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Study of the Fouling of Preheaters in the Southern Crude Processing Unit (UTBS)'S of Hassi Messaoud

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ABSTRACT

Fouling of heat exchangers is an important problem faced by industries in particular the oil industry. Indeed, fouling is an expensive phenomenon that increases energy losses, leads to a significant decline in production, and leads to a high maintenance cost. The detection of this latter can be very quick using calculation methods that evaluate the effectiveness of the heat exchanger through the global heat transfer coefficient; these methods require very specific operating conditions. The present study concerns the monitoring over time of the fouling resistance in heat exchangers of two preheating trains (10 and 30). The latter are located in the Southern crude processing unit (UTBS) of Hassi-Messaoud in Algeria. These exchangers are intended to heat unstabilized oil with stabilized oil. The results show that these exchangers are fouled, which required their cleaning.

Keywords: Fouling, heat exchanger, crude oil.

1. Introduction

Heat exchangers are very often faced with a crucial problem which influences their thermal performance as well as the pressure losses along this equipment, and consequently, which leads to additional economic expenses (increase in pumping power, cleaning, unit shutdown, etc.); This is clogging. This phenomenon is defined as the accumulation of undesirable solid particles on the exchange surfaces [1]. Given its importance and the damage it can cause, several research projects have been carried out in order to understand this phenomenon and find solutions [2,3].

2. Experimental

In order to study the evolution of the fouling resistance over time of the two preheating trains' heat exchangers, we calculated the latter using the Kern method [4]. Thus, the fouling resistance R_f represents the difference between the overall thermal resistance of the exchanger in the dirty state and that in the clean state.

Each train is composed of two tube-shell heat exchangers placed in series. Thus, the unstabilized crude oil leaving the desalter enters the preheater on the tube side where it will be heated by the stabilized crude oil leaving the column, which circulates on the shell side. After leaving the exchangers, the unstabilized crude oil enters directly into the stabilization column.

3. Results and Discussion

The following figure shows the evolution of the fouling resistance R_f according to time for trains 10 and 30. It is to note first of all that the preheating train 10 has been in service for 1075 days since the start of this study. This means that the plot only represents a small part of what is supposed to be represented by the fouling evolution. An unstable variation in R_f as a function of time is observed between the 1075th and 1085th days of the exchangers being switched on:" Sawtooth evolution". This could be attributed to disturbances in both fluids inlet temperature and flow rate. Indeed, the continuous variation of the latter in particular, leads to the deposit and/or the re-entrainment of deposit layers, which leads to an increase and decrease in R_f, respectively. Beyond the 1085th day, we note an increase and a rapid evolution of R_f, going from 0.065 m^2 K/W to 0.14 m^2 K/W, which represents a high value requiring the cleaning of the

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exchangers. After the exchangers were cleaned and then put into service, the absence of an induction time was observed. In fact, R_f is greater than 0, and moreover, is only slightly lower than the values obtained before cleaning. R_f varies, in fact, between 0.05 m² K/W and 0.07 m² K/W and tend towards an almost constant value after the 15th day. This could be explained by poor cleaning, leaving a few layers of initial deposits on the tube wall. Rearding the train 30, decrease and increase in R_f over time are observed due to the same reasons as above. Note also that the curve follows the same pattern. However, what attracts us the most are the values of R_f , which do not exceed 0.008 m² K/W, which represent 1/10 of the value observed on the exchangers of train 10. This leads us to ask questions, knowing that all the unit's trains operate under the same conditions and use the same fluids. After more in-depth research and detailed questioning of the operators, we deduced a malfunction of the desalter which did not sufficiently retain the droplets of water rich in salts, which consequently caused the fouling of the exchangers of train 10.

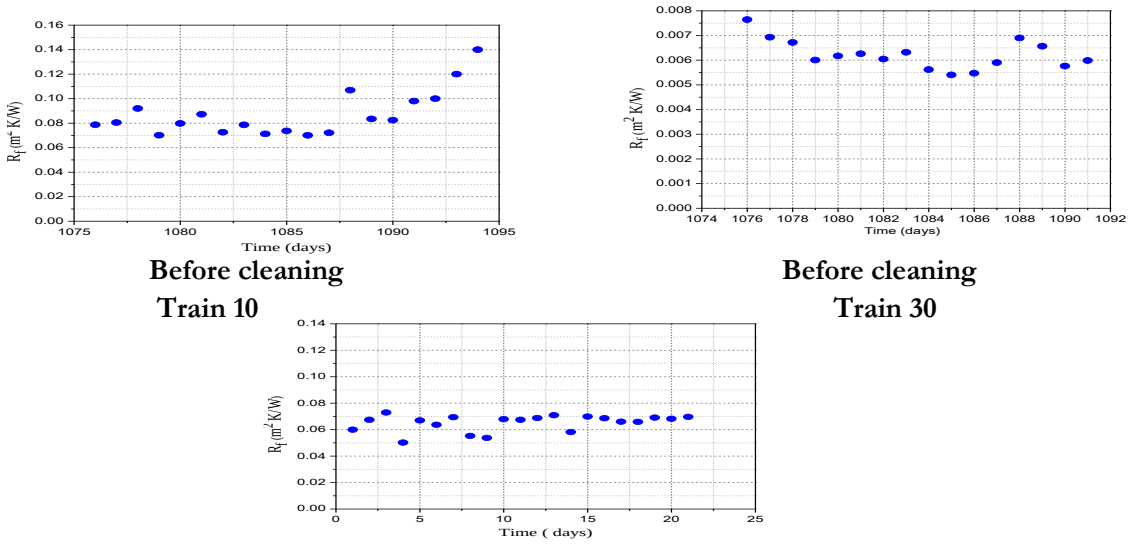

Figure 1: Fouling resistance according to time for train 10 and train 30.

4. Conclusions

The study of the fouling of two preaheater trains of the UTBS of Hassi Messaoud revealed the exixtence of fouling and a rapid evolution of its resistance over time. The results also show the absence of induction time after the cleaning of the train 10, explained by poor cleaning, despite the latter being recent. This led us to follow the evolution more closely until we realized a malfunction of the desalter, which does not correctly filter the droplets of water rich in salts.

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References

[1] Cengel Y.A. Heat Transfer - a Practical Approach. 2nd Ed., McGraw-Hill, 2002.

[2] Kamalifar S., Peyghambarzadeh S.M., Azizi S, Jamali-Sheini F. Experimental study on crude oil fouling in preheat exchangers at different operating conditions. *Thermal Sci. and Eng. Progress*, 39, 2023.

[3] Hosseini S., Khandakar A., Chowdhury M.E.H., Ayari M.A., Rahman T., Chowdhury M.H, Vaferi B. Novel and robust machine learning approach for estimating the fouling factor in heat exchangers. *Energy Reports*, 8, 2022, 8767.

[4] Kern D.Q. Process Heat Transfer. McGraw-Hill, 1950.

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