THIRD WORLD SYMPOSIUM ON SUSTAINABILITY SCIENCE AND RESEARCH

Sustainability Futures: Challenges and Opportunities Towards a More Sustainable World

April 8

SDG 6 and Industry 4.0: Development of a performance prediction model by Artificial Neural Networks applied to water treatment plants, located in the state of Espírito Santo, Brazil, aiming at the sustainability in their operations

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OBJECTIVES OF THE PAPER

To analyze the efficiency of the performance prediction models generated with Artificial Neural Networks (ANN) when applied to several conventional Water Treatment Plants (WTP), located in the state of Espírito Santo, southeastern region of Brazil.

APPROACH USED

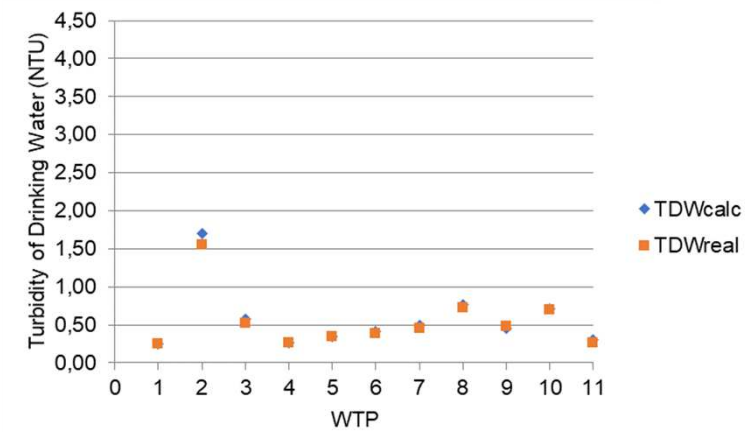
- Sample universe: 11 WTP located in the southeast region of Brazil with average affluent flows ranging from 32.04 L/s to 1,874.65 L/s.
- Collection and consolidation of raw water, treated water (drinking water), and operational quality data for the period 2009 to 2014.
- Use of the spreadsheet to calculate the Quality Index of Water Treatment Plants (IQETA) (Lopes, 2015) to obtain the hydraulic variables.
- Development of the ANN model, using the proportion 70/30, for training and simulation, respectively.
- Determination of the Spearman correlation (ρ), comparing the real and calculated treated water turbidity data.

KEY RESULTS

- From a total of 16,696 data made available, after consolidation this drops to 14,190 (15% loss of data). The variation of loss was from 0.13% to 65.46% in the WTP.

- Spearman's coefficient (ρ) was 72% in the training stage and 70% in the simulation stage, for a significance level of 5%.

- The plants were separated by size: small (20L/s<Q<100 L/s); medium (100L/s≤Q≤500L/s) and large (Q>500 L/s), and Spearman coefficients of 68%, 42% e 38%, respectively, were found.



MAIN CONCLUSIONS

The results reinforced the need for quality assurance of the monitoring data, and the model proved to be more representative for small stations, due to the large number of data that significantly influenced the model result for the group of stations.

The Artificial Neural Networks model appears to be a simplified development, with the use of machine training, however it makes it complex to replicate without building a new model.

This model can be considered a management tool of great impact in ensuring the achievement of SDG 6 ("Clean Water and Sanitation") and in sustainable management within the concept of Industry 4.0.

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