Process Integration of a Dynamic Industrial System

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Abstract

The aim of this study is to obtain a dynamic modelling and simulation of a Portuguese industrial integrated system composed of three different processes. This work includes the analysis of the optimal integration of the different units, and the study of the effect of some operational and atmospheric conditions on the system to maximize its global thermal efficiency.

The cogeneration system was modelled and analysed using the *GateCycle 5.34.0.r* software. It was concluded that the electric and the thermal power obtained strongly depend on air and economizer cooling water temperatures. The whole integrated process (cogeneration, plate exchangers and salt production unit) is simulated and exploited through *gPROMS 2.1.1*.

The best start-up conditions were established. The minimum number of ponds required strongly depends on atmospheric conditions, but it can never be less than three in order to obey the operational defined temperature intervals.

The scheduling of the evaporation ponds to be put into operation is also investigated in order to enhance the salt production and to optimise the salt harvesting. The simulation indicates that it is better to have the minimum number of ponds working (higher temperatures inside the ponds) and to have a "turbo" pond that receives a larger quantity of heated brine than the others.

It was also studied the effect of different atmospheric conditions, and the number of ponds in service required to overcome the more adverse atmospheric conditions.

The global process efficiency (thermal and electric power over natural gas consumption) is approximately 92%. However, the effective global thermal efficiency of the whole integrated site (accounting for the existing losses into the open air of the evaporation process) is in the range of 75- 80%, depending on the atmospheric and operational conditions considered.

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