Transport behavior of E. coli varies depending on manure source

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Escherichia coli is a commonly used indicator organism for detecting the presence of fecal contamination in drinking water supplies. The importance of *E. coli* as an indicator organism has led to several studies looking at the transport behavior of this important microorganism in groundwater environments. Commonly only a single strain of *E. coli* is used in these studies, yet research has shown that a significant amount of genetic variability exists among strains of *E. coli* isolated from different host species and even from the same host species. If these genetic differences result in differences in cell properties that affect transport, different strains of *E. coli* may exhibit different rates of transport in the environment.

A scientist at the USDA-ARS Animal Waste Management Research Unit in Bowling Green, Kentucky, in collaboration with researchers at the University of California at Riverside, compared cell properties and transport behavior of 12 different *E. coli* isolates obtained from six different fecal sources. Results from this study were published in the March-April issue of Journal of Environmental Quality.

For all 12 *E. coli* isolates, the following cell properties known to affect bacterial transport in the environment were measured: surface charge, hydrophobicity, cell size and shape, and the composition of the extracellular polymeric substance. Transport behavior of the *E. coli* isolates was assessed by measuring the amount of cells that were able to pass through columns packed with clean aquifer sands. The measured breakthrough concentrations of the bacteria were then modeled so that transport parameters for each *E. coli* isolate could be estimated. Correlations between measured cell properties and transport parameters were investigated.

Although each *E. coli* isolate was subjected to the exact same storage and growth conditions, the researchers observed a large range in measured cell properties, bacterial recovery, and fitted transport parameters for the different isolates. For example, cell hydrophobicity and surface charge were observed to vary by over an order of magnitude for the 12 different *E. coli* isolates. The total amount of bacteria passing through the sand columns ranged from less than 2% for one of the horse isolates to 95% for one of the beef cattle isolates and the fitted model parameters ranged by a factor of 50 for the different *E. coli* isolates. The only cell property observed to be statistically correlated with transport behavior of the *E. coli* isolates was cell width.

Carl Bolster, the lead scientist on the study, stated "This diversity in transport behavior must be taken into account when making assessments of the suitability of using *E. coli* as an indicator organism for specific pathogenic microorganisms in groundwater. In addition, our results suggest that the modeling of *E. coli* in the environment will likely require a distribution of bacterial attachment rates, even when modeling *E. coli* movement from a single fecal source."

Research is ongoing at USDA-ARS and UC Riverside to investigate the range in diversity in cell properties and transport behavior of *E. coli* under a variety of different experimental conditions; these include different growth conditions and types of sediment. Further research is needed to identify cell properties controlling *E. coli* transport in the environment.

More information: jeq.scijournals.org/cgi/content/abstract/38/2/465

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