A novel method to inactivate fecal coliforms in aqueous solutions, using a stream of hot air bubbles, without heating the solution above about 50°C, was studied in this work. Initially, it was found that at high salt concentrations (e.g. 0.15 M NaCl), where bubble coalescence is inhibited, modest but consistent coliform inactivation rates were obtained for a range of fecal coliform contamination levels. That is, the coliform densities drop at a rate of 4% per min over the range 550–14,000 CFU/100 mL. More importantly, an analysis of the likely mechanisms involved in the inactivation process led to the use of lower level salt concentrations, targeted specifically at a reduction in the repulsive interaction forces between typical coliforms and hot air bubbles, rather than at bubble coalescence inhibition. The results obtained support the view that surface forces can strongly influence the coliform inactivation rate and that the addition of low concentrations of, for example, CaCl₂, can increase inactivation levels by more than 1,000 times, without affecting bubble coalescence and bubble size.

Keywords: Thermal inactivation; Low temperature inactivation; Sewage treatment; Bubble coalescence; Surface forces; Electrical double layer forces; Van der Waals forces