Cent. Eur. J. Biol. • 8(11) • 2013 • 1127-1134
DOI: 10.2478/s11535-013-0221-x

VERSITA

Central European Journal of **Biology**

A study of the phototoxic effect of Benzo[a] Pyrene on bacteria

Research Article

Alžbeta Takáčová[1,2], Miroslava Smolinská[2,3,*], Petra Olejníková[4], Tomáš Mackuľak[2], Gabriel Čík[2]

[1]*VÚRUP, a.s., 820 03 Bratislava, Slovak Republic*

[2]*Department of Environmental Engineering, Institute of Chemical and Environmental Engineering, Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava, 812 37 Bratislava, Slovakia*

[3]*Department of Microbiology and Virology, Faculty of Natural Sciences, Comenius University in Bratislava, 842 15 Bratislava, Slovakia*

[4]*Department of Biochemistry and Microbiology, Institute of Biochemistry, Nutrition and Health Protection, Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava, 812 37 Bratislava, Slovakia*

Received 18 February 2013; Accepted 31 May 2013

Abstract: Although Benzo[a]Pyrene (BaP) released to soils tends to bind very strongly to soil particles, however, small amounts have been shown to leach into groundwaters. This polycyclic aromatic hydrocarbon is stable and can stay (and travel) in the environment for an extended period of time. Release of BaP into the environment therefore causes concern at a global environmental level. In this paper we evaluated the effect of BaP on the cell growth of *Escherichia coli* and *Enterococcus faecalis* in aerobic conditions. Irradiation of BaP increased its antibacterial activity which suggests that this process produced a singlet oxygen. This way would be able to speed up the processes of photochemical degradation of BaP.

Keywords: *Escherichia coli* • *Enterococcus faecalis* • *Polycyclic aromatic hydrocarbons* • *Phototoxicity*

1. Introduction

Polycyclic aromatic hydrocarbons (PAHs) in the environment are almost always derived from anthropogenic activities [1]. PAHs have a high melting and boiling point and low water solubility. Their solubility tends to decrease with increasing molecular weight and PAHs are highly lipophilic [2]. The volatility of the compounds from the aqueous phase is low, with half-lives of 500 and 1550 h for Benz[a]Anthracene (BaA) and Benzo[a]Pyrene (BaP), respectively [3]. Under aerobic conditions these compounds biodegrade very slowly in the aqueous compartment. Their biodegradation rates decrease significantly with increasing number of aromatic rings [4-7]. The most important degradation process for PAHs in air and water is indirect, hydroxyl radicals (•OH), mediated photolysis. Under laboratory conditions, the reaction of the PAH compounds with airborne •OH radicals shows maximum half-lives between about 3 and 11 h [8]. For pure water, the photodegradation half-lives appear to be in the range of hours [9,10], whereas the half-lives increase dramatically when there is sediment/water partitioning [11]. BaP is a potent environmental carcinogen that is metabolized into diolepoxides that react with exocyclic amines in DNA. Reports to date show that the highest molecular weight PAHs that can be mineralized by bacteria are four-ring PAHs, there are but few bacterial strains which can digest five-ring PAHs as the sole carbon and energy source [12-14]. These

* *E-mail: miroslava.smolinska@yahoo.com*