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"LIFE PREDICTION" FOR THE HEAT EXCHANGER

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Abstract- Heat exchanger degradation is a non- periodic non stationary process, which depends upon the variation of parameters w.r.t time. The measurements are associated with gross errors, if they are not properly handled, they may lead to erroneous estimation and prediction of heat exchanger performance. The objective of this paper is to predict the life of the heat exchanger while reaching to its threshold limit by the output factors like cleanliness factor and fouling factor. The performance factor of heat exchangers degrades with time due to scaling or fouling factor. In this paper we have monitored, predict the working life of the heat exchanger performance

Keywords- *heat exchanger, fouling factor, cleanliness factor, overall heat transfer coefficient.*

I. INTRODUCTION

Thackery et.al.estimated heat exchanger fouling problems were costing US industries on the order of billions per year. The high end of the estimate was proportionally ratioed from a similar UK study. No strand et.al.estimated that a typical refinery is paying $10 million per year for exchanger fouling problem.

All these cost are further multiplied when there are multiple process units at the same location. The biggest cost contributors are production losses, asset utilization, energy consumption and maintenance costs. For reducing the cost there is a solution of monitoring and prevention, there occurs some common problems:

1. Improper sensors for the continuous monitoring of the system.
2. During the calculations, the overall heat transfer coefficients often don't generate accurate and clear results because of noisy and poor quality data.

The detection and the prediction features are discussed in this current paper. Fouling factor is the subject of a future release. The current exchanger types in scope are plate type heat exchangers.

II. NOMENCLATURE

A	Heat Transfer surface area
CF	Cleanliness factor
Cph,Cpc	Specific heat of hot, and cold treams
FF	Fouling Factor
LMTD	Log mean temperature difference
Mh, mc	Mass flow rate of hot and cold streams
Q	Heat load
Qc	Heat load by cold stream conditions
Qh	Heat load by hot stream conditions
Thi,Tho	Hot stream inlet and outlet temperatures
Tci,Tco	Cold stream inlet and outlet temperatures
Ud	Overall heat transfer coefficient, fouled
Uc	Overall heat transfer coefficient at clean conditions

III.METHODOLOGY

The primary inputs to this method are Temperatures, flows of the hot and cold streams of a heat exchanger. The primary output is the predicted date when the heat exchangers cleanliness reaches to its threshold limit. Cleanliness factor is the matrix to drive the following prediction feature, for which we can predict the next expected cleaning date for an exchanger. The input parameters can be measured with the help of conventional instruments. The data sources can be varied by manual recording of local gauges. The sampling intervals for the heat exchanger conditions vary every five minutes. Following determinations are:

a. Fouling detection
b. Fouling prediction

IV. DATA RECONCILIATION

The function of data reconciliation is to get a set of measurements that are consisting with the heat balance equation.

Qh =MhCph(Thi-Tho) for hot stream

Qc =McCpc(Thi-Tho) for cold stream

To enable data reconciliation, al l the parameters required by equation must be measured. Data reconciliation is performed only if all the inputs in the above equation are available, allowing the hot side and cold side heat loads to be calculated independently.

V. FOULING FACTOR DETECTION

The objective of the date prediction is to produce a clear exchanger performance trend. The prediction module used as inputs, the filtered flows, temperature and pressure. Critical outputs from fouling detection are critical output from the fouling detection is the predicted date of cleanliness. When the exchanger performance reaches to its threshold limit For this the overall heat transfer is calculated immediately after the exchanger is started.

Uc is calculated immediately after the exchanger has been cleaned, at the time of the current cycle. During the course of run cycle a heat exchanger's performance will degrade from clean to fouled conditions. The speed at which it occurs is dependent on the application and vigilance of the field engineers.

The extent of degradation in performance is expressed by the fouling factor as calculated equation

FF=1/Ud-1/Uc

The calculation of Uc and Ud are based on flow rates and temperature of the hot and cold streams. The cleanliness factor (CF), is an alternate measurement of relative degradation in exchanger performance.

CF=Ud/Uc ×100

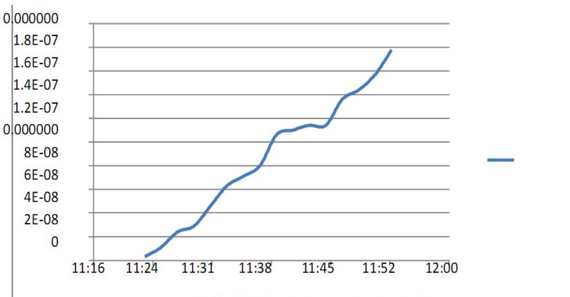
CF is closed to 100 for a clean exchanger and decrease over time as the exchanger fouls.

VI. DATE PREDICTION

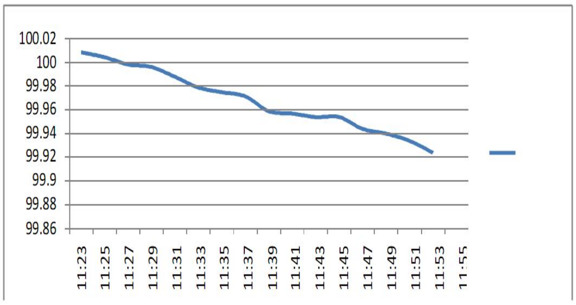
The objective of the date prediction is to show the actual performance image of the exchanger. And wi th this operation a model is generated from the predicted date which is then future used for the future forcast performance at any date The ability to predict the future is a highly valuable asset. For operational planning, the forecast must be greater than 6 months in advance. By this method the prediction gives a sufficient early warning of degradation to enable control actions to be taken to arrest or reverse the trend. If a fouling treatment program is in place on the exchanger in question, a correction may be effected by changing the dosage or conditions of treatment. In some case a non-chemical solution is recommended, such as re-distributing the coolant flow, repairing a leak, or mechanical cleaning of a plug gage. Once the corrective action has been taken effect, the adaptive predictor will then capture any resultant recovery.

VII. EXPERIMENT PERFORMED

The PHE is used in the process plant where steam is used for water heating and then used for further processes like chamber heating. So it is important for maintain the temperature of the system. By this method the prediction is when the PHE is depleted up to the threshold limit the immediate action for cleaning of the PHE must take to get back the initial r e sul t s . and app l yi n g this method fo r pr ed i ct e d date of cleaning the PHE is after 5 months after the initial date. For this rediction it has been taken 30 min parametric readings. And by this prediction. It is also forecasted for any no of years in advance.

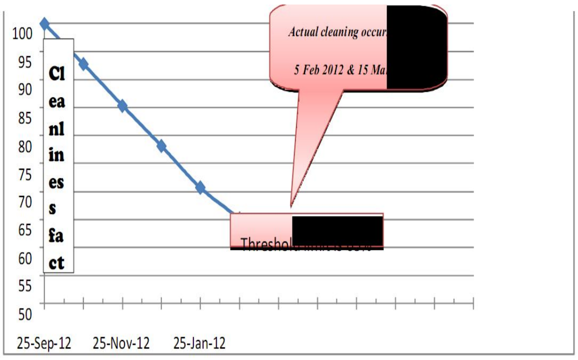


Graph 1:Fouling factor increasing w.r.t time



Graph 2: Clearance factor in % w.r.t time

VIII. PREDICTED DATE FOR CLEANLINESS



The limit for cleanliness is decided 40 days,20 days before and 20 days after the due date of limit. For the best performance and proper working is is recommend to clean the PHE on predicted date.

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