

# Study of microwave and convective drying kinetics of pea pods (*Pisum sativum* L.): A new modeling approach using support vector regression methods optimized by dragonfly algorithm techniques

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## Abstract

Machine learning and mathematical modeling techniques have been conducted to model the thin layer drying kinetics of pea pods, under either microwave or conventional air drying. The effect of nine different microwave output powers (200–1000 W) and five different ventilated oven temperatures (40, 60, 80, 100, and 120°C) on drying kinetics was studied. The experimental drying rates were fitted to 11 literature semi-empirical models to determine the kinetic parameters, finding the higher goodness-of-fit for the Midilli et al. model (average  $R^2=0.999$  for both drying methods). Moreover, the data were modeled using support vector machine (SVM) for regression which was optimized with dragonfly algorithm (DA) technique. The best result was obtained by Gaussian kernel with the optimal parameters  $\sigma$ ,  $C$ , and  $\epsilon$  values estimated as 0.2871, 78.45, and 0, respectively. The small root mean square error (RMSE = 0.0132) and the high determination coefficient ( $R^2=0.9983$ ) values proved how robust the SVM model is. DA-SVM techniques can reliably be utilized to describe the thin layer drying kinetics of pea pods. It is useful to provide models that can assist in the development of food process control algorithms, and provided insights into complex processes, for the technological design of microwave or convective drying for pea pods preservation.

## Practical applications

Drying of by-products from pea processing industry was investigated as a critical step prior to their valorization. The drying of pea pods has never been investigated before which is the case of the present study whose objective was to study and model the

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