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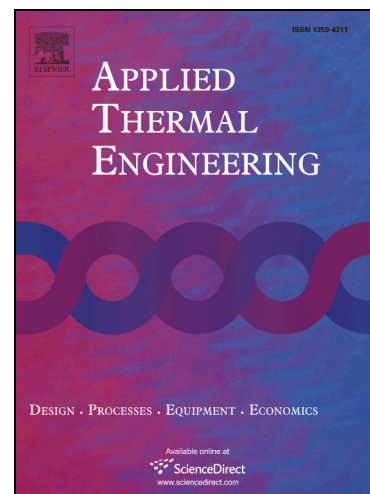
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## Steam batch thermal processes in unsteady state conditions: Modelling and application to a case study in the food industry

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### Abstract

Many industrial processes require high amounts of steam. Design and operation of steam plants are particularly complex when the steam supply is required for short periods and with a varying time schedules. To fulfil the discontinuous needs of steam users, avoiding the steam boiler oversizing to the peak value of the steam request, a thermal energy storage (TES) system can be adopted. The proper sizing of TES systems, which, in this application, is constituted by a steam accumulator vessel installed between the steam generator and the consumer, cannot be based on the sole initial and final state conditions of the steam storage, since a performance prediction of the process time-evolution is also required.

In this paper, a model of steam batch processes for industrial thermal treatments, able to describe unsteady operative conditions, is presented. More in detail, a three-stage steam plant, with a sequentially interconnected steam boiler, steam accumulator and processing tank, has been considered. The dynamic model of the charging and discharging processes of the steam accumulator has been applied to a real case study in the food industry: the batch debacterisation process of cocoa beans. Nevertheless, the obtained results can be profitably employed in the design and the performance assessments of a wide set of applications involving the steam processing fluid, such as desalination plants, solar thermal power plants, retorts, steam ovens and others.

**Keywords:** *Steam batch process; Steam accumulator; Tank steam filling; Unsteady process; Food industry*

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