Materials Today: Proceedings 46 (2021) 1729–1734

Contents lists available at ScienceDirect

Materials Today: Proceedings

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

Mechanical properties of hybrid sugar palm/ramie fibre reinforced epoxy composites

J.P. Siregar [a,b,*], M. Zalinawati [a], T. Cionita [c], M.R.M. Rejab [d], I. Mawarnie [d], J. Jaafar [a], M.H.M. Hamdan [a]

[a] College of Engineering, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Kuantan, Pahang, Malaysia
[b] Centre of Excellence for Advanced Research in Fluid Flow (CARIFF), Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Kuantan, Pahang, Malaysia
[c] Department of Mechanical Engineering, Faculty of Engineering and Quantity Surveying, INTI International University, 71800 Nilai, Negeri Sembilan, Malaysia
[d] Faculty of Mechanical & Automotive Engineering Technology, Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia

ARTICLE INFO

Article history:
Received 15 June 2020
Received in revised form 16 July 2020
Accepted 22 July 2020
Available online 2 September 2020

Keywords:
Natural fiber
Sugar palm
Woven fibre
Long fibre
Mechanical properties

ABSTRACT

There has been a dramatic increase in natural fibre composites over the past century when natural fibre has performed well as polymer reinforcement. The present study was conducted on the mechanical properties of reinforced epoxy hybrid composites on sugar palm fibre (SPF) (long fibre)/ramie fibre (woven). The hybridizing effect of sugar palm (S) and ramie (R) fibres at different weight ratios was studied at S:R = 15:10 and R:S = 15:10, and thus maintaining the total fibre load by 25% in weight. The composite hybrid specimen consisted of five layers of fibre was prepared alternately. The mechanical properties of composites were analysed by tensile and flexural tests, respectively. The result showed that the tensile and flexural strength of five-layer ramie composite was greater than the five-layer SPF composite. On the RSRSR hybrid composite with higher tensile (52.66 MPa) and flexural (80.70 MPa) strength properties among the five-layer SPF and SRSRS hybrid composites, positive hybridisation effects were observed. Since studies on hybrid composite reinforced long fibre SPF were combined with ramie woven reinforced epoxy to improve mechanical performance, the aim to achieve a green composite has become successful.

Selection and peer-review under responsibility of the scientific committee of the Innovative Manufacturing, Mechatronics & Materials Forum 2020.

1. Introduction

Due to high performance in terms of mechanical properties, significant processing advantages, low density, low cost, and excellent chemical resistance, the last decade has seen the rapid growth of fibre composite [1–2]. In a variety of applications, the production of composite materials based on the reinforcement of two or more fibre types in a matrix has played a dominant role for a long time. The manufacture use and removal of conventional fibre reinforced synthetic were due to environmental problems. Therefore, the emergence of natural fibre composite currently inclines, as the demand on green technology and renewable composite increases. Due to the need for environmentally friendly materials, synthetic material has shifted to natural fibre composites, which more attention is being paid on [3]. The fact that natural fibres are sourced from renewable resources of plants that can be easily biodegraded, more research in this field is encouraged. Jute, ramie, hemp, flax, kenaf, pineapple leaf fibre (PALF), coir, and several others are the examples of natural fibre that have been used in the development of fibre composite and research [4]. The use of natural fibres is particularly beneficial to local usage and industries. Natural fibres are widely used in the construction and automotive industries.

Natural fibres, such as sugar palm (Arenga pinnata) and ramie are found abundantly in Malaysia, Indonesia, and Thailand. They are considered a waste product of the agro-industry [5,6]. Today, SPF is considered an attractive natural fibre by many researchers due to its cellulose content that is readily isolated from other components [7,8]. The advantage of SPF is resistance to sea water and high durability [6,9]. The ramie (Boehmeria nivea) is also known as China grass. Ramie fibres have outstanding mechanical properties compared with most of the natural fibres around the world. It is known as eco-friendly fibre resource because ramie fibre has some advantages over synthetic fibres on the environment. As an example, it improves health and releases lesser carbon during production. Ramie fibres have oddly long fibre cells ranging between 110 mm and 140 mm. The length of ramie is nearly six

* Corresponding author.
E-mail address: januar@ump.edu.my (J.P. Siregar).

https://doi.org/10.1016/j.matpr.2020.07.565
2214-7853/
Selection and peer-review under responsibility of the scientific committee of the Innovative Manufacturing, Mechatronics & Materials Forum 2020.