A Novel Whole-Cell Bacterial Sensor Utilizing the Chemiluminescent Interactions between 3-Aminophthalhydrazide and Metalloproteins

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This study aimed to take a novel approach to bacterial detection using a the chemical, 3-aminophthalhydrazide, also known as luminol. An additional goal of experimentation was to attempt to isolate a lysis technique that was most effective in maximizing the chemiluminescence between luminol and the metalloproteins within the bacteria. A luminol solution was standardized with potassium ferricyanide to balance peak luminescence and solubility in order to maximize the efficiency of the chemiluminescent assay. The concentration of this solution, which was established at 0.06M, was used for the remainder of the study. This portion involved first isolating bacterium of preservative compounds and forming standard solutions and dilutions. Colony forming units were also derived by culturing the bacterial solutions. The solutions were then tested for chemiluminescence with luminol after control (no lysis), induced competency lysis, homogenization lysis, and freeze-thaw lysis. The results from this study point to the fact that luminol is an effective bacterial sensor. One limitation to this chemiluminescent detection technique was the relatively weaker light emissions when compared to the peak luminescence of the luminol reacting with ferricyanide. However, luminescence consistently increased as CFU/mL of the tested compound increased in all lysis techniques. Logarithmic regression performed on the data suggested that freeze-thaw lysis was the most effective lysis technique to maximize chemiluminescent interactions between bacterial metalloproteins and luminol. These findings, along with the cheaper cost of operation, serve to suggest that luminol could be used in a point-of-care treatment setting as well as in the field to test for the presence and amount of bacteria.

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