

Abstract

Effect of lubrication nature on chain drive efficiency

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Abstract: Chain drive efficiency has been proved to depend on numerous factors such as power output, pedaling cadence, the number of teeth of the rings or lubrication [1,2]. Indeed, actual chain lubricants rely on different technologies. Oils are widely used because they are easy to apply, protective against corrosion and wear, and efficient for decreasing friction in the chain. However, they tend to attract dust and metal elements from the chain, resulting in a pollution of the lubrication. Recently, many manufacturers have developed wax-based lubricants. Wax-based lubricants can be either solid (ready to be melt) or dissolved in an aqueous solution. As for oils, these lubricants protect the chain against the corrosion as a layer of wax isolates the metal from the elements. Moreover, independent reports have measured high wear resistance [3] and efficiency [4], and a very good contamination resistance. Even though the application is more complicated, wax-based lubricants are therefore a serious alternative to oils for lubricating a cycling chain drive. The aim of this study is to assess the difference of efficiency that exists between top-end lubricants available on the market. Four oils, two liquid wax-based lubricants and two solid wax-based lubricants were compared in a time-trial simulation on a motorised testing rig. Power output (450W), pedaling cadence (100 rpm) gear ratio (60-16) were fixed. Each lubricant was tested twice, each measure for one hour. Torque and angular velocity were measured using torquemeters (T40B, HBM, Germany) between the motor and the chainring (input) and between the cassette and the magnetic brake (output). Mechanical power was therefore calculated, allowing to determine the efficiency of the whole transmission. Results were pooled by typology of lubrication. Differences in efficiency could be explained by the physical state of the lubricants, as well as their chemical composition.

Keywords: Lubrication, Chain drive efficiency, Oil, Wax, Testing rig.

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