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ORIGINAL PAPER

# Effect of red mud filler on mechanical and buckling characteristics of coir fibre-reinforced polymer composite

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**Abstract** Red mud produced as by-product in Bayer's process for alumina production is posing severe environmental challenge in its disposal. Present work describes using this environmental pollutant as filler in combination with coir fibre using polyester resin for composite production. Tensile properties, flexural properties, compressive properties, hardness and density of coir polymer composites with and without red mud filler were evaluated experimentally. Subsequently, buckling analysis of the prepared composite was also done experimentally and using finite element method at different grid size and for different number of elements to establish the grid independence of obtained results. It has been observed that compressive strength, hardness and density of the prepared composite improved with addition of red mud as filler. This may be attributed to metallic oxides present in chemical composition of red mud. Addition of the filler had a negative effect on tensile and buckling properties as the load cannot be transferred effectively from fibre to resin. Interestingly, it has been observed that composite plates with 20 % fibre gave optimum combination of various properties. The main aim of this work was to study the effect of red mud filler on the mechanical properties and buckling strength of the prepared composites leading to development of a novel low-cost, light-weight composite material using an environmental pollutant which can be used for light-weight structural application.

**Keywords** Red mud · Coir fibre · Polyester resin · Mechanical properties · Buckling analysis

## Introduction

Technical advancements in field of composites have made it possible to manufacture laminated composite materials possessing unique customised properties such as high strength/stiffness, low weight, better corrosion resistance, resistance to heat and environmental degradation, customised properties based on varying stacking pattern, etc. This has resulted in increased application of such materials in variety of structures including aerospace, civil infrastructure, marine, etc. [1]. Natural fibres like jute, coir, bagasse, banana, etc., are nowadays favoured than conventional glass, aramid and other artificial fibres owing to their light weight, abundance, low cost and good mechanical properties [2, 3].

The natural fibre composites are readily used in automobile industries, military application, construction industries, furniture industries, low-cost housing, etc.

The higher cost of composites is the only factor hampering its use in majority of industrial application in spite of possessing customised properties specific to given application. Some researchers have found that adding low cost and readily available filler is the easiest way to bring down the cost of composites. However, mechanical properties of the composites should not be affected adversely in the attempt of reducing the cost. Therefore, fillers are added firstly to improve the mechanical and tribological properties and

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