

Package ‘dryingkineticmodels’

July 21, 2026

Title Drying Kinetic Models Comparison and Analysis

Version 1.0.0

Description Fits multiple thin-layer drying kinetic models to experimental moisture ratio data, compares model performance using statistical criteria, performs residual diagnostics, identifies the best-fitting model, and exports results to Word documents. Twenty models from Ertekin and Firat (2017) <[doi:10.1016/j.jfoodeng.2016.09.030](https://doi.org/10.1016/j.jfoodeng.2016.09.030)> are fitted using the Levenberg-Marquardt algorithm described in Marquardt (1963) <[doi:10.1137/0111030](https://doi.org/10.1137/0111030)>.

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Depends R (>= 4.1.0)

Encoding UTF-8

Language en-US

RoxygenNote 7.3.3

Imports readxl, lmtest, minpack.lm, tseries, officer, flextable

Suggests knitr, rmarkdown

VignetteBuilder knitr

NeedsCompilation no

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Repository CRAN

Date/Publication 2026-07-21 11:10:08 UTC

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dryingkineticmodels-package

dryingkineticmodels: Drying Kinetic Models Comparison and Analysis

Description

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dryingkineticmodels *Drying Kinetic Model Comparison and Analysis*

Description

Fits 20 thin-layer drying kinetic models to experimental moisture ratio data, ranks them by a composite goodness-of-fit criterion (R^2 , RMSE, and χ^2), identifies the best model, predicts moisture ratio (MR) using the best model, performs residual diagnostic tests, and exports a fully formatted report to a Word document.

Usage

```
dryingkineticmodels(
  file_path,
  verbose = FALSE,
  models = NULL,
  export_word = FALSE
)
```

Arguments

file_path	Either a character string giving the path to an .xlsx file, or a data frame. In both cases the first two numeric columns are used as time and MR.
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verbose	Logical. If TRUE, also prints detailed diagnostic and progress information to the console via <code>message()</code> . Default FALSE. Regardless of this setting, a short note confirming which columns were used as TIME and MR is always printed, since choosing the wrong columns silently would give incorrect results.
models	Optional character vector naming which of the 20 models to fit (see Details for valid names). If NULL (default), all 20 models are fitted, preserving prior behavior. Fitting fewer models is faster and is mainly useful for quick checks or small examples.
export_word	Logical. If TRUE, builds and exports a Word document summarizing the model comparison, diagnostics, and plots. If FALSE (default), skips Word export and only returns the results list.

Details

The function expects the input to have at least two numeric columns. The **first** numeric column is treated as drying time as 'time' and the **second** as moisture ratio as 'MR'. Reorder your columns in Excel if needed before calling the function.

The 20 models fitted are: Lewis, Page, Modified Page, Henderson & Pabis, Logarithmic, Two-Term, Two-Term Exponential, Diffusion Approximation, Wang & Singh, Midilli-Kucuk, Modified Henderson & Pabis, Verma, Weibull, Aghbashlo et al., Jena & Das, Hii et al., Parabolic, Thompson, Demir et al., and Thin-Layer Exponential-Linear. The corresponding names to use with the `models` argument are "Lewis", "Page", "Modified_Page", "Henderson_Pabis", "Logarithmic", "Two_Term", "Two_Term_Exponential", "Diffusion_Approximation", "Wang_Singh", "Midilli_Kucuk", "Modified_Henderson_Pabis", "Verma", "Weibull", "Aghbashlo", "Jena_Das", "Hii_et_al", "Parabolic", "Thompson", "Demir_et_al", and "Thin_Layer_ExpLin".

Starting values are obtained via a coarse grid search using `nlsLM`, making the fitting robust across a wide range of datasets without requiring manual starting value specification.

Goodness-of-fit statistics reported are R^2 , RMSE, MAE, χ^2 , and RSS. Model ranking uses the combined rank of R^2 , RMSE, and χ^2 following Goyal et al. (2007).

Residual diagnostics include the Shapiro-Wilk test (normality), Durbin-Watson test (autocorrelation), Breusch-Pagan test (homoscedasticity), and Runs test (randomness).

Value

A list (returned invisibly) with five elements:

comparison_table Data frame of all model fit statistics, sorted by composite rank.

best_model The result list for the best-fitting model.

anova_table ANOVA table for the best model.

predicted_MR Data frame containing observed time, observed MR, predicted MR, residuals, and 95% the best-fitting model.

columns_used Data frame recording which input columns were used as TIME and MR. Always check this to confirm correct column selection, especially when `verbose = FALSE`.

References

Goyal, R. K., Kingsly, A. R. P., Manikantan, M. R., & Ilyas, S. M. (2007). Mathematical modelling of thin layer drying kinetics of plum in a tunnel dryer. *Journal of Food Engineering*, 79(1), 176–180. doi:10.1016/j.jfoodeng.2006.01.041

Examples

```
# Small, fast toy example (runs automatically during R CMD check)
toy_df <- data.frame(
  time = c(0, 30, 60, 90, 120, 150),
  MR   = c(1.00, 0.72, 0.51, 0.36, 0.26, 0.18)
)
toy_result <- dryingkineticmodels(toy_df, models = c("Lewis", "Page"),
                                export_word = FALSE)
toy_result$comparison_table

# Fuller example using a bundled sample dataset (slower, includes Word export)
sample_file <- system.file("extdata", "sample_drying_data.csv",
                           package = "dryingkineticmodels")
df <- read.csv(sample_file)
result <- dryingkineticmodels(df, export_word = TRUE)
```

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