Development of machine learning model for CO_2 capture plants to predict solvent degradation
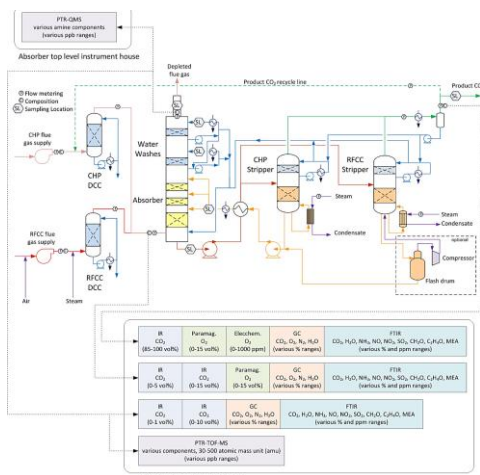
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Introduction and background:

The purpose of this study is developement of machine elarning methods to predict solvent degradation phenomena in a carbon capture plant. The information regarding 10 types of solvent degradation in the TCM plant were extracted. Then, three methods of Support Vector Regression (SVR), Random Forest (RF) and Artificial Neural Netwrok (ANN) were used to find the proper model for all types of solvent degradation. To reach the best result for each method, hyperparameters were tuned by grid search and randomized search cross validation.

Problem description and objective:

Solvent degradation is one of the most major issues in carbon capture plant counting about 22% operational cost. There are many sources of solvent degradation in a plant. However, there are two main groups of solvent degradation namely oxidative and thermal degradation that are due to oxygen in absorber and high temperature in stripper, respectively. Since solvent degradation is a complex phenomena and there is no software or traditional solution to predict it, machine learning methods can be a useful tool.Therefore, three methods of Support Vector Regression (SVR), Random Forest (RF) and Artificial Neural Network (ANN) were used to find the best models presenting solvent degradation. To find the best model, hyperparameters were tuned by using optimizations methods such as grid search and randomized search cross valdiation.

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