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POTENTIAL APPLICATION OF UV-BIOSENSOR IN PERSONAL SPACE DOSIMETRY

Abstract

Human space exploration is one of the most challenging and interesting scientific endeavors of the 21st century. It is considered as the next logical step of peaceful cooperation in space on a global scale. However, space is a very hostile environment and continuous medical cares are fundamental for future human exploratory missions. Space solar UV radiation may cause severe and irreversible damages to humans. Thereby, the study of photobiological processes under extraterrestrial environments is an important aspect, when we try to understand the real effects and consequences of the UV radiation on life. On Earth, several biological dosimeters have been used to measure the effects of solar radiation on living systems. One of them is based in the spore inactivation doses (SID) of *Bacillus subtilis* strain TKJ6312. Due to the deficience in the nucleotide excision repair and spore photoproduct lyase repair mechanisms, the spores of this strain acquire a sensibility to UV radiation and maintain characteristically resistance for other environment factors. The spore dosimetry fulfills the criterions established by BIODOS project from the European Commission to be applied as UV-biosensor including its simplicity, facility of use and transport and a well characterized action spectrum. Besides, the biosensor can be stored for several years before and after the UV exposure. Laboratory studies demonstrate that the SID action spectrum profile agrees with the MED (Minimal Erythema Dose) and Scup-h (Photocarciogenesis) action spectrum. Similar results were also found in field experiments for minutes and days. A long term study performed at the Brazilian Southern Space Observatory (29.4°S, 53.8°W), which analyzed monthly data of SID, MED and Scup-h from 2000 to 2007, demonstrated a high correlation index of 0.84 and 0.83 for SID versus MED and SID versus Scup-h, respectively. Furthermore, a variety of studies ratifies the practical application of the biosensor for personal dosimetry of children and workers under different circumstances of UV exposure and in different geographical regions of the Earth. The simplicity, robustness and high resistance of bacterial spores under extreme environment conditions makes the biosensor an applicable biological tool in space studies involving the effects of radiation in living systems. Altogether, these results indicate the potential application of spore biosensor for personal UV dosimetry in space and others planetary surfaces.