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Data Article

Theoretical and analyzed data related to thermal degradation kinetics of poly (L-lactic acid)/chitosan-*grafted*-oligo L-lactic acid (PLA/CH-g-OLLA) bionanocomposite films

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A R T I C L E I N F O

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Keywords:
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A B S T R A C T

The theoretical and analyzed data incorporated in this article are related to the recently published research article entitled "Thermal degradation behaviour of nanoamphiphilic chitosan dispersed poly (lactic acid) bionanocomposite films" (http://dx.doi.org/10.1016/j.ijbiomac.2016.11.024) (A.K. Pal, V. Katiyar, 2016) [1]. Supplementary information and data (both raw and analyzed) are related to thermal degradation kinetics and explains various model fitting and is conversional methods, which are used in this research work to enhance the knowledge about degradation behaviour of PLA/CH-g-OLLA bionanocomposite system. Non-isothermal degradation kinetics of such polymeric system was proposed using Kissinger, Kissinger–Akahira–Sunose, Flynn–Wall–Ozawa and Augis and Bennett models to estimate the activation energies (E_a) and R^2 values.

Specifications Table

Subject area	Material Sciences
More specific subject area	Polymer degradation
Type of data	Text file, equations and tables

DOI of original article: http://dx.doi.org/10.1016/j.ijbiomac.2016.11.024

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How data was acquired	Data is analyzed using Thermogravimetric analyzer (Libra TG 209, Netzsch, Germany) under the following condition: Sample weight = ~5–8 mg, Temperature range = 35–650 °C, Heating rates = 2, 5 and 10 °C min^{-1} and Atmosphere = inert atmosphere (flow rate ~50 mL min^{-1})
Data format	Text and analyzed data
Experimental factors	PLA and PLA/CH-*g*-OLLA bionanocomposite films were fabricated by varying CH-*g*-OLLA loading from 1–5% (wt/wt).
Experimental features	Various combinations of PLA/CH-*g*-OLLA bionanocomposite films were prepared by solution casting method. The activation energies (E_a) and R^2 values for all the combinations were analyzed by the data obtained from thermogravimetric analysis for evaluating the degradation behaviour at each conversion.
Data source location	Department of Chemical Engineering, Indian Institute of Technology Guwahati, Guwahati, Assam-781039 (India)
Data accessibility	Data are presented in this article only

Value of the data

- The basic information about thermal degradation kinetics is required to understand the degradation behaviour of any polymeric system.
- Various model fitting and isoconversional methods give information about the degradation pathway and related analyses confirm the degraded products. Both parameters are useful to check the industrial viability and recyclability of PLA/CH-*g*-OLLA bionanocomposites.
- The presented basic information can be useful for other researchers to choose suitable model on the basis of their assumptions and limitations.
- The activation energies with R^2 values are calculated using Flynn–Wall–Ozawa and Kissinger–Akahira–Sunose model.

1. Basic theoretical data

1.1. Theoretical consideration of thermal degradation kinetics

A general reaction is applied to describe the thermal decomposition of polymeric materials as mentioned in Eq. (S1).

$$P\left(\frac{\text{solid}}{\text{liquid}}\right) \rightarrow Q\left(\frac{\text{solid}}{\text{liquid}}\right) + R(\text{volatileorgases}) \tag{S1}$$

where, P and Q are the reactants and R is the reaction product generated during the consumption of P and Q.

The decomposition rate ($\frac{d\alpha}{dt}$), for isothermal reactions may be described as shown in Eq. (S2).

$$\frac{d\alpha}{dt} = k(T)f(\alpha) \tag{S2}$$

where, $\alpha = \text{Extentofconversion} = \frac{W_0 - W_t}{W_0 - W_f}$, W_0, W_t and W_f are initial weight, weight at time t and final weight of the sample respectively. $k(T)$is the rate constant at temperature T. $f(\alpha)$ is a function of reaction model, which depends on degradation mechanism. The temperature dependant rate constant may be explained with the help of Arrhenius equation as expressed in Eq. (S3).

$$k(T) = A\exp\left(-\frac{E_a}{RT}\right) \tag{S3}$$

where, E_a, A, T and R are the activation energy (kJ mol^{-1}), pre-exponential factor (s^{-1}), absolute temperature (K) and universal gas constant (8.314 J mol^{-1} K^{-1}) respectively. The above Eqs. (S2) and