SURVIVAL OF AN INDICATOR BACTERIA IN SOIL: EFFECT OF TEMPERATURE AND MOISTURE

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ABSTRACT

Soil is a natural digestion system for animal waste. However, land disposal sites and agricultural land pose serious threat to the quality of surface and groundwater. In this study, a clay loam from Sarawak was inoculated with wild strain *E. coli* isolated from animal waste. Results indicated that first order decay rate increased as temperature increased from 25 °C to 35 °C and as moisture decreased from saturation to air-dry. Lag period of the bacteria was found to be the longest (8 days) in saturated soil at 25 °C and the shortest (1 day) in air-dry soil at 35 °C. Interaction between temperature and moisture was significant. First order decay model can be used after lag period to estimate *E. coli* decay. It fit the data the best in cool wet condition. It is recommended that disposal of animal waste be carried out during hot dry season of the year.

INTRODUCTION

As animal production increases to meet the demand of meat, animal waste also increases in quantity. Due to a lack of alternative uses, the land remains the primary means of waste disposal. Land disposal sites and agricultural land pose a serious threat to the quality of river water and groundwater as well as the soil itself (Pell 1997). Studies have shown that rivers and ground water that receive runoff or seepage from agricultural land has high fecal bacteria concentrations (Buckhouse and Gifford 1976; Niemi and Neimi 1991).

E. coli is the predominant fecal coliform used as a specific indicator of possible fecal contamination. Factors affecting the survival of fecal bacteria in soil include physical and chemical factors of soil such as pH, porosity, organic matter content, particle size distribution, moisture content, adsorption, and temperature and biological factors such as competition from indigenous microflora, antibiotics and toxic substances (Crane and Moore 1986).

To better manage animal waste to protect soil and water resources, the survival of fecal bacteria has to be known. Few studies were conducted to investigate the effect of soil moisture on bacterial die-off (Boyd et al. 1969). Increasing temperature increases bacterial die-off (Howell et al. 1996). Even though the individual effect of temperature and moisture has been investigated, interactive effects of these factors has not been studied.

Linear first order decay model is frequently used to model bacteria die off in the environment (Chick 1908; Crane and Moore 1986). The objective of this study were to determine the individual and interactive effect of temperature and moisture on the decay rate of *E. coli* in the selected soil and to determine if first order decay model is a good representation of *E. coli* decay.

MATERIALS AND METHODS

Soil

The soil used was sampled at the foothill of Gunung Serambu in Siniawan, Sarawak. Topsoil was collected using a shovel and the location of the sampling site was determined by a GPS (Magellan Promark). The soil sample was air-dried and sieved through a 2 mm pore sieve. Saturated water