International Conference on Nonlinear Modeling & Optimization
28-29 Aug. 2012, Shomal University, Amol, Iran.

Application of Artificial Neural Network and multiple linear regression for modeling and sensitivity analysis of a stripper column

H. Sadeghialiabadi [1, 2,*], N. Saghatoleslami [2], M. C. Amiri[1]
1. Department of Chemical Engineering, Isfahan University of Technology, Isfahan, Iran, h.sadeghialiabadi@yahoo.com
2. Department of Chemical Engineering, Faculty of Engineering, Ferdowsi University of Mashhad, Mashhad, Iran

Abstract
There are many ways to produce the hydrogen. A way is through steam reforming. Because in this method CO_2 presents as an impurity with hydrogen, hence CO_2 should be removed. Since stripper column is key equipment in purification process, thus, in this study, stripper column is modeled and investigated by artificial neural network as a technique of nonlinear modeling. The number of variables used for modeling is 5 and 2 as input and output variables, respectively. Next, in order to validate, this model compared with multiple linear regression (MLP) method. Determining the input effective variables on performance of the column is the later purpose of results of this modeling. The results reveal that the ANN method is more powerful tool than MLP one to describe and predict the column. However, the major and minor input variable for both methods are analogous.

Keywords: Multiple Linear Regression, Artificial Neural Network, Sensitivity Analysis, Stripper Column, Nonlinear modeling.

1. Introduction
Hydrogen can be obtained using the methane reforming process, according to equation 1 (for each hydrocarbon):

$$\alpha C_m H_{2n} + \beta H_2O \rightarrow [(m+n)\alpha + \gamma]H_2 + (m\alpha - \gamma)CO + \gamma CO_2 + (\beta - m\alpha - \gamma)H_2O \qquad (1)$$

Where

$$0 \le \gamma \le m\alpha \qquad (2)$$

The stoichiometric corfficient γ of Equation 1 depends on the cheminal equilibrium of the reaction.[1]. Because most hydrogen using processes, operate more efficiently with high purity hydrogen particularly hydroconversion process. In using of the used alkanolamine absorbents, an absorber and stripper are typically arranged [2]. The absorption of acidic gases such as CO_2 in alkali solutions is a common and important industrial process. To this end, it is necessary to investigate effective parameters on process by a good model. In the present research, the process of elimination of CO_2 was performed using a stripper column, and was modeled via artificial neural network technique. Then this model was compared with a statistical method, namely, multiple linear regressions to validate. The suitable operating parameters to be used to model include flow rate of rich-solution feed in terms of cubic meter per hour (CMH), flow rate of vent CO_2 of column above in terms of natural cubic meter per hour (NCMH), flow rate of reflux flow in terms of cubic meter per hour (CMH), temperature of rich-solution feed (^{0}C), temperature of reflux flow (^{0}C), and temperature of outlet vapor of reboiler (^{0}C). Eliminated CO_2 level depends on several input variables. Some variables might have great contribution or influence on certain specific output variable, and some others might have less influence on this specific output variable. The input variables that have a great impact on a particular output variable are called major input variables, whereas those that have small impact on this particular output variable are called minor input variables. Determining effect that each parameter has on target output is called sensitivity analysis. In

[1,*] Corresponding author: Ph D Student, Chemical Engineering
[2] Associate professor, Chemical Engineering