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MICROBIAL SOURCE TRACKING (MST) ANALYSIS

DIFFERENTIATION OF FAECAL SOURCES IN WATERWAYS AND CATCHMENTS

Risk assessment of drinking water supplies for the likely occurrence of pathogenic organisms has for many years focused on the detection of total coliforms, faecal coliforms and more recently *E. coli* as the primary indicator of potential faecal contamination. However, outbreaks have occurred in the absence of these microbial indicators, thus highlighting the need for a multifaceted approach for risk assessment in drinking water supplies.

Microbial Source Tracking (MST) combines physical, chemical and biological diagnostic tests to characterize the level and source of potential faecal contamination. One facet of MST uses molecular techniques to detect specific markers of faecal contamination in the environment. These molecular markers were developed to differentiate human from animal strains of the bacterial group *Bacteroides*.

ALS Water Resource Group, in conjunction with several Melbourne water utilities and the Victorian Smart Water Fund, has examined human- and animal-specific MST methods using *Bacteroides* markers. The *Bacteroides* MST tests can be used to give a qualitative assessment of the likelihood of human or animal faecal contamination being present. These methods can be applied in a variety of situations; such as determining pathogen hazards to bathers in recreational waters, evaluate of source waters for treatment, or tracing the origins of contamination in catchment studies.

METHOD INFORMATION

ALS METHOD CODE

MST 1, 2, 3

LEVEL OF REPORTING

E.coli: <1 cfu/100mL	Enterococci: <1 cfu/100mL
Turbidity: 0.1 NTU	Bacteroidales: <1 ME per L
Ammonia: 0.01mg/L	Campylobacter: P/A
Salmonella: P/A	pH: 0.01
Norovirus G2: P/A	Adenovirus type F: P/A
Waterfowl: <1 ME per L	Gull: <1 ME per L

METHOD REFERENCE

NATA Accredited & In-house

Urban storm water site examined using MST suite in the recent Smart Water Fund study.

WHY USE MICROBIAL SOURCE TRACKING?

MST can provide valuable information when investigating water supplies and catchment areas.

- Human faecal contamination poses a greater risk to human health than contamination from other faecal sources; MST used on supply sources can assist in determining the scale of response required when indicator bacteria are detected.

- Urban storm water used as fit-for-purpose applications requires varying levels of treatment. Determining the level of treatment entails assessment of the hazards involved; with pathogen hazards related to the origin of contamination.

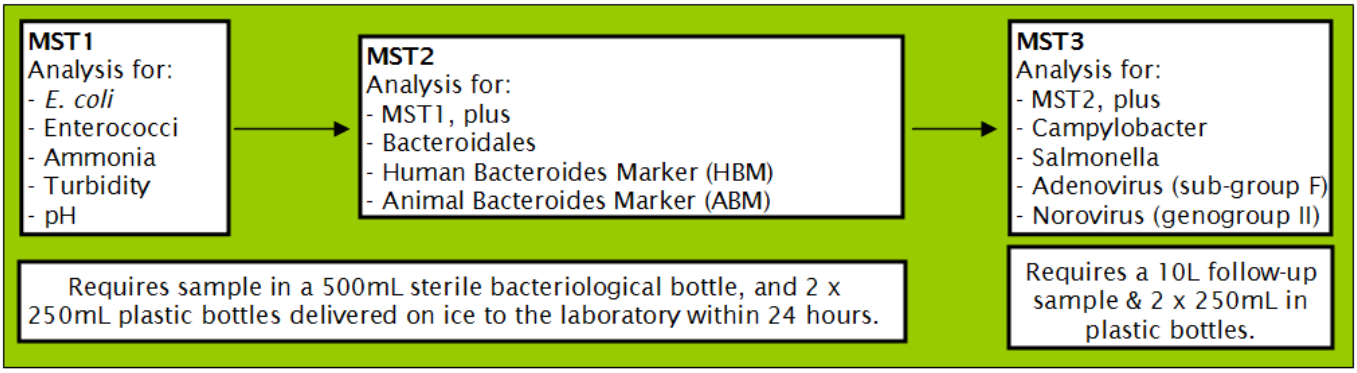
- Catchment studies frequently require identification of sources of sporadic contamination, enabling remedial action and protection of supply.

- Environmental waters used for recreation or aquaculture are frequently located in sites sensitive to the impacts of sewage pollution. MST can be used in site risk assessment and in the investigation of contamination incidents in these locations.

- MST techniques based on *Bacteroides* are starting to be utilized for major expenditure decisions and regulatory action regarding sewage disposal in the United Kingdom; substantial studies using these methods are taking place around the world.

MST: A TIERED APPROACH

ALS can evaluate water samples from catchments and various waterways for the likelihood of different sources of contamination. Investigations have proven that a tiered approach is most applicable when using MST methods. This involves initially performing a suite of routine water quality tests (MST1), to screen sites and identify locations requiring further investigation using the *Bacteroides* parameters (MST2). The analytical data from the range of tests are then used to interpret the results. This approach is outlined below.



This tiered approach ensures a cost-effective screening of a large number of sites by MST1, or using historical data (if available), before site-specific evaluation with MST2. Further investigation by MST3 can elucidate those sites with conflicting results, significant variation over time, or where source waters are highly variable (e.g. storm water).

Key parameters in the MST1 suite (Turbidity, Ammonia, *E. coli* and Enterococci) are assigned a threshold, which when exceeded, could trigger further testing by weighting of the parameter according to its correlation with Bacteroides tests. The weighted values are then added together for each site and scores are ranked as low, medium and/or high risk of faecal contamination.

The *Bacteroides* tests in the MST2 suite require a relatively small volume of sample, which is stored while awaiting results of the MST1 suite. *Bacteroides* analysis is performed using recently published* quantitative polymerase chain reaction methods. Further research is currently underway expanding the range of the MST2 parameters. These new targets identify avian sources of faecal contamination.

Interpretation of analytical results is essential in MST. Utilising the experience from the wide range of sites examined in the Smart Water Fund study, ALS supplies interpretation of MST results, grouping by the likelihood of fecal contamination (low, medium or high) and for each potential source examined (currently human, animal and avian).

MST analysis and interpretation is a new addition to ALS services which has wide ranging applications throughout the water industry. For further details please contact pathogens@alsglobal.com

REFERENCE

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