LUPINE PUBLISHERS
Open Access

Concepts of Dairy & Veterinary Sciences

DOI: 10.32474/CDVS.2018.01.000103

ISSN: 2637-4749

Mini Review

Microbial Source Tracking Markers for Detection of Faecal Contamination in Environmental Waters

Asima Zehra* and Maliha Gulzar

School of Public Health and Zoonoses, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India

Received: April 06, 2018; **Published:** April 10, 2018

***Corresponding author:** Asima Zehra, School of Public Health and Zoonoses, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India

Mini Review

Microbial source tracking (MST) describes a suite of methods and an investigative strategy for determination of faecal pollution sources in environmental waters. They rely on the association of certain fecal microorganisms with a particular host, that ranges from human [1] to agricultural animals [2,3] to pets [4] and wild animals such as gulls [5]. MST is used to appraise recreational water quality and to correlate with human health risk.

Many MST publications fixate mostly on human source contamination, as this has been an issue of concern for managers and regulators. Human sewage pollution is among the greatest concerns especially in India [7,8] for human health due to [1] the known risk of exposure to human waste and [2] the public and regulatory will to reduce sewage pollution. However, methods to identify animal sources are receiving increasing attention as our understanding of zoonotic disease potential improves.

Numerous epidemiological studies of waterborne illness in countries like India indicate that the common aetiological agents are bacteria, viruses and parasitic protozoa and the coliform presence is an important parameter for determining water pollution levels. But the presence of coliforms of soil and litter origin had raised doubt about their reliability as an indicator of the pathogen [6]. Also, the method used for coliform estimation is not precise. Hence CPCB believes that BOD is the single most reliable parameter. Based on this approach the CPCB estimated that 67% of river stretches in India is relatively clean with BOD less than 3 mg/litre. Also, poor correlations have been reported between waterborne human viruses or protozoa and thermotolerant coliforms [6,9,10]. In contrast to MST markers, faecal coliforms provided a poor metric to assess risks of exposure to faecal contamination of human origin in the rural setting in India [9]. Such a situation is critical to understand, as evident from recent drinking water outbreaks where coliform standards were met [11] and in India most of the outbreaks go unnoticed. FIB concentrations have not been well correlated with pathogens in many studies [10]. Furthermore, many epidemiology studies have failed to find a correlation between human health outcomes and FIB levels, particularly when the pollution is not from a known point source such as a wastewater treatment plant (WWTP) [14,15]. Nonetheless, water regulatory agencies have yet to come to terms with the inherent problems resulting from reliance on faecal indicator bacteria as currently determined. Fortunately, new index organisms for some pathogens look promising like C. perfringens, phages and viruses like Adenoviruses. As these index organisms are relatively untested worldwide, extensive trials are necessary before their general acceptance in microbial risk assessment. It should be noted that useful index organisms in one system are not necessarily of value in a different environment.

Use of multiple tests increases the surety of presence or absence of water pollution. In particular, it has been reported that at least two parameters are needed to accurately differentiate between two distinct faecal pollution sources: one specific indicator that identifies the source and another, a universal indicator that provides information on the faecal load [12]. In consequence, the indicators should be carefully selected based on appropriate statistical analyses. Persistence studies are needed to provide complementary information, addressing the effects of environmental aspects like temperature, solar radiation, salinity, pH, chemical pollutants, water filtration, turbidity, starvation, predation and presence of heavy metals, among others.

Other relevant issues are the use of methods based either on genomic targets or in the quantification of new microbial tracers through library-independent methods, the combination of methods, and comparative and integrated studies between research groups with standardised procedures to avoid differences in implementation. Also, in order to increase the validity of MST methods, it is necessary to consider temporal variability when designing the sampling scheme of the source material and constructing source libraries and increase the specificity and field

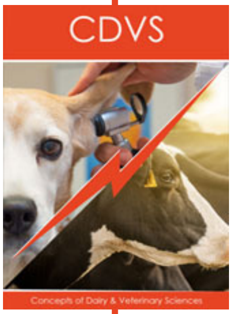
Citation: Asima Z, Maliha G. Microbial Source Tracking Markers for Detection of Faecal Contamination in Environmental Waters. Con Dai & Vet Sci 1(1)- 2018. CDVS.MS.ID.000103. DOI: 10.32474/CDVS.2018.01.000103.

testing of DNA-based markers. The number and range of potential host sources included in MST studies must be deliberately chosen to suit the water body and particular questions associated with it [13].

References

1. Mc Quaig SM, Scott TM, Harwood VJ, Farrah SR, Lukasik JO (2006) Detection of human derived fecal pollution in environmental waters by use of a PCRbased human polyomavirus assay. Appl Environ Microbiol 72(12): 7567-7574.
2. Shanks OC, Atikovic E, Blackwood AD, LuJ, NobleRT, et al. (2008) Quantitative PCR for detection and enumeration of genetic markers of bovine fecal pollution. Appl Environ Microbiol 74(3): 745-752.
3. Weidhaas JL, Macbeth TW, Olsen RL, Sadowsky MJ, Norat D, et al. (2010) Identification of a Brevibacterium markergene specific to poultry litter and development of a quantitative PCR assay. J Appl Microbiol 109(1): 334-347.
4. Kildare BJ, Leutenegger CM, Mc Swain BS, Bambic DG, Rajal VB, et al. (2007) 16S rRNAbased assays for quantitative detection of universal, human, cow, and dog specific fecal Bacteroidales: a Bayesian approach. Water Res 41(16): 3701-3715.
5. Lu J, Ryu H, Hill S, Schoen M, Ashbolt N, et al. (2011) Distribution and potential significance of a gull fecal marker in urban coastal and riverine areas of Southern Ontario, Canada. Water Res 45(13): 3960-3968.
6. Ministry of Environment & Forests, Govt. of India. (2002) Water quality in India - status and trend (1990 - 2001). Delhi: Central Pollution Control Board 1-20.
7. JM Mauskar (2008) Evaluation Of Operation And Maintenance Of Sewage Treatment Plants In India-2007 (PDF). Central Pollution Control Board, Ministry of Environment & Forests.
8. Water Quality Database of Indian Rivers, MoEF (2009) Retrieved 15 September 2016 Central Pollution Control Board, India, Annual Report 2008–2009 (PDF). Central Pollution Control Board, Ministry of Environment & Forests, Govt of India.
9. Schriewer A, Wuertz S, Misra P, Clasen T, Panigrahi P, et al. (2015) Human and Animal Fecal Contamination of Community Water Sources, Stored Drinking Water and Hands in Rural India Measured with Validated Microbial Source Tracking Assays. The American Journal Of Tropical Medicine And Hygiene 93(3): 509-516.
10. Harwood VJ, Levine AD, Scott TM, Chivukula V, Lukasik J, et al. (2005) Validity of the indicator organism paradigm for pathogen reduction in reclaimed water and public health protection. Appl Environ Microbiol 71(6): 3163-3170.
11. Marshall MM, Naumovitz D, Ortega Y, Sterling CR (1997) Water borne protozoan pathogens. Clin Microbiol Rev 10(1): 67-85.
12. AR Blanch, Lluís Belanche-Muñoz, Xavier Bonjoch, James Ebdon, Christophe Gantzer, et al. (2006) Integrated analysis of established and novel microbial and chemical methods for microbial source tracking. Appl. Environ. Microbiol 72(9): 5915-5926.
13. Harwood VJ, Stoeckel DM (2011) Performance criteria. Microbial Source Tracking: Methods, Applications and Case Studies 7-30.
14. Dwight RH, Baker DB, Semenza JC, Olson BH (2004) Health effects associated with recreational coastal water use: urban versus rural California. Am J Public Health 94(4): 565-567.
15. Colford JM, Wade TJ, Schiff KC, Wright CC, Griffith JF, et al. (2007) Water quality indicators and the risk of illness at beaches with nonpoint sources of fecal contamination. Epidemiology 18(1): 27-35.

DOI: 10.32474/CDVS.2018.01.000103



Citation: Asima Z, Maliha G. Microbial Source Tracking Markers for Detection of Faecal Contamination in Environmental Waters. Con Dai & Vet Sci 1(1)- 2018. CDVS.MS.ID.000103. DOI: 10.32474/CDVS.2018.01.000103.