

Quantifying Pollutants from Household Wastewater in Kuching, Malaysia

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Abstract: In Malaysia, septic tank effluents were discharged into rivers. However, knowledge on quantity of household wastewater pollutants was incomplete. Therefore, water consumption, wastewater flow and pollutants concentrations and loadings were investigated. The residential areas studied were the high income area of De Summit Condominium (DS), medium income areas of Tabuan-Jaya (TJ) and Taman Satria-Jaya (TSJ) and low income areas of RPR Batu-Kawa (RPR) and Taman Malihah (TM). Results indicated that wastewater flows ranged from 95-122 L/c/d which were 33-67% of the water consumption rates. DO and BOD₅ ranged from 0.7-4.4 mg/l and 67-135 mg/L respectively. Nitrate-nitrogen was the highest at DS (0.19 mg/L). Reactive phosphorus ranged from 4.4-12.7 mg/L. In all areas, *E. coli* ranged from 10⁶-10⁷ cfu/100mL. Mean loadings of BOD₅, reactive-phosphorus, nitrate-nitrogen and *E. coli* were found to be 8-14 g/c/d, 0.6-1.0 g/c/d, 4.3-9.6 mg/c/d and 3.3-7.2x10⁹ CFU/c/d respectively. Reactive phosphorus loading was 1.6 times higher in the low income areas (RPR and TM) when compared to the other areas. With the area population of 44,515, 10x10⁶ L/d of water was consumed, 5x10⁶ L/d of wastewater produced contributing to 511 kg/d of BOD₅, 31 kg/d of reactive phosphorus, 1.8x10¹⁴ *E. coli*/d to surface water around Kuching.

Key words: Household wastewater • Water quality • Sewage • Wastewater treatment

INTRODUCTION

Discharge of household wastewater into surface water may present a variety of concerns such as high biochemical oxygen demand, significant nutrient inputs, high suspended solids, ecosystem disturbance and health hazard due to potential pathogens. Household wastewater consists of as black water (urine and faeces) and grey water from the kitchen, bathroom and washing machine. Studies of household wastewater generation in England and Malta showed that wastewater was high in organic matter, ortho-phosphorus and ammonia [1]. Most studies of household wastewater focused on chemical parameters but not the microbial parameters [1-3].

Kuching, being the capital city of Sarawak with relatively more job opportunities and educational facilities is growing rapidly. As the population increases, household wastewater discharges also increase resulting in an increasing pressure on the natural cleansing ability of the rivers. In the city, individual septic tank is the most common form of sewerage system for most of the residential areas. The septic tank effluents were typically discharged into municipal storm drains. However, septic

tank was reported to be ineffective in reducing nutrients loading of wastewater [4]. In a pilot study of the Danish Cooperation for Environment and Development (DANCED) in collaboration with Natural Resources and Environment Board (NREB) Sarawak through the Sustainable Urban Development Project, household wastewater was identified the most significant source of pollution of the Sarawak River fronting Kuching City [5]. It was the first attempt to identify the most significant sources of pollution and the quantity of wastewater flow in Kuching City. However, water quality parameters such as dissolved oxygen, nitrate, phosphate and *E. coli* were not included in the investigation [5]. Health effects criteria signify that swimming in marine waters of as few as 10 *E. coli*/100ml is risky [6]. *E. coli* is one of the coliform bacteria commonly found in the intestinal tract of warm-blooded animals. It is more representative of faecal contamination than other coliforms. Each person discharges 100-400 billion coliform organisms per day, in addition to other kinds of bacteria [7]. Furthermore, knowledge on instantaneous maxima and minima of wastewater flow for Kuching City which are important for the establishment of design flows and calculation of pipe diameters and gradients [1] were also lacking.