

CALCIUM OXIDE REMEDIATION OF ANTHROPOGENIC CONTAMINATION OF WATER AT THE GBNERR IN MISSISSIPPI

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ABSTRACT

Grand Bay National Estuarine Research Reserve (GBNERR) is an important ecosystem in the Mississippi Gulf Coast. The GBNERR may be a potential source for contamination with anthropogenic bacterial pathogens that may play a significant role in the causation of waterborne human diseases. The objective of this study was to evaluate the interaction of physicochemical and microbiological water quality parameters at the GBNERR, determine quantitative levels and establish the potential for remediation of post-contamination of water and seafood by human fecal pollution from anthropogenic sources at the reserve. Water samples were collected aseptically from Bayous Heron, Cumbest, Point Aux Chenes Bay and Bangs Lake (Pine-O-Pine). Physicochemical parameters were determined using standard protocols. Eight bacteria/parasitic species including Cryptosporidium were concentrated from water samples by membrane filtration. Water samples were tested for the presence of traditional indicator microorganisms including: heterotrophic (HPC), total coliforms (TC), fecal coliforms (FC) and enterococcus (ENT) in CFU/ml concentrations. Mean values of temperature, specific conductivity, dissolved oxygen and pH were within acceptable levels in comparison to MDEQ, USEPA and the USGS standards during the time of investigation. However, the values of turbidity in Grand Bay water exceeded USEPA recommended levels in several occasions during the investigation. Data from this study indicates significant variability ($p < 0.0001$) in mean bacteria concentrations between sites. The data also indicates significant impact of Calcium oxide treatment in the remediation of post contamination and survival of pathogens from the GBNERR Bayous Heron, Cumbest and Pine-O-Pine when compared with control findings. The interaction of physicochemical and microbiological parameters of water through external chemical manipulation by Calcium oxide may provide utility in the remediation of post-contamination with anthropogenic pathogens such as *E. coli, Enterococci, Campylobacter, Vibrio, Giardia and Cryptosporidium*. Presence of high numbers of indicator bacteria suggest public health concerns for oyster and shellfish consumers as well as other water contact activities. Hence, control strategies should be developed and implemented to prevent or remediate any future contamination of the GBNERR waters citing the economic impact of such contamination on shell fish fishing activities on the reserve.

Keywords: Calcium Oxide, anthropogenic, water and foodborne disease, natural remediation, shellfish

INTRODUCTION

The United States Centers for Disease Control and Prevention has routinely conducted waterborne disease surveillance since 1971. Incidence of waterborne disease, related to outbreaks and non-outbreaks are significantly underreported because of the generally mild associated symptoms, short duration of illnesses, and lack of patient reporting to a physician, among other factors. Waterborne illness outbreaks are not common in the U.S., but they do still occur and can lead to serious acute, chronic, or sometimes fatal health consequences, particularly in sensitive and immunocompromised populations. From 1971 to 2002, there were 764 documented waterborne outbreaks associated with drinking water, resulting in 575,457 cases of illness and 79 deaths; however, the true impact of disease is estimated to be much higher. Current protocols in municipal water treatment are effective if applied properly, but it was noted that frequent waterborne disease outbreaks occur due to inadequate, interrupted, and intermittent treatment. Contamination of water resources is not uniformly distributed, but their influences are rather affected by the number of bacteria to which humans are exposed. Contaminated water plays an important role in the transmission of bacteria to humans from humans, animals, and sewage sources leading to the ingestion of water contaminated with zoonotic agents [1-8].

Water quality is affected by a combination of natural factors (e.g. precipitation, temperature, bedrock, soil, terrain) and anthropogenic factors (e.g. agricultural practices, domestic wastewater/industrial influent). Anthropogenic and natural factors affect water quality and the changes in temporal and spatial relationship will determine improvements in water quality management efforts. From a microbiological perspective, the quality of treated water can deteriorate as a result of excessive