

SODIUM BICARBONATE REMEDIATION OF ANTHROPOGENIC CONTAMINATION OF WATER AT THE GBNERR IN MISSISSIPPI

Ibrahim O. Farah, Willis O. Lyons, Zikri Arslan, Gloria Miller, Hamed Benghuzzi, and Paul B. Tchounwou

Department of Biology, Jackson State University, Box 18540, Jackson, MS 39217, and the University of Mississippi Medical Center, Jackson, MS 29216, USA.

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 bacterial species including Campylobacter 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 Sodium bicarbonate 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 Sodium bicarbonate 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 at the reserve.

Waterborne diseases threaten human health in spite of modern techniques of disinfection, sanitation, and water purification. For all living organisms, water is the most vital and important element for survival. Monitoring the microbiological quality of water is essential for ensuring the safety of commercial drinking water for all populations especially those in under-developed and even developing countries. The use of accurate, fast, reliable, sensitive, and specific diagnostic methods in water purification can influence the remediation of microbial pathogens in potable water and bottled drinking water [1-3]. Studies showed that ingestion of water contaminated with coliforms such as *Escherichia coli* (*E. coli*), *Salmonella* species (*Salmonella* spp.), and *Vibrio cholerae* (*V. cholerae*) can create serious complications including diarrhea, enteritis, and death; leading to high economic losses. *Salmonella* spp., *V. cholerae,* and *E. coli* are classified as zoonotic agents and are ubiquitous in nature. Humans, animals, and sewage can be sources of these bacteria, and contaminated water plays an important role in transmission of bacteria to humans [4-7].