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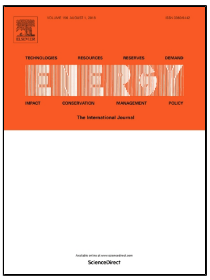

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Modelling Scaling Growth in Heat Transfer Surfaces and Its Application on the Design of Heat Exchangers

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ABSTRACT

The aim of this paper is to present a new model for the prediction of scaling formation in tubular heat exchangers. In design, the effect of fouling upon the heat transfer performance is accounted for by using fixed values of the fouling factor. In real operation, however, fouling strongly depends upon the prevailing operating conditions and they change over time. Under some conditions, the growth of fouling with time can be linear or it can show an asymptotic behaviour. Fouling factors reported in the open literature are not accompanied with specific information regarding the conditions at which they were obtained such as velocity, temperature, concentration and pH. Therefore, the designer must exercise caution when choosing fouling factors since this choice has an impact upon the size of the unit and upon capital expenditure. In view of the above, the purpose of this paper is to present a new fouling model for the prediction of scaling to assist in the design of heat exchangers and in the assessment of their thermal-hydraulic performance. The new model is validated against experimental data published in the open literature and its performance compared to other published theoretical models. The new model shows improved results.

Keywords: Scaling, fouling resistance, fouling model, viscous forces, inertial forces, calcium carbonate.

1.Introduction

In the operation of heat exchangers, fouling is a common phenomenon that causes the deterioration of the thermal-hydraulic performance of the unit with time. Most types of fouling are a complex combination of mechanisms that make their theoretical prediction difficult. This is so since the operating conditions play a decisive role in its appearance and build-up. The main operating conditions that affect fouling are fluid velocity, temperature, concentration of foulant and pH among others [1]. It is a known fact that even the material of construction plays an important role on the rate of deposition [2].