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Bacterial community shift as potential bioindicator to indicate the river water contamination due to palm oil mill effluent final discharge

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Abstract. A thorough outlook on the effect of palm oil mill effluent (POME) final discharge towards the composition and functional status of bacterial community in the receiving river is provided in this study by using high-throughput MiSeq and flow cytometry, respectively. The shift of bacterial community dynamics could be used to determine the potential bacterial indicators to indicate contamination caused by POME. This study showed that the POME final discharge did not only alter the natural physicochemical properties of the river water but also caused the reduction of bacterial diversity in the receiving river. The Chromatiaceae and Alcaligenaceae which were not detected in the upstream but were detected in the downstream part of the river are proposed as the indicator bacteria to indicate the river water contamination caused by POME final discharge. The emergence of the potential indicator bacteria in the downstream part of the river was shown to be carried over by the effluent. Moreover, the functional status of the bacterial community at single-cell level is determined with regards to their abundance, viability and nucleic acid content to monitor the effect of POME final discharge in the affected river. The shift of low nucleic acid (LNA) to high nucleic acid (HNA) bacterial cells in the affected river suggests the transformation of dormant to active cells due to POME final discharge which may serves as potential bioindicator in the screening of anthropogenic effect due to POME final discharge in the river water with originally high LNA proportions. Monitoring the effluent discharge at low trophic level using MiSeq and flow cytometry is considered as an accurate pollution monitoring approach which can be used to complement the conventional POME pollution assessment method.

Keywords: Palm oil mill effluent; Wastewater; Polluted river; Bacterial community; Bacterial indicator