OPTIMIZATION AND CHARACTERIZATION OF THE BULK FDA VIABILITY ASSAY TO QUANTIFY LIVING PLANKTONIC BIOMASS

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by

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ABSTRACT

Optimization and characterization of the Bulk FDA viability assay to quantify living planktonic biomass

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The detection and quantification of viable aquatic biomass, especially of the microbial community, is a fundamental aspect of ecological, oceanographic, environmental and other specialized fields. The abundance and activity of aquatic microbial communities and how they change in space, time or in response to some environmental perturbation are subjects of significant research interest. Environmental management officials and technicians must quantify viable marine microorganisms in waste, gray, drinking and ballast water to determine if regulations are met. Unfortunately, few methods exist to assess viable biomass; those that do are often laborious, unreliable, expensive, qualitative rather than quantitative, or restricted to the measurement of a specific group of organisms. Moreover, the distinction between living and dead can be ambiguous for marine microorganisms, whether this distinction is made visually or via an indirect process, such as a chemical indicator. A need exists in scientific and public sectors to develop a convenient means to quantify the total, or bulk, viable biomass present in any water sample. A method for determination of total living biomass based on bulk fluorometric detection in simple optical reaction cuvettes has recently been developed (Welschmeyer and Maurer, 2013); the method, termed the Bulk FDA technique, is based on quantitative conversion of fluorescein diacetate (FDA) to the fluorescent product, fluorescein, by ubiquitous enzymes in living organisms. This thesis describes the optimization and characterization of the Bulk FDA technique. The optimized assay should prove useful in a wide range of academic and regulatory applications.