

Alcaligenaceae and chromatiaceae as pollution bacterial bioindicators in palm oil mill effluent (POME) final discharge polluted rivers

ABSTRACT

Microorganisms are progressively adopted as reliable and specific bioindicators of pollution, with Alcaligenaceae and Chromatiaceae being recently proposed to indicate contamination in river water due to palm oil mill effluent (POME) final discharge. This study was conducted to evaluate the reliability of these bacteria to act as specific bioindicators by assessing their detections in correlation with environmental factors in rivers polluted by POME final discharge when compared to by other pollution sources. By using the Illumina MiSeq high throughput sequencing platform, bacterial diversities and compositions were compared among unpolluted (upstream) river, polluted rivers due to POME final discharge and other rivers polluted by mining, chemical and automotive industries. To correlate between bacterial compositions and metabolisms in rivers subjected to different pollutants sources, the viability and the ratio of the high and low nucleic acids (HNA/LNA) bacterial cells were also compared by using a double staining assay based on flow cytometry. Interestingly, Alcaligenaceae and Chromatiaceae were found only in POME final discharge polluted rivers (>0.15%) but were not detected in rivers polluted by other pollutants. Higher bacterial cell viability was detected in rivers polluted by POME final discharge (86–91%) as compared to the other polluted rivers (15–80%). From the viable fractions of the bacterial cells, higher HNA cells (91–93%) were quantified in the POME final discharge receiving rivers but with only 5–18% in the other rivers. These trends indicated that the nutrients carried by the POME final discharge enhanced the growth of bacteria in the receiving river water that might include Alcaligenaceae and Chromatiaceae. These results suggested that either Alcaligenaceae or Chromatiaceae or both were unique in the POME final discharge polluted rivers but not in the others. They could function as specific and reliable bacterial bioindicators relevant for the establishment of a complementary monitoring system for POME pollutant discharge.

Keyword: Palm oil mill effluent (POME) final discharge; Bacterial bioindicator; Bacterial community; River pollution; Illumina Mi Seq; Flow cytometry