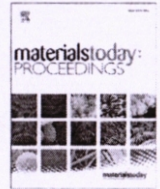




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## Effect of alkali treatment on wear behaviour of walnut shell reinforced bio-composites

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### ABSTRACT

In this study, the tribological behaviour of composites reinforced with walnut shells (0 % to 10 % at 2 % interval) has been investigated. The pin-on-disc machine is used to observe the impact of walnut shell addition on the wear properties of the composite. An increase in walnut shell content is associated with diminished wear resistance. Inadequate adhesion among the fibre and the matrix was also identified as the cause of this wear strength degradation in testing results. Pre-treatment of walnut shell with sodium hydroxide increases wear resistance by strengthening matrix adherence to fibre. Different normal loads (from 6 N to 48 N), sliding velocities of 100 cm/s, and sliding distances (SD) of 0 to 2000 m were all considered in the experiments. The findings revealed that operation settings and filler reinforcement have an important impact on the wear behaviour of composite containing walnut shell filler. In comparison to dry and hot contact, the specific wear rate (SWR) is nearly 7 to 8 times lesser in wet conditions. Additionally, equated to a composite with a higher filler loading, the performance of one with a lesser loading of walnut shell filler was superior in terms of wear.

### 1. Introduction

There is a current focus on recycling garbage. Walnut shell filler, obtained from the walnut husk, is a lignocelluloses filler that has many applications [1]. Walnut shell filler fibres have a number of characteristics that make them a popular choice as a reinforcing material in modern polymeric composites [2]. These include a less density, minimal price, maximum strength, and reduced tool wear. Walnut shell filler fibre is used in a wide range of industries, including the textile business, the agricultural area, and tribological usage, thanks to its high quality, durability, and thermal stability [3]. Natural fibre composites have several uses in the auto industry and can be found in a variety of places inside the vehicle, including the dashboard, headliner, tray, door panels, and more [4]. Since natural fibre/filler composites have so many practical and industrial uses, they are frequently put through a variety of tribological loading scenarios that subject the component to wear mechanisms such as abrasion, adhesion, and sliding [5]. Since their utility in various production sectors depends on their tribological behaviour, it

is essential to assess and explore this aspect of the established composite [6]. The tribological behaviour of polymer composites with walnut shell filler fibres is poorly understood [7]. How a polymer composite with walnut shell filler reacts tribologically in both dry and wet circumstances. The wear resistance of the composite was found to be significantly greater in the wet state than in the dry state, as determined by testing data [8]. The wear and frictional capabilities of a varied layer of walnut shell filler-reinforced polyester composite. According to the research, a polyester composite with walnut shell filler fibre reinforcement depend on 3 layers exhibited better friction as well as wear behaviour than a composite based on four layers or plain polyester [9,10]. The same author followed up with a report on another investigation that looked at how chemical treatment affected the performance of a polyester composite with walnut shell filler fibres. After being treated, the filler fibres in walnut shells show strong interfacial adhesion with the polyester matrix [11]. As a bonus, the composite made from walnut shell filler fibres treated with alkali exhibited superior wear resistance than that of composites made from untreated and bleached walnut shell filler fibres

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