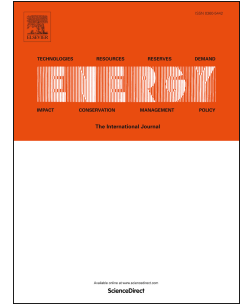


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Energy, Exergy and Advanced Exergy Analysis of a Milk Processing Factory

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Abstract

Energy, exergy and advanced exergy methods were used to analyse a milk powder production facility. While a conventional energy analysis is used to map the energy flows and to suggest possibilities for process integration through pinch analysis, an exergy analysis identifies the locations and magnitudes of thermodynamic irreversibilities. The advanced exergy analysis determines the real potential for thermodynamic improvements by dividing the exergy destruction into its avoidable and unavoidable parts, which relate to technological limitations, and into its endogenous and exogenous parts, which present the interactions between the different sub-systems. This analysis was based on factory data with which the complete production line (milk treatment, evaporators and dryers) and the utility systems were modelled. The results show the potential for optimisation and a comparison of the applicability of the different methods to the dairy industry. The pinch analysis and energy mapping showed that the potential for heat integration was small. The exergy analysis revealed the gas burner and spray dryer caused most exergy destruction, while the heaters had low exergy efficiencies. The advanced exergy analysis found the evaporators to have a high share of avoidable exergy destruction. However not all results from the advanced exergy analysis were practical.

Keywords: Energy efficiency, Exergy analysis, Advanced exergy analysis, Process integration, Pinch analysis, dairy Industry

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