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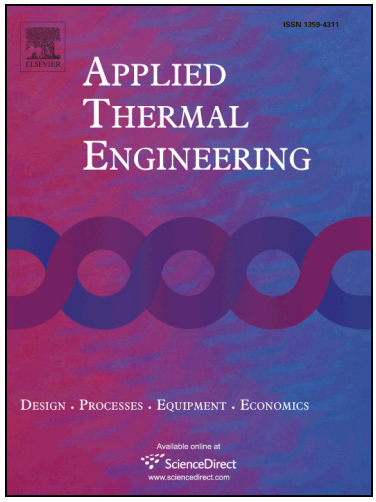

Research Paper

Exergy Analysis of Wine Production: Red Wine Production Process as a Case Study

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Exergy Analysis of Wine Production: Red Wine Production Process as a Case Study

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ABSTRACT

This paper performs exergy analysis of a red wine production line and defines the exergy destruction rates to assess the system performance in terms of sustainability. A model study with necessary data is chosen for the calculations. The total exergy destruction rate of the overall system was determined to be 344.08 kW while the greatest destruction rate of the exergy in the whole system occurred in the open fermenter (333.6 kW). The system thermal efficiency was obtained to be 57.2 % while the exergy efficiency was calculated as 41.8 %. The total exergy destruction rate of the overall system increases with the increase both in the grape flow rate and the reference temperature when the reference pressure is assumed as 101.325 kPa. Furthermore, the chemical exergy of streams was found much higher than the physical exergy for each stream. The exergy results were illustrated through the Grassmann diagram. Furthermore, cumulative exergy loss and specific exergy loss values were determined as 2692.51 kW/1 kg/s grape processed and 5080.20 kW/kg wine, respectively.

Keywords: red wine, thermodynamic analysis, exergy, sustainability

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