Journal of Science & Cycling
Breakthroughs in Cycling & Triathlon Sciences

OPEN ACCESS

Conference Abstract

Chain wear and elongation in Elite cycling: a case study

R. Aubert[1,2,3*], Frederic Grappe[1], Xavier Roizard[2], V. Tissot[2] and Fabrice Lallemand [3,4]

[1] Laboratoire Athlète Matériel Environnement (LAME), Centre de Performance Equipe Cycliste Groupama-FDJ, F-25000 Besançon, France
[2] Université de Franche-Comté, CNRS, Institut FEMTO-ST, F-25000 Besançon, France
[3] Société AFULudine, F-39100, Dole, France
[4] Université de Franche-Comté, CNRS, Institut UTINAM, F-25000 Besançon, France

* Correspondence: (RA) remiaubert@outlook.com

Received: 10 March 2023; Accepted: 21 March 2023; Published: 23 October 2023

Abstract: In modern cycling, chain drives are commonly used since they are reliable and very efficient (1). However, their efficiency is known to be a function of chain wear, being highest after a few break-in kilometers and then slightly decreasing with the accumulated kilometers (2). Bicycle mechanics usually use mechanical gauges in order to check the chain elongation and therefore decide when to replace the chain. However, chain elongation can result from both material loss due to friction and mechanical elongation caused by a plastic deformation of the chain elements, which would be independent of material loss. Moreover, the wear of chain link elements is not uniform (3). The aim of this study is to determine the part of plastic deformation on chain elongation. The hypothesis is that plastic deformation is highly responsible for chain elongation. Identical chain spans were tested either on fatigue on a traction machine or in real riding conditions, on a same number of chain cycles (150 000). Since the traction machine acts only in the longitudinal axle, there is no friction occurring during these tests which therefore cause mechanical elongation but no wear. On the other hand, real riding conditions combine both traction and friction. Chain spans elongation was measured throughout the tests. For real riding conditions, parameters such as power output (W), pedaling cadence (rpm), gear ratio, weather and lubrication were controlled. They allowed to determine the chain tension Fn (N), the number of chain cycles and the mechanical work W endured by the chain roller (Nm).

Keywords: Cycling, Chain drive, Wear, Elongation

References

1. Spicer, James B., Christopher J. K. Richardson, Michael J. Ehrlich, Johanna R. Bernstein, Masahiko Fukuda, et Masao Terada. « Effects of Frictional Loss on Bicycle Chain Drive Efficiency ». Journal of Mechanical Design 123, no 4 (1 December 2001): 598 605. https://doi.org/10.1115/1.1412848.
2. 2. Friction Facts. « Drivetrain efficiency test.pdf », s. d.
3. Lates MT, CGavrila C. Friction phenomenon study for chain link – guide contact in translational oscillatory motions. IOP Conf Ser: Mater Sci Eng. 2019 Aug 1;591(1):012093.