A NEW PURPLE BACTERIUM THAT OXIDIZES SULFIDE TO EXTRACELLULAR SULFUR AND SULFATE*

by T. A. HANSEN, A. B. J. SEPERS**, and H. VAN GEMERDEN

Laboratory of Microbiology, University of Groningen, Haren (Gr.), The Netherlands

SUMMARY

The properties of a newly isolated fresh-water purple bacterium (strain 51) are discussed. This bacterium was found to oxidize sulfide to extracellular sulfur and sulfate during phototrophic growth with sulfide as the electron donor. However, strain 51 differs in many aspects from the Ectothiorhodospira species which thus far were the only purple bacteria known to exhibit this characteristic. The new isolate appeared to show more resemblance to *Rhodopseudomonas capsulata* although some differences with this species exist as well.

During growth in batch cultures with hydrogen sulfide as the electron donor, strain 51 did not produce sulfate in significant amounts before sulfide had been completely oxidized.

INTRODUCTION

The purple sulfur bacteria (Chromatiaceae) are able to utilize hydrogen sulfide as an electron donor in photosynthesis. Sulfide is oxidized to elemental sulfur and sulfate. The elemental sulfur accumulates as characteristic globules inside the organisms. A few species of the Chromatiaceae, however, deposit the sulfur outside the cells, like the green sulfur bacteria do. Apart from this characteristic feature, these species of the Chromatiaceae have some other important properties in common. The shape of these organisms is more or less vibroid. They all have stacks of lamellar photo-

** Present address: Delta Institute for Hydrobiological Research, Yerseke, The Netherlands.
synthetic membranes. Their carotenoids belong to the spirilloxanthin series. So far, three species of purple sulfur bacteria have been described that produce extracellular sulfur. They were placed in the genus Ectothiorhodospira by Pfennig and Trüper.

In this paper the properties of a newly isolated purple bacterium that forms extracellular sulfur and sulfate are described. However, the organism differs in many aspects from Ectothiorhodospira species. This bacterium, designated as strain 51, bears in fact more resemblance to the purple non-sulfur bacterium Rhodopseudomonas capsulata.

**MATERIALS AND METHODS**

**Media and growth conditions**

The organisms were grown in a basal medium supplemented with sulfide, organic compounds, yeast extract and growth factors. The composition of the basal medium was as described before. However, in the description of the trace-element solution, CoCl₂·6H₂O (20 mg/l) was omitted by mistake. The vitamins were added from filter-sterilized stock solutions to final concentrations (μg per litre): biotin 10; thiamin 280; potassium-paraaminobenzoate 260. The pH of media containing sulfide was adjusted to 7.3; other media were used after adjustment to pH 7.0.

**Kinetics of sulfide oxidation in batch cultures**

For the experiments 5-litre cultures were incubated at 30°C and 4000 to 6000 lux (incandescent light). The NH₄Cl-concentration was reduced to 100 mg/l. The cultures were mixed by a magnetic stirrer. Samples were taken by applying nitrogen pressure. For the determination of cell nitrogen, samples of 150 to 250 ml were centrifuged (30 min, 27000 × g), washed once with 100 ml water, and digested by a Kjeldahl method employing a Technicon AutoAnalyzer.

**DNA base composition**

DNA was isolated and purified according to Marmur. The DNA base composition expressed as moles % guanine + cytosine was calculated from the melting point Tm in 'standard saline citrate' and the buoyant density applying the formula of De Ley. DNA from Bacillus subtilis served as reference.

Other methods used were identical to or only slightly different from procedures described earlier.