COMPARISON OF THE CARBON BLACK AND BIOCHAR IMPACT ON THE POWER CONSUMPTION DURING RUBBER MIXING

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1. INTRODUCTION

Rubber producers are widely used in a number of applications, and they are favoured when, compared to other materials, their greatly deformable characteristics are needed and their storage attributes are desired. The most common rubber composites contain carbon black and necessary additions, by type of reinforcing agents, complex fillers. Carbon black (CB) is a traditional filler, mostly used in natural rubber composites, because of its graphite crystal structure can significantly improve the characteristics of the final product. In the last decades, demand for energy is growing rapidly, while the reserves of fossil fuels are decreasing, it is necessary to find alternate sources, therefore, in the exceptional reinforcement properties, purity and low cost. Recently, the major interest is made in replacement of CB with biochar because of its

2. MATERIALS AND METHODS

2.1. Components for rubber mixing

Natural rubber, accelerators and curing agents are components of so-called rubber blend. Accelerators, used in this work, are carbon black or biochar, N-isopropyl-N'-phenyl-p-phenylenediamine (IPPD), stearin, and zinc oxide (ZnO). Curing agents are Sulphur and N-Cyclohexylbenzothiazol-2-pyrimidinedithiocarbamic acid bis (maleimido) diphenyl methane (CBS). Carbon black (CB) and biochar (BC) were prepared following the same recipe and procedure, as with biochar. During the mixing of components, current and voltage of the mixer are measured, and obtained data was used for calculating the consumed power for mixing, where voltage and power are necessary for the operation of the mixing motor.

2.2. Mixing procedure

The mixing power was performed with laboratory mixer HAACK Rhinoplast (model 60) modified with drive unit HAACK Rheolux EU-5 ammeter ( ddlsheld AAP-98778) and voltmeter (ddlsheld AAP-98778).

2.3. Power calculation

The current for mixing was calculated following the Equation \( P = U \cdot I \). Where, the \( P \) is power [V], the \( U \) voltage [V] and the \( I \) current [A]. Power consumption is calculated in the power integral over the mixing time, i.e., the area under the curve power vs. time.

3. RESULTS AND DISCUSSION

From Figure 2 it can be observed that with higher share of CB and biochar, the power consumption is increasing, especially for blends with CB, which can be explained with CB smaller particle size, purity and higher interaction with natural rubber. Higher power consumption for mixing can be related to the better mixing and homogeneity of the final rubber product. In order to investigate the difference in the power consumption, it is necessary to conduct more experiments related to particle size and activity of both materials.

5. REFERENCES