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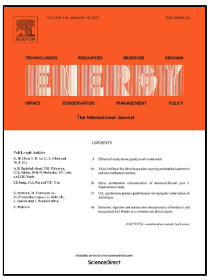

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Sustainability assessment of heat exchanger units for spray dryers

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ABSTRACT

In this study, the sustainability assessment is performed to the system known as heat exchanger unit with spray dryer. The five-different dead state temperatures (0-5-10-15-20°C) are considered. It is found that the heat exchanger has the highest energy efficiency (63.32%), while the overall system has the lowest one (5.56%). So, the combination of the spray dryer with the heat exchanger is more effective. On the other hand, the overall exergy efficiency of the system is lower than the heat exchanger and spray dryer for all of the dead state (environmental) temperatures. The exergy efficiency of the heat exchanger is inversely proportional to the dead state temperature, and the maximum rate is found as 49.65% at 0°C. Furthermore, the exergy efficiencies of the spray dryer and overall system are directly proportional to the dead state temperatures, and the corresponding maximum rates are found to be 26.41% and 24.32% at 20°C, respectively. Also, the exergy destruction is directly proportional to the dead state temperatures. The minimum and maximum exergy destruction rates are found at the dead state temperatures of 0°C and 20°C, respectively. Furthermore, the most sustainable system is found as the heat exchanger unit.

Keywords: Heat exchanger; Sustainability; Spray dryer; Thermodynamic; Efficiency; Exergy

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