

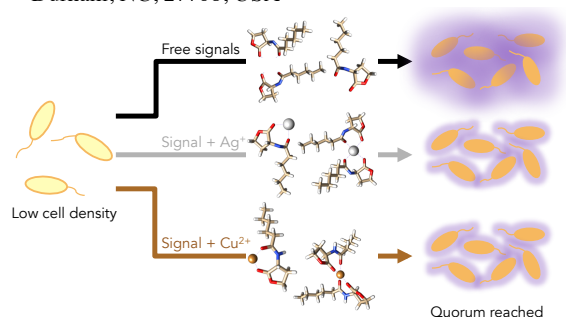
Acyl homoserine lactones complex metal ions, altering toxicity and quorum response

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Quorum sensing (QS) in bacteria is responsible for biofilm formation, virulence factors, and antibiotic synthesis. QS is, thus, of importance to human health and function of environmental and engineered systems. Metal nanomaterials (NM) have recently been found to disrupt QS; however, the mechanism of disruption is unclear. In this research, we first study the interactions between QS-signaling molecules and metal ions released from common engineered NMs, silver and copper. Interactions between Ag⁺ or Cu²⁺ and a QS autoinducer, *n*-hexanoyl-dl-homoserine lactone (HHL), were investigated via mass spectrometry, Fourier transform infrared spectroscopy, and computational simulations. Next, biological impacts of metal ion-HHL interactions were performed on *Chromobacterium violaceum* CV026. Results from the initial interaction studies suggest that a coordination complex between Ag⁺ or Cu²⁺ and HHL occurs with the oxygen-containing functional groups, in a predominately 1:1 molar ratio. Once complexed with Ag⁺ or Cu²⁺, *Chromobacterium violaceum* CV026 QS-induced violacein production was inhibited. Furthermore, the HHL-Ag⁺ complexation significantly reduced silver toxicity to CV026, indicating that HHL can act as a sink for free Ag⁺. Our work shows that QS-signaling molecules form complexes with Ag⁺ and Cu²⁺ and that these complexes should be considered in studies involving soluble metal NMs. This also brings into question the role of QS-signaling molecules in environmental systems where cations are abundant.