

Bioconversion of D-limonene into value-added monoterpenes using *Paenibacillus popilliae* 1C and *Streptomyces rochei* AB1: Exploring bacterial biotransformation pathways and metabolite diversity

Madjeda Beichi¹, Fatiha Saidani¹, Nacera Riad¹, Fatima Elzahra Ferradji¹, Fatima Elzahra Mesbaiah², Mohamed Reda Zahi^{1*}, Kamel Eddouaouda¹, Abdelmalek Badis¹ and Mohamed El Hattab^{1*}

¹Laboratory of Natural Products Chemistry and Biomolecules Faculty of Sciences - University Blida 1
Road of Soumaa - BP 270- Blida 09000, Algeria

²National Centre for Research and Development of Fisheries and Aquaculture (CNRDPA) 11,
Colonel Amirouche Street, P.O. Box 67, Bou Ismaïl, 42415, Tipaza, Algeria

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The present study focuses on the bioconversion of D-limonene using two bacterial strains, *Streptomyces rochei* AB1 and *Paenibacillus popilliae* 1C, isolated and identified by our research team. Rich mediums (International *Streptomyces* Project 9 medium for strain AB1 and Luria-Bertani medium for strain 1C) were used for biotransformation experiments. Furthermore, biodegradation tests were conducted with D-limonene as the only carbon and energy source in a modified minimum medium. The minimum inhibitory concentration (MIC) of D-limonene was 10 ± 0.09 mg/mL. The strains achieved a bioconversion yield of nearly 70% following 7-day of incubation period. Analysis by GC-MS revealed the formation of various hydrocarbons and oxygenated monoterpenes, including alcohols, ketones and terpene hydrocarbons. Some metabolites, such as cis-verbenol, isovaleric acid and 2-methylbutanoic acid, were identified in biotransformation assays using *Paenibacillus popilliae* 1C. To our knowledge, this genus has never before been known to produce these metabolites during the biotransformation of D-limonene. Carveol, carvone, limonene-1,2-diol, linalool, and α -terpinolene were among the other metabolites found. Similar biodegradation products were obtained with *Streptomyces rochei* AB1, suggesting the occurrence of common metabolic pathways involved in D-limonene bioconversion. These findings highlight the biotechnological potential of the studied strains for the production of value-added monoterpenes.

Keywords: Bioconversion, D-limonene, Monoterpenes, *Paenibacillus popilliae* 1C, *Streptomyces rochei* AB1

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