyces* sp. KMM 7210**

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Actinobacteria are the leading producers of antibiotic, cytotoxic, and other biologically active compounds [1–3]. The marine world has been for several decades a rich source of these producers [4–6]. In continuation of the search for biologically active compounds in actinobacteria of the Okhotsk Sea, we determined the composition of free fatty acids from *Streptomyces* sp. KMM 7210 [7] that were studied previously by us, and *Nocardiopsis umidischolae* KMM 7036.

Actinobacterium *Streptomyces* sp. KMM 7210 was isolated from sediment collected at a depth of 3 m (Troits Bay, Poseta Gulf, Sea of Japan). The strain was cultivated with rocking for 5 d at 22°C in Ehrlenmeyer flasks (300-mL), each of which contained potato starch (1.0 g), peptone (0.2 g), yeast extract (0.2 g), CaCO₃ (0.1 g), and distilled water and seawater (50 mL each) at pH 7.7. The culture medium was worked up with EtOAc and evaporated *in vacuo*.

Actinobacterium *Nocardiopsis umidischolae* KMM 7036 was isolated from a sponge *Mycale* sp. collected at a depth of 606 m (Deryugin Bank, Sea of Okhotsk). The strain was cultivated for 28 d at 28°C in 40 Petri dishes, each of which contained agar (0.4 g), FeSO₄ (0.00125 g), MgSO₄ (0.0025 g), filtered millet broth (15 mL), and seawater (10 mL) at pH 7.5. The millet broth was prepared from millet (100 g) and distilled H₂O (600 mL). The biomass was worked up with EtOAc and evaporated *in vacuo*.

Total fractions of fatty acids were obtained by chromatography of EtOAc extracts over silica gel using hexane:EtOAc (0→10%).

Fatty acids as methyl esters were analyzed by GC [HP-5SM column (0.2 mm × 30 m); Agilent 6850, Germany]. The temperature program was injector 270°C, 100°C (1 min), 10°C/min, 270°C (20 min), detector 300°C (He carrier gas). GC–MC of fatty-acid methyl esters was carried out in the same mode on an HP GC 6890 spectrometer with an HP-5 ms column (30 m × 250 mm × 0.25 μm) with 5% phenylmethylsiloxane (MSD5973, Hewlett–Packard, USA) (He carrier gas). Compounds were identified by comparison of experimental mass spectra with those of known compounds using the NIST98 database. Table 1 presents data for the fatty-acid compositions of the bacteria.

According to the results (Table 1), both strains produced saturated, unsaturated, and branched acids. The fraction of unsaturated acids was greater than that of saturated. *N. umidischolae* contained a high percent of palmitic acid (18.9%) whereas its content in the *Streptomyces* sp. was 4.0% with the fraction of stearic acid in it reaching 13.9%. High contents of palmitic (16:0) and stearic (18:0) acids are characteristic of actinobacteria [8–10], in particular actinobacteria of the genera *Streptomyces* [10] and *Nocardiopsis* [9, 11]. *N. umidischolae* produced tuberculostearic acid (10-methyl-C_{18:0}), the presence of which is characteristic of all representative of this genus [9, 11–13].

Actinobacteria are known to produce fatty acids (saturated, unsaturated, branched) with chain lengths in the range C₁₀–C₁₈ [11–14]. Our results agreed with those in the literature. The fatty-acid composition of *N. umidischolae* isolated from the marine world was studied for the first time.

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TABLE 1. Fatty-Acid Composition of Fractions from Strains of Actinobacteria *Nocardiopsis umidischolae* KMM 7036 and *Streptomyces* sp. KMM 7210, % of Total Fatty Acids

Acid	Strain of studied microorganism		Acid	Strain of studied microorganism	
	<i>Nocardiopsis umidischolae</i> KMM 7036	<i>Streptomyces</i> sp. KMM 7210		<i>Nocardiopsis umidischolae</i> KMM 7036	<i>Streptomyces</i> sp. KMM 7210
Saturated			Σ_{unsat}	62.3	33.8
16:0	18.9	4.0	Branched		
17:0	Tr.	—	14-CH ₃ -15:0	5.4	48.1
18:0	4.6	13.9	14-CH ₃ -16:0	Tr.	—
20:0	—	Tr.	10-CH ₃ -18:0	Tr.	—
$\Sigma_{\text{sat.}}$	23.5	17.9	Σ_{br}	5.4	48.1
Unsaturated			Total mass of FA in EtOAc fraction	99.9	36.77
16:1	—	19.1			
18:1	22.4	14.7			
18:2	39.9	—			

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