Whole-Genome Shotgun Sequence of *Rhodococcus* Species Strain JVH1

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Here we present a whole-genome shotgun sequence of *Rhodococcus* species strain JVH1, an organism capable of degrading a variety of organosulfur compounds. In particular, JVH1 is able to selectively cleave carbon-sulfur bonds within alkyl chains. A large number of oxygenases were identified, consistent with other members of the genus.

Rhodococci are known for their ability to metabolize organic pollutants (7), in part due to the number and diversity of oxygenases found in their relatively large chromosomes and extrachromosomal elements (8). Commonly a soil organism with pathogenic and nonpathogenic members, rhodococci have been isolated from a variety of environments (3, 10, 11). *Rhodococcus* species strain JVH1 has the ability to produce biomass while exploiting organosulfur compounds, including benzothiophene, benzyl sulfone, benzyl sulfide, 1,4-dithiane (6), chloroethyl ethyl sulfide, chloroethyl methyl sulfide, sulfoacetic acid, 2-mercaptoethanol, thioglycolic acid, and a mustard gas hydrolysis product such as thiodiglycol. Of greatest interest is the ability of JVH1 to cleave the C-S bonds within the alkyl chain of *bis*-(3-pentafluorophenyl)-sulfide (14).

Genome sequencing of JVH1 was carried out by Génome Québec and McGill University Innovation Centre/Centre d'Innovation Génome Québec et Université McGill using 454 pyrosequencing with a Roche GS-FLX titanium sequencer. The whole-genome shotgun sequence generated 283 Mb of data, 97% of which was assembled into 173 contigs greater than 500 bp for a total of 9,187,305 bp, with an estimated 30× coverage. Annotation using MANATEE generated 9,315 open reading frames (ORFs), with an average length of 883 bp, including 51 tRNA genes, two 5S rRNA genes, one 16S rRNA gene, and one 23S rRNA gene, with an overall GC content of 66.9%. JVH1 has at least two large uncharacterized plasmids greater than 60 kb, reflected in the identification of 117 genes related to mobile and extrachromosomal function.

Contigs were arranged using MAUVE (1) with the *Rhodococcus jostii* RHA1 chromosome as a template following comparisons with the available closed genomes of related organisms, including RHA1, *Rhodococcus opacus* strain B4, and *Rhodococcus erythropolis* strain PR4. JVH1 was originally proposed to be related to *R. opacus* based on 16S rRNA gene sequence data available in 2004 (14), but given the similarities between the JVH1 and RHA1 genomes, it is clear that JVH1 is more closely related to *R. jostii* than *R. opacus*. This is further supported by a phylogenetic analysis of the 16S rRNA gene and seven housekeeping genes (9) using MEGA5 (12) from fully sequenced members of the *Corynebacterineae* suborder.

Pathway tools software (5) was used to reconstruct metabolic pathways, and all the necessary enzymes for central metabolism of sugars, including glycolysis, the Entner-Doudoroff pathway, the pentose phosphate pathway, and three variants of the citric acid cycle, were identified. Many amino acid transport proteins were identified, including one for L-cysteine. Six transport proteins involved in sulfate uptake were annotated, while 316 transport proteins with no known substrates were identified. Sulfur-specific

metabolic genes found in the JVH1 genome include biosynthesis of the sulfur-containing amino acids cysteine and methionine, as well as genes with homologies to those in the *ssu* operon responsible for desulfurization or organosulfur compounds (2, 4, 13). A total of 254 oxygenase-coding genes, including monooxygenases and dioxygenases, were identified, with activities reported against aromatic compounds such as phenols, biphenyl, benzoate, toluene, and steroids. Of the oxygenases identified in JVH1, there are five taurine dioxygenases, 48 luciferase-like monooxygenases, and 15 nitrilotriacetate monooxygenases.

Nucleotide sequence accession number. This whole-genome shotgun project has been deposited at DDBJ/EMBL/GenBank under the accession number [AKKP01000000](https://doi.org/10.1093/nucleic-acids-research/41.12.2255). The version described in this paper is the first version.

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