CSREES National Water Quality Program

Project Title: **Ultraviolet Light Disinfection of Drinking Water: An Alternative to Chlorination**

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Institution/Agency: Florida A&M University

State: FL **(EPA) Region:** 4 **Theme:** Drinking Water and Human Health

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Summary:
Effectiveness of ultraviolet (UV) light to disinfect drinking water was studied under controlled laboratory conditions. Pathogenic waterborne bacteria Escherichia coli, Salmonella typhi, Shigella flexneri, and Streptococcus faecalis suspensions of estimated bacterial count of 1 x 105 to 1 x 106 colony forming units (CFU) per millimeter were exposed to UV light at 254 nm. The bacteria were suspended in 5 cm depth of sterile water, and exposed to UV light for 20, 10 and 5 seconds. Bacterial suspensions containing turbidity ranging from 0 to 160 Nephelometric Turibidity Units (NTUs) were exposed to UV light for 20, 10 and 5 seconds at 5 cm depth of water. Bacterial kill was measured as a function of the dose of the germicidal UV light. Bacterial growth population was estimated by serial dilution, plate count and membrane filter methods. UV light irradiation reduced bacterial count from 1.8 x 107, 1.2 x 107, 2.2 x 107 CFU mL-1, and colonies too numerous to count of E. coli, S. flexneri, S. typhi and S. faecalis, respectively,to non detectable levels. UV light irradiation had an average kill of 42% when the bacteria were exposed for 5 seconds in water with turbidity of 100 NTUs, 46% kill at 10 seconds exposure, and 57% kill when the exposure time was extended to 20 seconds. A 100% kill was observed at 5 seconds exposure in water containing an average of 25 NTUs. A 100% kill was observed at 10 seconds exposure in water containing an average of 55 NTUs, and in water containing an average of 60 NTUs at 20 seconds exposure to UV light. Increased levels of turbidity had a negative effect of reducing the true UV light dose reaching targeted organisms, thus reducing DNA damage and subsequent disinfecting effectiveness. Photoreactivation study with visible light from a fluorescent lamp was carried out with all of the bacteria. There was no evidence of photoreactivation for the evaluated bacteria species after exposure to visible light for 24 hours.