SEWAGE POLLUTION IN TERENGGANU RIVER ESTUARY

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Abstract

Terengganu River estuary is a unique estuary with seasonal seawater intrusion and unpredictable amount of rainfalls. Determination of parameters related to sewage pollution such as total coliform counts, fecal coliform counts, *Escherichia coli* counts, total alkalinity, total suspended solids and BOD were the main aim of this study. Two trips of sampling were conducted in 28 June 2002 and 7 November 2002 to determine sewage pollution status in Terengganu River Estuary.

Generally, all of the parameters showed higher concentration during June than November except for the total suspended solids which showed a reverse phenomenon. In June, the total coliform count, fecal coliform count, and *Escherichia coli* count showed levels higher than the interim microbiological standard of mean 100 MPN/100 ml. The mean MPN/100 ml of total coliform bacteria in the riverine and coastal waters in June was 1373 and 170 MPN/100 ml respectively as well as 1123 and 1260 MPN/100 ml respectively in November. The estuarine zone had a total coliform count ranging from 220 - >2,400 MPN/100 ml in June and 540 - >2,400 MPN/100 ml in November. The mean MPN/100 ml of fecal coliform bacteria in the riverine and coastal waters in June was 1147 and 50 MPN/100 ml respectively as well as 1123 and 920 MPN/100 ml respectively in November. The estuarine zone had a fecal coliform count ranging from 110 - >2,400 MPN/100 ml in June and 70 - >2,400 MPN/100 ml in November. However, the *Escherichia coli* count showed a lower mean and range in June which were 247 MPN/100 ml (riverine), 26 MPN/100 ml (coastal water) and ranging from 33 - >2,400 MPN/100 ml (estuarine) in June respectively. In November, the mean *Escherichia coli* count in riverine, estuarine and coastal water was 105 MPN/100 ml, 266 MPN/100 ml

and 17 MPN/100 ml respectively. The mean total alkalinity level in June increased from the riverine system (31.11 mg$CaCO_3$/L) to the estuarine system (62.33 mg$CaCO_3$/L) and then to the coastal water system (121.33 mg$CaCO_3$/L). Lower total alkalinity was found in November with a mean value of 29.84 mg$CaCO_3$/L. BOD level did not differ significantly in June and November. The mean BOD value was 2.58 mgO_2/L in June and 2.35 mgO_2/L in November. Lower values of total suspended solids were recorded in June (20.61 mg/L) than November (32.28 mg/L). Generally, the results of this study reveal that the Terengganu River Estuary is heavily polluted by sewage.

Abstrak

Muara Sungai Terengganu merupakan satu muara yang unik dengan kemasukan air laut yang bermusim dan jumlah hujan yang sukar diramalkan. Penentuan parameter-parameter yang berkaitan dengan pencemaran sisa kumbahan termasuk bilangan jumlah coliform, bilangan fecal coliform, bilangan *Escherichia coli*, jumlah alkaliniti, jumlah pepejal terampai dan BOD merupakan tujuan utama kajian ini. Dua penyampelan telah dilakukan pada 28 Jun 2002 dan 7 November 2002 untuk menentukan status pencemaran sisa kumbahan di Muara Sungai Terengganu.

Secara amnya, kesemua parameter menunjukkan kepekatan yang lebih tinggi pada bulan Jun berbanding dengan bulan November kecuali untuk jumlah pepejal terampai yang menunjukkan fenomena terbalik. Pada bulan Jun, bilangan jumlah coliform, bilangan fecal coliform dan bilangan *Escherichia coli* menunjukkan paras yang lebih tinggi berbanding nilai "interim microbiological standard" dengan min 100 MPN/100 ml. Min MPN/100 ml untuk bakteria coliform dalam *riverine* dan *coastal water* pada Jun adalah sebanyak 1373 dan 170 MPN/100 ml, manakala sebanyak 1123 dan 1260 MPN/100 ml pada bulan November. *Estuarine* mempunyai jumlah bilangan coliform yang berjulat antara 220 - >2,400 MPN/100 ml pada bulan Jun, dan 540 – >2,400 MPN/100 ml pada bulan November. Nilai min MPN/100 ml bakteria fecal coliform dalam *riverine* dan *coastal water* pada Jun adalah sebanyak 1147 dan 50 MPN/100 ml, manakala pada bulan November pula sebanyak 1123 dan 920 MPN/100 ml. Zon *estuarine* berkenaan turut mempunyai bilangan fecal coliform yang berjulat antara 110 -

>2,400 MPN/100 ml pada bulan Jun dan 70 - >2,400 MPN/100 ml pada bulan November. Walaubagaimanapun, bilangan *Escherichia coli* menunjukkan min dan julat yang lebih rendah iaitu sebanyak 247 MPN/100 ml (*riverine*), 26 MPN/100 ml (*coastal water*) dan berjulat antara 33 - >2,400 MPN/100 ml (*estuarine*) pada bulan Jun. Untuk bulan November, min bilangan *Escherichia coli* di *riverine, estuarine* dan *coastal water* bernilai 105 MPN/100 ml, 266 MPN/100 ml dan 17 MPN/100 ml masing-masing. Min paras jumlah alkaliniti pada bulan Jun meningkat daripada sistem *riverine* (31.11 mg$CaCO_3$/L) kepada sistem *estuarine* (62.33 mg$CaCO_3$/L), dan seterusnya kepada sistem *coastal water* (121.33 mg$CaCO_3$/L). Jumlah alkaliniti yang lebih rendah didapati pada bulan November dengan nilai min sebanyak 29.84 mg$CaCO_3$/L. Aras BOD tidak menunjukkan perbezaan yang ketara pada bulan Jun dan November. Nilai min BOD adalah sebanyak 2.58 mgO_2/L pada bulan Jun dan 2.35 mgO_2/L pada bulan November. Nilai jumlah pepejal terampai yang lebih rendah telah dicatatkan pada bulan Jun (20.61 mg/L) berbanding bulan November (32.28 mg/L). Secara amnya, kajian ini menyimpulkan bahawa Muara Sungai Terengganu amat dicemari oleh sisa kumbahan.