

2000 US SJWP Winner's Abstracts

Correlating Residual Antibiotic Contamination in Public Water to Drug-Resistant *Escherichia coli*: Is Remediation an Option?

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Abstract

Purpose: (A) Determine the presence of antibiotics Penicillin, Tetracycline and Vancomycin along a 44 km stretch of the Ohio River and two tributary streams. (B) Test in-situ bacteria from each of the test sites for acquired drug resistance. (C) Determine the viability of selected methods of remediation.

Methods and Materials: (A) Water samples from seven outdoor locations were collected regularly, over a ten-week period, as well as single samplings of tap water from each of the three municipalities adjacent to the river. Levels of antibiotic concentrations in the samples were determined utilizing gel electrophoresis, resulting in 1050 values of river and stream water data and 135 values of tap water data, upon which standard deviations and confidence levels were determined. (B) *Escherichia coli* samples isolated from test sites were subjected to the Kirby-Bauer Disk Sensitivity procedure to determine the level of bacterial resistance to Penicillin, Tetracycline and Vancomycin. In all, 28 dish cultures were studied for sensitivity to the three antibiotics, with measurable data submitted to a line of the best fit statistical analysis to determine correlation coefficients. (C) Three PVC filtrate-packed cylinders were utilized to test the efficacy of mixtures of sterile sand, *Saccharomyces cerevisiae* culture (Brewer's Yeast) and ground activated charcoal as filters for each of the three antibiotics in question. Standard deviations and confidence levels were determined for the resulting 135 values.

Observations: (A) All river and tributary sites yielded detectable amounts of the three test antibiotics in concentrations ranging from 0.7 – 5.9 parts per trillion. Lesser amounts were detected in tap water. (B) All *E. coli* samples cultured from river and tributary sites exhibited acquired antibiotic resistance. Analysis indicated that the greatest acquired resistance appeared in the samples containing the highest level of antibiotic contamination. (C) Water samples, which passed through packed columns of sand (the primary filtrate media used by municipalities in the mid-Atlantic region of the United States), saw no reduction in antibiotic contamination. Columns packed with a sand/activated charcoal mixture removed 93.3% of Vancomycin, 96.0% of Tetracycline and 77.1% of Penicillin concentrations.

Conclusions: The presence of antibiotic contamination in American waterways results in a progressive resistance among some bacteria to those same antibiotics that once controlled them. Some remedial filtration techniques have

shown themselves to be effective, but there is further need for both study and action toward a more responsible utilization of antibiotics if these pharmaceuticals are to continue to be effective.

Consider quality of life and health in the absence of pharmaceutical breakthroughs such as Penicillin, Tetracycline and Vancomycin. This research may serve as a warning that the benefits of antibiotic drugs are gradually being neutralized, with the bacteria that survive non-lethal exposures to these former wonder-drugs developing into far more powerful versions of their former incarnations. A more responsible approach to prescription and utilization of antibiotics is necessary to enable medical science to maintain control of these microbial threats to public health.