

**BACTERIAL DEGRADATION OF HYDROCARBONS WITH  
IMPLICATIONS FOR ASPHALTS  
PART 2: ATTACK MECHANISMS**

**S.E. Zoorob**

Senior Research Officer, Nottingham Centre for Pavement Engineering,  
University of Nottingham, NG7 2RD, UK, salah.zoorob@nottingham.ac.uk

**P. Phillips**

Technical and development director, Aggregate Industries UK Ltd, Moordale  
House, Hlland Ward, Ashbourne, Derbyshire, DE6 3ET, UK.

*ABSTRACT*

In part 1 of this paper, evidence of large scale hydrocarbon degradation in the natural environment caused by microbial attack was presented. This paper includes a more detailed discussion of the preferred hydrocarbon types for bacterial attack based on molecular weight and degree of saturation. The differences between aerobic degradation processes compared to anaerobic nitrate and sulphate reducing mechanisms is explained. A discussion is also included on the effects of surface area and oil concentration on growth rate and rate of hydrocarbon utilization.

A very interesting mechanism is introduced by which microorganisms can produce biosurfactants and organic acids, which result in microbial emulsification of oils.

Finally, a brief review of previous investigations showing that some bacteria can utilize bitumens with similarities between the biodegradation of bitumens and that of petroleum. Microbial degradation was shown to be limited mostly to the surfaces of the bitumen sample with the saturates and naphthene aromatic fractions most affected causing the bitumen surfaces to lose their original adhesiveness accompanied by a significant increase in visocosity.

*KEY WORDS:* Petroleum, biosurfactants, organic acids, aerobic, saturates.