Oblique impact analysis of cycling helmets made from kenaf (Hibiscus cannabinus) and flax (Linum usitatissimum) natural fiber

ABSTRACT

This paper describes the performance of a natural-fiber-based cycling helmet in an oblique impact with a simulated road surface. The linear accelerations and impact energy of a head form weighing 4 kg were measured and calculated. Helmet standards require helmets to be tested with a simple drop test onto an anvil. The maximum permitted deceleration of the dropped head form is typically 300g, which is equivalent to an impact velocity of 20 km/h (12.5 mph). The two helmets being tested were suspended onto a guided drop-table in the particular desired impact orientation. Just before impact, the test object was released from suspension so it can move unrestrained thereafter. The main advantage of this process is that the object is free to move naturally during impact, which provides for more realistic drop-testing. For oblique impact test, all helmets tested passed the requirement set by EN1078:2007 with linear acceleration measured lower than 250 g in a free fall test from 1.5 m platform. By comparing the resultant linear acceleration with a commercial cycling helmet, Kabuto Aero SL, flax aero helmet shows 11.82% reduction in the resultant linear acceleration with 214.16g. The Kenaf helmet recorded 168.48g, which corresponds to a 30.63% reduction in the resultant linear acceleration compared to the Kabuto helmet and 21.33% reduction compared to the Flax helmet.

Keyword: Oblique impact; Cycling helmets