

DEVELOPMENT OF A COMPLEMENTARY CHEMILUMINESCENCE/HPLC  
METHOD FOR PREDICTING THE CHEMICAL FATE OF 1-BROMO-3-CHLORO-  
5,5-DIMETHYLHYDANTOIN UNDER AQUEOUS CONDITIONS

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## ABSTRACT

The quality of drinking water, particularly in developing countries, has been an ever-present concern in the United States and abroad, and has sparked a flurry of ongoing research both in water filtration technologies and oxidizing biocides. Various *N*-halamines and *N,N'*-halamines have been studied and tested for their effectiveness as water disinfectants, and results have shown that many of these compounds exhibit both bactericidal properties and antimicrobial activities. One microbial inhibitor, 1-bromo-3-chloro-5,5-dimethylhydantoin (BCDMH) is available in briquette-form, and is a ready addition to a water filtration system thereby offering an affordable water filtration technology that can be applied in remote areas, operate with no electricity, and be simple to operate and maintain. This feature is particularly applicable to areas where contaminated drinking water introduces a health hazard. Therefore, we became interested in the fate of BCDMH when subjected to the variety of conditions expected for well water treatment specific to the harsh conditions of Bangladesh.

We have developed complementary chemiluminescence/HPLC methods to monitor the decomposition of BCDMH under aqueous conditions similar to those of Bangladesh. We are able to quantify the appearance of dimethylhydantoin (DMH) by HPLC while also monitoring the decomposition of BCDMH by chemiluminescence.

The results show that both methods give good selectivity, linearity, and repeatability under pristine conditions, but added ingredients, such as those expected in Bangladesh water have an effect. The HPLC method produced results with smaller differences between different sample compositions. The chemiluminescence technique gave varied results based upon added metals and their oxidation states. Metals that are

readily oxidized, such as iron (II) and arsenic (III) give lower chemiluminescence readings. The combination of the two techniques gives insight as to the decomposition of the BCDMH and subsequent availability as an antimicrobial agent.

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## DEDICATION

I would like to dedicate this thesis to my husband, Chad Jones, whose sacrifices for my education have been many. Thank you.

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