

LABRYS PORTUCALENSIS, A BACTERIAL STRAIN WITH THE CAPACITY TO DEGRADE FLUOROBENZENE



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INTRODUCTION

During the last decades, environmental contamination by fluorinated organic compounds has received increasing attention because of their use as herbicides, fungicides, surfactants, refrigerants, intermediates in organic synthesis, solvents and pharmaceuticals. The physico-chemical characteristics of fluoroaromatics often make them highly recalcitrant (1). During our studies on the microbial degradation of fluorobenzene (FB), a pure bacterial culture with the unique capacity to utilize this compound as a sole carbon and energy source was isolated from a sediment sample collected from an industrially polluted site in northern Portugal (2). The isolated strain, designated F11, was found to belong to subgroup 2 of the class Alphaproteobacteria and to fall within the order Rhizobiales. The present study presents a summary of the main morphological and physiological characteristics of strain F11, including metabolic versatility studies and FB degradation pathway, as well as a detailed classification of this strain based on cellular fatty acid profiling, phylogenetic analysis of the 16S rRNA gene and DNA–DNA hybridization experiments.

RESULTS AND DISCUSSION

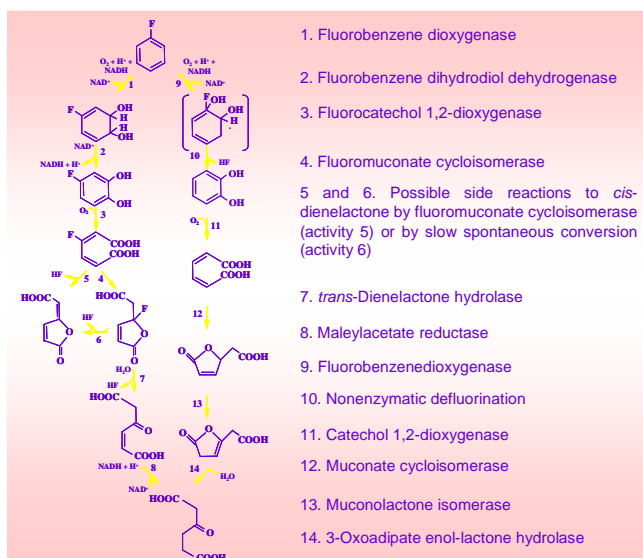


Figure 1. FB metabolic pathway by strain F11.

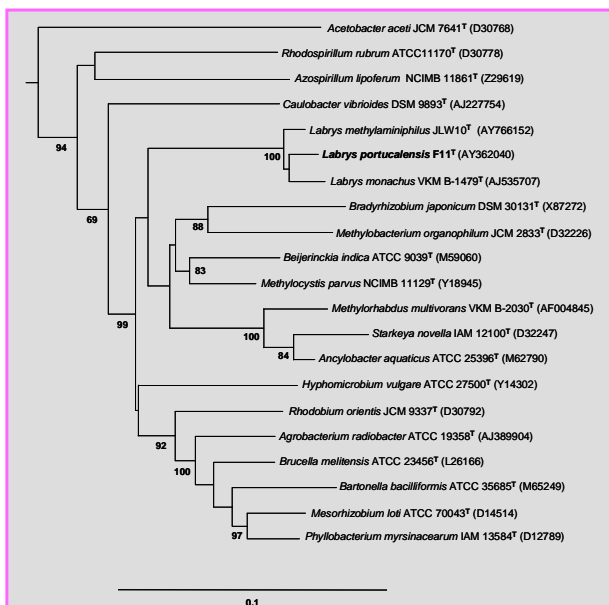


Figure 2. Phylogenetic tree obtained by neighbour-joining analysis of 16S rRNA gene sequences. The 16S rRNA gene sequence of Escherichia coli MRE600 (GenBank accession number J01859) was used to root the tree (not shown). Only bootstrap values >65% are reported at nodes. Bar, 0.1 substitutions per site.

Table 1. Summary of some morphological and physiological characteristics of strain F11

Characteristic	Strain F11
Origin	Contaminated sediments
Cell morphology	Short, thick rods
Colony description	White circular mucous glistening and entire-edged colonies
Catalase/oxidase	+/+
Growth pH range	4.0-8.0
Optimum pH range	6.0-8.0
Growth temperature range (°C)	16-37
Optimum growth temperature range (°C)	28-32
Fluorescent pigments	–
Nitrate reduction	–
Hydrolysis of:	
Gelatin	–
Agarose	–
Indol production	–
Voges–Proskauer reaction	+
Urease production	+
N ₂ fixation	+
Utilization of:	
Acetate	+
Benzoate	+
Citrate	+
D-Gluconate	+
DL-Lactate	+
D-Lactose	+
DL-Malate	+
Maltose	(+)
Methanol	–
Methylamine	–
Toluene	–
Trimethylamine	+
Fatty acids (% of total content)	
C _{16:0}	22.7
C _{18:1} w7c	18.4
C _{18:0}	3.0
C _{19:0} cyclo w8c	48.5
Major quinones	UQ-10
DNA G+C content (mol%)	62.9

+, Positive; -, negative; (+), weakly positive

Table 1. Utilization of various aromatic compounds by strain F11

Substrate	F11
4-Fluorobenzoate	++
2-Fluorobenzoate	+
Trifluoroacetic acid	+
Benzoate	++
Benzene	++
Fluorobenzene	++
Bromobenzene	-
Iodobenzene	-
Chlorobenzene	-
4-Chlorophenol	-
3-Chloro-4-fluoroaniline	-
4-Chlorobenzoate	-
Phenol	++
4-Fluorophenol	++

-, negative; +, positive; ++, strongly positive

DNA–DNA hybridization experiments indicated that strain F11 represents a separate species, based on the recommended minimum value of 70% for strains of the same species.

The phenotypic, chemotaxonomic, genotypic and phylogenetic data indicate that strain F11 represents a novel species of the genus *Labrys*, being named as *Labrys portucalensis* sp. nov.

REFERENCES

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2. Carvalho MF, Ferreira Jorge R, Pacheco CC, De Marco P, Castro PML (2005) Isolation and properties of a pure bacterial strain capable of fluorobenzene degradation as sole carbon and energy source. *Environ Microbiol* 7: 294-298.

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