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Using Male Specific RNA Coliphages as Indicators of Faecal Contamination in Surface and Groundwater of Rural Bangladesh

Though significant attempts were made in the 1960s to improve water quality and sanitation in Bangladesh, diarrheal morbidity remains a prevalent problem in the region. The persistence of this problem is related to high levels of fecal pollution present in drinking water. In order to test drinking water for harmful faecal pathogens, scientists use indicator organisms. The goal of this study was to examine the effectiveness of using male specific RNA coliphages as indicator organisms in surface and ground water from rural Bangladesh. Samples were collected from two canals, eight ponds and forty-nine shallow groundwater wells from the village of Bara Haldia, Matlab Upazilla, Bangladesh during the monsoon season in July and August 2009. A filtering plating method was developed to enumerate bacteriophages from the water samples collected. Coliphage concentrations were calculated using the number of plaque forming units (pfus) and the volume of water plated. Using this method, bacteriophages were found in 46.93% of groundwater and 100% of the surface water samples tested with a minimum detection limit of 0.5 pfus/ 30 ml. Mapping of the groundwater coliphage concentrations indicated spatial correlation and the log transformed concentrations with a Gaussian model had a nugget ratio of 0.46 and a spatial range of 320m. These results indicate a uniform recharge source for the coliphage that could be related to population and latrine density. The coliphage data are not correlated with E. coli concentrations or groundwater chemistry including arsenic, chloride, ammonia, bromide, and nitrate. The lack of correlation with E. Coli is interesting and signifies that different processes control the distribution of viral and bacterial pathogens. Experiments with tubewell hand pumps indicate that while E. Coli form biofilms in the pumpheads, whereas coliphage do not survive in hand pumps. Furthermore, E. Coli distribution shows little to no spatial correlation. In summary, our work indicates it is possible to use FRNA coliphages as indicator organisms in the field in Bangladesh as they may accurately represent patterns of recharge.