USE OF BIO-BASED RESINS AND VEGETABLE OILS BLENDS AS ALTERNATIVE TO TRADITIONAL PLASTICIZERS IN TIRE TREAD COMPOUNDS

The automotive industry is in constant development, with a special focus on increasing the sustainability of tires while maintaining their high performance. One of the most used approaches to reach this goal is the use of bio-based raw materials. Rubber compounds used in tires are a complex mixture of various materials in which the main constituents are: (i) elastomeric matrix, (ii) fillers and (iii) plasticizers. In the case of plasticizers, there is an urgent need for alternatives due to the EU regulations to limit / ban the use of oils containing polycyclic aromatic hydrocarbons (PAH) in order to avoid any future dependence on limited fossil resources. The most investigated replacement for traditional plasticizers are vegetable oils and bio-based resins. However, the use of these alternatives did not reach the desired performance when compared to traditional oils. In this framework, the combination of both bio-based plasticizers (vegetable oils and resins) could be a promising option to reach similar or better performance than oils obtained from fossil resources. With this study the student will be contributing to the development of a more sustainable tire.

Objective:

The objective of this assignment is to develop a more sustainable tire tread compound. In this framework different blends of vegetable oils and bio-based resins as a potential environmentally-friendly replacement for Treated Distillate Aromatic Oil (TDAE) in tire tread compounds will be tested. Various vegetable oils and bio-based resins are available to be used as partial or full replacement of TDAE. New rubber compounds will be prepared, characterized and compared with the state-of-the-art tire tread compound with TDAE as plasticizer.

Assignment:

At the beginning of the assignment the student will propose different vegetable oils and bio-based resins based on a literature research, their properties and availability. The final choice of the alternative plasticizers will be done in agreement with the supervisor. Afterwards, the selected materials will be characterized and a set of new rubber compounds will be designed and prepared. Their properties will be tested and compared to a reference compound prepared using TDAE oil. The obtained results will be discussed based on the oil and resin characteristics and how they affect the main properties of a tire tread (wet grip, rolling and abrasion resistance).

Report:

The graduation report should contain a description and evaluation of: 1. The selection of the alternative plasticizers types; 2. Alternative plasticizers characteristics in comparison to TDAE oil.; 3. the preparation and processing of rubber compounds; 4. the testing procedures, results and final conclusions.

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