

Genotoxicity of white phosphorus

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Abstract

In earlier studies we showed for the first time the growth of microorganisms in culture media containing white phosphorus as the only phosphorus source. This fact suggests the possibility of developing methods for biodegradation of white phosphorus, i.e., its neutralization in the environment by microorganisms. However an effective biological decontamination of the substance is impossible without a thorough study of its toxicological properties. There should be performed a comprehensive study of the impact of white phosphorus on microorganisms, as well as the possibility of formation of lethal metabolites which more toxic than the initial substance. Genotoxicity is an important indicator of toxicity, since the structure of the hereditary material is the same in all living organisms, i.e., the result obtained on bacteria is easily extrapolated to humans. Our previous research has revealed the absence of genotoxicity of white phosphorus. Genotoxicity was estimated by the Ames test, which demonstrated that white phosphorus is not a mutagen. However, with all the advantages of this method, the use of the Ames test only is not enough to reliably assess the genotoxicity. For this purpose a whole battery of tests is used, and the SOS-lux test for DNA damaging activity is among them. In the present work SOS-lux test has demonstrated genotoxicity of white phosphorus. This result is obtained for the first time – all the available literature sources reported no genotoxic properties of white phosphorus. Our previous research has revealed the absence of genotoxicity of white phosphorus. Genotoxicity was estimated by the Ames test, which demonstrated that white phosphorus is not a mutagen. However, with all the advantages of this method, the use of the Ames test only is not enough to reliably assess the genotoxicity. For this purpose a whole battery of tests is used, and the SOS-lux test for DNA damaging activity is among them. In the present work SOS-lux test has demonstrated genotoxicity of white phosphorus. This result is obtained for the first time – all the available literature sources reported no genotoxic properties of white phosphorus. It has been shown that genotoxicity for a mixture of white phosphorus and hydrogen peroxide is much higher than that for white phosphorus only, i.e., P₄ peroxide oxidation products appear to possess greater genotoxicity than that of the initial material. It was also found that the most pronounced SOS response, which correlates with the intensity of DNA damage, occurs approximately 6 hours after placing the culture of *Salmonella* in medium containing white phosphorus. White phosphorus exhibits the largest DNA damaging activity in a concentration range of 25-250 µg/ml. Toxic (and genotoxic) properties of culture medium with white phosphorus retained after 8 months when stored frozen.

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