Investigating the Efficacy of Bioluminescent Mushroom Panellus stipticus as a Biosensor to Detect the Toxicity of Water Contaminants

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Conventional chemical assays of water samples typically target certain chemicals and are difficult to apply to a broad range of water contaminants. An economical and robust bioassay method for determining the toxicity of water contaminants should help improve public health worldwide. This research explored the effect of six common water contaminants - $CuSO_4$, $ZnSO_4$, $NaNO_3$, $HgCl_2$, Atrazine, and Permethrin, on the bioluminescence of the Panellus Stipticus mushroom. Panellus Stipticus was cultivated using two methods; a nutrient culture method and a plug spawn method. The harvested mushrooms were introduced to contaminants that were diluted according to EPA Maximum Contaminant Level values and at other varying concentrations. Decay in Panellus Stipticus bioluminescence intensity was visually monitored as well as measured using a Sper Lux/FC meter. Decay can be visibly observed with bioluminescent intensity reduction of 10%. The bioluminescent intensity of Panellus Stipticus was measured at 4.7 lux. 30 minutes exposure to metal salts, $CuSO_4$, $HgCl_2$, and $ZnSO_4$, reduced the bioluminescent intensity by 68-72%. 90 minutes exposure to alkali metal salt contaminant, $NaNO_3$, showed a reduction of bioluminescence intensity by 15%. Panellus Stipticus subjected to Atrazine and Permethrin contaminants showed a reduction of bioluminescence intensity by 12-13% after 150 minutes. Bioluminescence intensity decay of 10% or greater could be detected within 130 minutes under all contaminant concentrations. This makes Panellus Stipticus a viable qualitative and quantitative biosensor to detect toxicity of water sources.

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