ARTICLE IN PRESS

Materials Today: Proceedings xxx (xxxx) xxx

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Artificial neural networks for the prediction of mechanical properties of CGNP/PLGA nanocomposites

Mohammad Habeeb [a,*], Huay Woon You [b], Kiran Balasaheb Aher [c], Girija Balasaheb Bhavar [d], Sarita Suryabhan Pawar [e], Shital Dnyaneshwar Gaikwad [f]

[a] Department of Pharmaceutics, Crescent School of Pharmacy, B.S. Abdur Rahman Crescent Institute of Science and Technology, Chennai 600048, India
[b] Pusat GENIUS@Pintar Negara, Universiti Kebangsaan Malaysia, Bangi 43600, Malaysia
[c] Department of Pharmaceutical Quality Assurance, Shri Vile Parle Kelavani Mandal's Institute of Pharmacy, Dhule, Maharashtra 424001, India
[d] Department of Pharmaceutical Chemistry, Shri Vile Parle Kelavani Mandal's Institute of Pharmacy, Dhule, Maharashtra 424001, India
[e] Department of Pharmaceutical Chemistry, Sanjivani College of Pharmaceutical, Education, and Research, Ahmednagar 423603, India
[f] Department of Pharmaceutical Chemistry, Samarth Institute of Pharmacy, Belhe, Pune, Maharashtra 412410, India

ARTICLE INFO

Keywords:
Artificial neural network
Nanocomposites
Spark plasma sintering

ABSTRACT

The mechanical properties of composite-based components have an impact on both their quality and efficacy. As a result, a scientific framework is needed to discover the practical set of progression constraints that will result in exceptional mechanical qualities. The possibilities of an artificial neural network (ANN) for predicting mechanical properties—specifically, the density and hardness of a carboxyl decorated graphene Nanocomposites (CGNP)/Poly Lactic-co-Glycolic Acid (PLGA) nanocomposite created under various spark plasma sintering (SPS) operating conditions—are explored in this work. A back-propagation with a 2–10-2 structural design and Levenberg-Marquardt algorithm was advanced to anticipate the automated performance of CGNP/PLGA nanocomposites in expressions of density and hardness parameters. The hypothesized outcomes of the models were compared to the actual experimental value. Density (0.9842) and hardness (0.9737) were found to be near to one; the archetypal accomplished well, with a good correlation coefficient (R) for both outputs and a low root-mean-squared error. The anticipated data findings were found to be quite compatible with the values acquired from the investigational assessment results. Our findings demonstrate the utility of a well-trained ANN method in assessing the density and hardness properties of SPSed CGNP/PLGA nanocomposites. As a result, the ANN system provides an unswerving tool for making decisions that can reduce the high costs involved with the experimental characterization of newly manufactured polymer composites.

1. Introduction

Graphene, a one-atom-thick layer of sp2 carbon atoms with a two-dimensional honeycomb lattice, has become one of the materials that have received the most attention in chemistry, physics, materials science, and nanotechnology. Graphene is the world's thinnest and strongest material, with exceptional heat and electricity conductivity. Graphene is commonly employed in electronic devices due to its amazing characteristics [1,2]. Biological applications [3] energy conversion and storage, and nanocomposites are a few examples. Graphene with carboxyl groups Nano-platelets (CGNPs) is an innovative Nano filler with appealing properties such as strong compatibility with most polymers, high absolute strength, and low cost4, 5. CGNPs were employed to underline epoxy amalgamated and epoxy/carbon fiber complex covers in this work to improve their mechanical qualities. The mechanical possessions of CGNPs/epoxy nanocomposite were examined, including eventual tensile power and flexure possessions PLGA, also known as poly lactic-co-glycolic acid, is a biodegradable, biocompatible, and FDA/EMA (European Medicines Agency) authorized copolymer[6,7]. It is commercially accessible in a variety of molecular weights and copolymer ratios, allowing the final PLGA behavior to be tailored to a specific application [8–10]. A composite material is a consolidation of a base substance acknowledged as a medium or a glue and a plaster substantial (support). Stuffing materials might be smithereens, specks, threads, or regular or artificial whiskers. The incorporation of these fillers into polymers leads to amalgamated materials with

* Corresponding author.
E-mail address: mdhabeebqa@gmail.com (M. Habeeb).

https://doi.org/10.1016/j.matpr.2023.08.354
Received 2 June 2023; Received in revised form 25 August 2023; Accepted 28 August 2023

Source details

Feedback > Compare sources >

Materials Today: Proceedings

Scopus coverage years: 2005, from 2014 to Present

E-ISSN: 2214-7853

Subject area: Materials Science: General Materials Science

Source type: Journal

View all documents > Set document alert Save to source list Source Homepage

CiteScore 2022
3.2

SJR 2022
0.445

SNIP 2022
0.774

CiteScore CiteScore rank & trend Scopus content coverage

Improved CiteScore methodology

CiteScore 2022 counts the citations received in 2019-2022 to articles, reviews, conference papers, book chapters and data papers published in 2019-2022, and divides this by the number of publications published in 2019-2022. Learn more >

CiteScore 2022

3.2 = 80,455 Citations 2019 - 2022 / 24,871 Documents 2019 - 2022

Calculated on 05 May, 2023

CiteScoreTracker 2023

4.1 = 87,460 Citations to date / 21,342 Documents to date

Last updated on 05 September, 2023 • Updated monthly