

Surface Water Quality Assessment and Apportionment of Pollution Sources Using APCS-MLR, MCDM and GIS Modelling Techniques in Brahmani River Basin, Odisha

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Abstract

Surface water is an important source for drinking water supply in Brahmani River, Odisha, India. However, this basin plays an important role in local economy and ecosystem. Thus, rapid use of water quality leads to serious water pollution. An attempt has been made in this work to understand the suitability for human consumption, considering 15 water quality (WQ) parameters collected yearly from seven water sources. Time frame taken into consideration is 3 years (2020-2023). CRITIC ((C)_{critic})-based water quality index (WQI) and MCDMs like MOORA method was applied to compute the results. The concept MOORA was introduced in the current work to utilize weights and rough set theory to give a reliable and unbiased description of overall pollution levels of each sampling location. The interpolation method (IDW) was applied in ArcGIS 10.5 to produce the spatial map. The results were compared with the values or ranges mentioned by standard organizations (WHO) for assessing WQ and these revealed that the river water is slightly alkaline and DO is quite healthy. Most of the parameters evaluated were found to fall in the allowable limits of the WHO standards. The results of (C)_{critic} weights indicated that WQ status belonged to good-poor quality of water. Principal stations such as St-(1), (2), (3) and (7) found to be high values, indicates poor H₂O and having more impact on WQ. This observation may be an outcome of the indecorous management of domestic, agricultural and industrial effluents in the region. It was also come into fact that the location (7) had the second highest critic weight. This culminates primary with point-based pollution such as wastewater from household and industrial sources, non-point sources such as agricultural activities and natural phenomena such as soil erosion and flooding. None of the locations falls under excellent WQ. The visualization of the MOORA method suggests that St-(1) was the most polluted station on the basis of its rank and its performance score ($Y_j=0.54$). The study recommended continuous pollution monitoring and local regulations to reduce the entrance of both diffuse and point-source pollution into the river. Hence, special attention should be given to maintain ecological sustainability. Moreover, the water quality methods which are discussed extensively in the paper, can also provide an overall idea about indexing for further research.

Keywords: Brahmani River, CRITIC, MOORA, domestic, rank, Sustainability.