**USING ARTIFICIAL NEURAL NETWORKS TO QUANTIFY THE DYNAMICS OF THE TOTAL ORGANIC CARBON DEGRADATION DURING THE OZONATION OF OIL-DRILLING CUTTINGS**

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**ABSTRACT**

Artificial neural networks (ΑΝΝ) are currently one of the most important supervised machine learning methods, characterized by the presence of labels (i.e., target values) that can be either numerical data (task: regression) or categorical data (task: classification) [1]. As an effective tool to perform nonlinear input-output mapping, ANN have been used extensively in chemical engineering for various applications such as adaptive control, model-based control, process monitoring, fault detection, dynamic modeling and parameter estimation [2]. ANN are based on decomposition of input-output relationship into series of linearly separable steps using hidden layer(s) neurons [3]. Generally, ANN models are developed in four steps: data transforming - network architecture defining - training (calibrating) the network – validating the network. Although there are several architectures of neural networks available the feed-forward multilayer perceptron (MLP) ANNs trained with backpropagation algorithm (BP) are consider among the most commonly used networks. The MLP-BP ANNs with only one hidden layer have been reported as universal approximators of any non-linear function and can be sufficient for most important application [4].

In the present study, a feed-forward multilayer perceptron (MLP) ANN trained with backpropagation algorithm (BP) is used to determine the kinetic parameters governing the performance of the oil-drilling cuttings (ODC) ozonation. Ozonation tests of ODC, pre-treated with surfactant (SDS) and diluted with synthetic seawater, are performed on semi-batch bubble flow reactors. The total organic carbon (TOC) is measured with a total carbon analyzer. A dynamic mathematical model is developed to describe the ODC ozonation by combining transport with reactive processes, and minimizing the number of unknown parameters. Numerical simulations for various values of dimensionless parameters generate the datasets that are then employed for the training and validation of the neural network. The trained neural network is then exploited for as an optimization tool for optimal parameter estimation from experimental data of ODC ozonation.

**KEYWORDS:** Artificial neural network, Numerical Simulation, Ozonation, Parameter estimation

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