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Application of fuzzy evaluation technique and grey clustering method for water quality assessment of the coastal and estuaries of selected rivers in Sarawak

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Abstract

Background: Estuarine and marine water quality has remarkable importance because these water resources are used for multiple reasons for instance: transportation, tourism, recreation, and other human or economic ways to use water. The objective of the study was to assess the water quality of the coastal and estuaries of the Rambungan, Sibu, Salak, and Santubong rivers in Sarawak, Malaysia. Water samples were collected from 10 locations and analyzed by employing standard techniques. A fuzzy comprehensive evaluation, grey clustering evaluation methods, Thailand Marine Water Classification System, and the Malaysian Marine Water Quality Index (MMWQI) and its classification system were applied to compute the index of each water quality parameter.

Results: The results showed that all the analyzed water quality parameters were within the allowable threshold levels. The results obtained by the application of fuzzy comprehensive evaluation and grey clustering evaluation methods proved that the coastal and the estuaries waters were clean with exception of coastal location CZ9 and the estuary of Salak river which showed slight pollution. Based on the Malaysian Marine Water Quality Index, it was observed that all the locations were in the classification group of moderate (i.e. 50–79%). This suggests that the estuaries of selected rivers can be used for natural resource conservation, while the coastal regions are good for fish farming.

Conclusion: It can be deduced that the suggested techniques were workable and logical. The method developed and the information in this study can serve as a reference and decision support for scientists and policymakers of concern.

Keywords: Fuzzy comprehensive evaluation, Grey clustering method, Classification system, Water quality index, Water sources

Background

Water pollution is one of the major environmental issues in the Sarawak State of Malaysia and thus water quality assessment is the foundation of the river, marine, and coastal water pollution control, which is significant for implementing management practices to rivers, estuaries, and coastal marine zones (Asare et al. 2019a, b; Omorinoye et al. 2019). A large number of boatyards are located along the estuaries and the coastal marine zones of river Rambungan, river Sibu, river Salak, and river Santubong in the Sarawak State of Malaysia are involved with various commercial activities, which include

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