البحث الثانى
مشترك - منشور بمجلة دولية   ((غير مستخلص من رسالة))

عنوان البحث:

Machine learning, mathematical modeling and 4E (energy, exergy, environmental, and economic) analysis of an indirect solar dryer for drying sweet potato

تعلّم الآلة، والنمذجة الرياضية، والتحليل الرباعي (الطاقة، إكسيرجي، البيئي، والاقتصادي) لمجفف شمسي غير مباشر لتجفيف البطاطا الحلوة

Abstract

A developed indirect solar dryer is built and operated to dry sweet potato cubes. Since, numerous instruments have gathered experimental data to comprehensively evaluate the system's energy, exergy, environmental, and economical aspects. Additionally, four machine learning algorithms, namely Decision Trees (DT), Gradient Boosting Regression (GBR), Multiple Linear Regression (MLR), and Random Forest (RF), are evolved to forecast the solar collector's energy ($RSAH, \eta$) and exergy efficiency ($RSAH, \eta_{EX}$) as well as the drying chamber's mean drying temperature and exergy efficiency(DC, η_{Ex}). In addition, ten drying kinetics mathematical models were employed to fit with sweet potato moisture ratio variation over the experiment. Also, Color and bioactive compounds were analyzed. Results show that, $RSAH, \eta$ and $RSAH, \eta_{EX}$ was 72.9 %, and 5.6 %, respectively. Storage unit thermal ($\eta_{Th.,SU_{PCM}}$)and exergy efficiency ($\eta_{Ex,SU_{PCM}}$) were 43.4%, and 18.4 %, respectively, the discharging lasted around 5.5 hours. Theoretical drying chamber thermal efficiency (DC, η_{th}) was from 21.9 to 97.2 %. And av. DC, η_{Ex} was 46.1 %. RF algorithm achieved the best results for $RSAH, \eta, RSAH, \eta_{EX}$, DC, T_{mean}, and DC, η_{Ex}, forecasting, because of its superior adaptability and generalization. The overall dryer efficiency was 15% with a specific energy consumption of 4.509 kWh/kg moisture. The Page model showed the best fitting with sweet potato moisture ratio data. In addition, CO_2 mitigation reached 20.2 with earned carbon credit is 56771 RMB. The economic payback period is 29.24 months, the annual total revenue is 8464 RMB and 0.7 RMB as a Return on investment.

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