ABSTRACT

Water is important for living organisms. The increase of human activities along a river affects the water quality and sediment characteristics. This study was conducted to determine the water quality and sediment characteristics of the Batang Baleh and its tributaries and the effect of weather on the water quality. Thirty-four stations were selected along Batang Baleh and its tributaries. Five different trips were carried out from February 2015 to January 2016. One sampling took place at each station in the upstream and midstream areas of Batang Baleh whereas three trips were made to the downstream area. The results of this study show that stations near logging activities had significantly higher levels of water turbidity, TSS, COD, TP, Chl-*a*, NO_2-N, NO_3-N, TAN and Org-N, and sediment TP, TKN, OM and TOC. The range of water turbidity, TSS, COD, TP and Chl-*a* are 476.97 NTU – 1176.70 NTU, 487 mg/L – 1040 mg/L, 102.0 mg/L – 187.6 mg/L, 319 µg/L – 880 µg/L and 0.52 mg/m^3 – 1.48 mg/m^3 respectively. NO_2-N, NO_3-N, TAN and Org-N values range from 0.005 mg/L – 0.020 mg/L, 0.013 mg/L – 0.028 mg/L, 0.43 mg/L – 1.28 mg/L and 0.74 mg/L – 1.29 mg/L respectively. Sediment TP, TKN, OM and TOC values range from 110.5 mg/kg – 161.1 mg/kg, 793.8 mg/kg – 931.1 mg/kg, 2.17 % – 4.41 %, 0.85 % – 1.94 % respectively. Stations near longhouses had significantly higher levels of water TP, NO_2-N, NO_3-N and sediment TKN. The water TP, NO_2-N, NO_3-N and sediment TKN values ranged from 207 µg/L – 375 µg/L, 0.004 mg/L – 0.019 mg/L, 0.006 mg/L – 0.017 mg/L, 571.0 mg/kg – 895.7 mg/kg respectively. The sediment was not polluted in TP as the values did not exceed the Lowest Effect Limit of the Ontario Sediment Standards. However, nine and twenty-one stations of TOC and TKN respectively exceeded the Lowest Effect Level which means that the sediment may have adverse effect on some benthic organisms. During the wet season (January 2016), high mean values of

TSS (542 mg/L) and TP (292 µg/L) reduced the water quality of the downstream area. Based on WQI, eight stations were classified as Clean and one station was Polluted while the rest were Slightly Polluted. Sungai Gaat complied with Class II of WQI and all parameters fall in Class I or Class II of NWQS during high water level. The downstream stations classified as Clean during high water level deteriorated to Slightly Polluted status during low and/or medium water levels due to a decrease in DO value and an increase in BOD and COD values. The practice of selective logging and proper discharge of municipal wastes from local villagers are needed for water quality improvement of this river.

Keywords: Nutrients, sediment quality, longhouses, logging, water quality

Kualiti Air dan Ciri-Ciri Sedimen di Batang Baleh, Sarawak

ABSTRAK

Air adalah penting untuk kehidupan. Peningkatan aktiviti manusia di sepanjang sungai akan memberi kesan kepada kualiti air dan sedimen. Kajian ini dijalankan untuk menentukan kualiti air dan ciri-ciri sedimen di Batang Baleh dan anak-anak sungainya serta kesan cuaca terhadap kualiti air. Tiga puluh empat stesen di sepanjang Batang Baleh dan anak-anak sungainya dipilih untuk kajian ini. Pensampelan telah dilaksanakan dari Februari 2015 hingga Januari 2016. Pensampelan telah dijalankan sekali di kawasan huluan dan pertengahan Batang Baleh manakala bagi kawasan hiliran dijalankan tiga kali. Kajian ini menunjukkan bahawa stesen berhampiran aktiviti pembalakan mempunyai tahap yang lebih tinggi bagi parameter kekeruhan air, TSS, COD, TP, Chl-a, NO_2-N, NO_3-N, TAN dan Org-N, serta TP, TKN, OM dan TOC dalam sedimen. Julat masing-masing bagi kekeruhan air, TSS, COD, TP dan Chl-a ialah 476.97 NTU – 1176.70 NTU, 487 mg/L – 1040 mg/L, 102.0 mg/L – 187.6 mg/L, 319 µg/L – 880 µg/L dan 0.52 mg/m^3 – 1.48 mg/m^3. Nilai NO_2-N, NO_3-N, TAN dan Org-N berkisar masing-masing di antara 0.005 mg/L – 0.020 mg/L, 0.013 mg/L – 0.028 mg/L, 0.43 mg/L – 1.28 mg/L dan 0.74 mg/L – 1.29 mg/L. Nilai TP, TKN, OM dan TOC dalam sedimen berkisar masing-masing di antara 110.5 mg/kg – 161.1 mg/kg, 793.8 mg/kg – 931.1 mg/kg, 2.17 % – 4.41 % dan 0.85 % – 1.94 %. Stesen berhampiran rumah panjang mempunyai tahap yang lebih tinggi dalam parameter TP dalam air, NO_2-N, NO_3-N, dan TKN dalam sedimen. Julat masing-masing bagi TP dalam air, NO_2-N, NO_3-N, dan TKN dalam sedimen ialah 207 µg/L – 375 µg/L, 0.004 mg/L – 0.019 mg/L, 0.006 mg/L – 0.017 mg/L, 571.0 mg/kg – 895.7 mg/kg. Sedimen tidak tercemar dari segi TP kerana nilai tidak melebihi had kesan yang paling rendah menuruti Piawai Sedimen Ontario. Walau bagaimanapun, sembilan dan dua puluh satu

stesen masing-masingnya dari segi TOC dan TKN telah melebihi had kesan yang paling rendah bermaksud sedimen mungkin mempunyai kesan buruk ke atas beberapa jenis organisma bentik. Musim hujan (Januari 2016) menunjukkan nilai min yang tinggi bagi TSS (542 mg/L) and TP (292 mg/L) yang mengurangkan kualiti air di kawasan hiliran. Berdasarkan WQI, lapan stesen telah diklasifikasikan sebagai Bersih dan satu stesen Tercemar manakala yang lain diklasifikasikan sebagai Sedikit Tercemar. Semasa dalam paras air yang tinggi, Sungai Gaat mematuhi Kelas II dari segi WQI dan semua parameter dalam Kelas I atau Kelas II menuruti NWQS. Walau bagaimanapun, status air bersih di stesen hilir semasa paras air yang tinggi berubah ke status yang sedikit tercemar ketika paras air rendah dan sederhana disebabkan penurunan nilai DO dan peningkatan nilai BOD dan COD. Pembalakan terpilih dan pembuangan sisa perbandaran yang sewajarnya dari penduduk setempat adalah diperlukan untuk peningkatan kualiti air yang baik di sungai ini.

***Kata kunci**: Nutrien, kualiti sedimen, rumah panjang, pembalakan, kualiti air*