

A NOVEL METHOD FOR THE DEACTIVATION OF *ENTEROCOCCUS FAECALIS*, *STAPHYLOCOCCUS AUREUS*, AND *ESCHERICHIA COLI*

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The development of new techniques for the reclamation of water is a long standing environmental and public health issue. It has been found that water related diseases account for a major part of the morbidity and mortality worldwide. The World Health Organization (WHO) reported that in 2000, 1.1 billion people still lacked access to safe water sources, of these 86% are located in rural areas. A pathogenic condition such as diarrhea accounts for about 4 billion cases per year and is responsible for approximately 2.2 million deaths, mostly among children under five years old. *E. faecalis*, *S. aureus* and *E. coli* has been closely linked to the development of pathogenic conditions such as meningitis, endocarditis, diarrhea, and several forms of nosocomial surgical infections. Costing in excess of \$500 million dollars in treatment options, bacterial resistant infections are becoming a major health concern. Additionally, these bacteria have well-characterized heat and drug resistant mechanisms. Previous studies have shown that *E. faecalis*, *S. aureus* and *E. coli* are now becoming resistant to several therapeutic agents. The aim of this project is to determine if the addition of low levels of metal ions such as, copper, zinc, manganese, aluminum, and silver, can enhance the deactivating effects of dielectric heating of *E. faecalis*, *S. aureus* and *E. coli* (Wards Natural Scientific, Rochester, NY). Previous research has suggested that thermal and chemical stressors work via similar but not the same stress mechanisms, therefore it is proposed that, the coupling of both thermal and chemical process will work synergistically to deactivation of *E. faecalis*, *S. aureus* and *E. coli*. To test this hypothesis *E. faecalis*, *S. aureus* and *E. coli* were placed in a solution containing various metal ions (copper, zinc, manganese, aluminum, and silver) for an hour period and then exposed to multimode microwave heating using a Panasonic Inverter Microwave (model #NN-S543BF) for a period of 3 minutes at 130 Watts. The results suggest that certain metal ions do can enhance the deactivation of *E. faecalis*, *S. aureus* and *E. coli* when coupled to dielectric heating using microwave radiation. Concentration of 1×10^{-6} M of metal ions such as aluminum, zinc and manganese were able to significant deactivate *E. faecalis* *S. aureus* and *E. coli* up to a concentration of 5×10^{-8} CFU. Copper and silver ions also appear to significantly deactivate *E. faecalis* without the need for microwave heating at 1×10^{-6} M concentration.