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Evaluation of water quality of Utinga and Bita dams applying principal components analysis and artificial neural networks

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The economic growth of the State of Pernambuco above the national average in recent years can be attributed to investments in L the sectors of construction and industry, which has its main pillars in the Industrial and Port Complex Governor Eraldo Leite Gueiros Suape (CIPS) and the tourist pole. To ensure the continuity of the development of this region over the next few years, the water supply is ensured by Suape System and already own of the Utinga (10,270,000 m3) and Bita (2,7000,000 m3) dams, will win a big boost with the construction of the Engenho Maranhão (50,000,000 m³) dam on the river Ipojuca. The Ipojuca river receives untreated sewage from several densely populated municipalities of its watershed, and crosses the sugar cane area where use fertilizers and pesticides, contributing to the degradation of this river. Therefore, to investigate the changes in the quality of water from dams with Bita and Utinga technical principal components analysis (PCA) and Multilayer Perceptron artificial neural networks (MLP ANN) was applied, and compared with the resolution of the National Council for the Environment (CONAMA) 357/05. The study involved collections of samples carried out in the period from February 2007 to March 2013. Of the water samples used, it was observed that 78.5% were at odds with the limits of Resolution CONAMA 357/2005 for Class 2 fresh water. The parameters presented in violation of the resolution were hydrogen potential dissolved oxygen, biochemical oxygen demand, total phosphorus, turbidity, total solids and thermotolerant coliforms. The results of PCA the first four components explain 65.92% of the total variation of the data. The first component (PC1) explained 26.5% of the data variance and the most important variables for water quality were the OD (0.80), BOD (-0.78), thermotolerant coliforms (-0.78) and ST (-0.56). The MLPANN that showed the best performance was with 11 neurons in the hidden layer, hyperbolic tangent function and softmax function for the output layer, obtaining an average of 89.7% of global successes and 83.6% of correct answers in the test. The performance of the MLP ANN 9-11-5 model, the most significant input parameters in the identification of water quality were the total phosphorus, thermotolerant coliforms and dissolved oxygen concentrations. The result shows a tendency to water quality degradation from dams due to the presence of microorganisms, salts and nutrients responsible for the eutrophication process, which is configured by the greatest concentration of the total phosphorus and thermotolerant coliforms, and lower pH and DO, probably due to occurrence of effluent disposal of industrial, domestic and Agroin-sugarcane industry.

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