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Estimation of kinematic viscosity of biodiesel-diesel blends: Comparison among accuracy of intelligent and empirical paradigms

Salah I. Yahya [a b], Babak Aghel [c]

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Abstract

Recently, Biodiesels are found high popularity as environmentally friendly and renewable fuels. Suitable combustion, appropriate atomization process, high flash point, and proper cetane number approved biodiesels as potential alternative for petroleum-based diesel fuels. Since, characteristics of biodiesels as well as biodiesel-diesel blends are directly related to their viscosity, an accurate approach is required for prediction of this important transport property. Therefore, this study tries to compare the accuracy of different empirical and intelligent paradigms for estimation of biodiesel-diesel blends. For this regard, the best topology of adaptive neuro-fuzzy inference systems (ANFIS) and least squares support vector machines (LSSVM) are determined at first, and then their predictive performances are compared with five empirical correlations in literatures. Combination of statistical study and ranking analysis justified that the LSSVM with polynomial kernel is the most accurate approach for the considered matter. The designed model estimated kinematic viscosity of 636 biodiesel-diesel blends with an excellent AARD=0.754%, MAE=0.03, RAE=1.98%, RRSE=2.3%, MSE=0.003, RMSE=0.05, and R^2-value of 0.9997.