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Impact of Different Land Uses on the *Escherichia coli* Concentrations, Physical and Chemical Water Quality Parameters in a Tropical Stream

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ABSTRACT

Rural streams are important source of water for the nearby communities. However, bacterial contamination from agriculture and human settlement may render the water unsuitable for drinking and body contact recreation. Hence, the objective of this study was to determine the impact of different land uses such as animal farming and human settlement on *E. coli* concentrations in the Serin River, a tropical stream. Samplings were conducted at 9 stations from September 2009 to March 2010. Results showed that *E. coli* concentrations ranged from 2,000-6,900,000 CFU/100 mL with *E. coli* concentrations in fish aquaculture water exceeding the WHO standard. Animal and crop farming stations showed the highest *E. coli* concentrations in the tributaries. Re-suspension from stream sediment and non-point sources such as runoff contributed to the high concentrations observed in the main river. Multiple linear regressions indicated that total suspended solids and dissolved oxygen were significant water quality parameters and they explained 68.1% of the total *E. coli* variations observed.

Keywords**:** Animal farming, agricultural run-off, total suspended solids, dissolved oxygen, tropical stream

INTRODUCTION

Microbial contamination of surface water in different parts of the world potentially limits the usage of surface water for drinking and recreational purposes. Animal farms, agriculture and domestic sources have been reported to impact the fecal bacteria concentrations downstream (Hyland *et al.* 2003; Pappas *et al.* 2008). In Canada, high fecal coliforms and *E. coli* counts have been reported in drainage of agricultural lands and a decrease in fecal coliforms and *E. coli* counts was recorded after wastewater treatment plants was upgraded with the installation of UV disinfection system (Hyland *et al.* 2003). In Malaysia, major source of organic contamination in Malaysian rivers were caused by continual discharge of untreated or partially treated waste from human and pigs (Muyibi *et al.* 2008). Animal wastes have been known to harbour pathogenic organisms that could cause water-related infectious diseases such as dysentery, cholera, gastroenteritis, salmonellosis and typhoid fever (Bitton 1994; Maier *et al.* 2009). According to Mara & Horan (2003), animal wastes such as pig's faeces could contain *E. coli* concentration of up to 10^6 *E. coli* per gram of pig's faeces and daily load *E. coli* of 10^9, while *E. coli* concentration in sewage and sewage effluent could harbour up to 10^3-10^7 per 100 mL respectively. Thiagarajan *et al.* (2007) had reported that application of dairy manure on field drainage sites produced annual *E. coli* loads of 4.1-5.5 X 10^{10} CFU/ha. The timing of manure application had effect on run-off of *E. coli* concentration where heavy rainfall can increase transport of *E. coli* from land surface to water body (Shehane *et al.* 2005). Faecal coliforms are commonly used as an indicator for faecal contamination in the river (Ham & Kobori 2009). In recent years, *E. coli* has substituted faecal coliforms as the ideal indicator organism because it is easier to distinguish than other faecal coliforms and have a high occurrence rate in faeces (Baudisova 1997; Edberg *et al.* 2000; Garcia-Armisen & Servais 2004; Tallon *et al.* 2005; Mishra *et al.* 2008).

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