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Impact of Nano-Silver Exposure on Microbial Activity

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A key gap in environmental impact assessments of emerging contaminants is the change in biological activity of microorganisms exposed to toxic substances. Silver-nanoparticles are among the top cytotoxic nanomaterials suspected to threaten microbial functions of natural and engineered systems. In this study, a novel light-interference technique termed 'bio-speckle' is employed to determine real-time biological activity of monocultures and biologically complex samples. Bio-speckle uses laser illumination of biological samples to create interference patterns of the scattered light that can be used to quantify intracellular organelle movement as a measurement of biological activity. To test the potential of bio-speckle technique for toxicity assays, filter paper microcosms of the model environmental bacterium Pseudomonas fluorescens strain SBW25 were exposed to uncoated nano-silver suspensions for 2, 24, 48, and 72 hours. At the end of each exposure period, biological activity was quantitatively determined as the dynamic speckle pattern's moment of inertia. Results suggest that the biological activity of bacteria decreases exponentially with the time of exposure of the colonies to the silver nanoparticles.