UPMBIOCHEMICALS | UPM

UPM BioMotion™ **Renewable Functional Fillers (RFF)**

A SUSTAINABLE SOLUTION FOR RUBBER HOSES

Climate change, raw material scarcity, regulatory pressure, and consumer preferences for sustainable products are critical drivers for replacing fossil-based materials with innovative and renewable solutions. UPM BioMotion™ **Renewable Functional Fillers (RFF) are wood-based and offer a negative carbon footprint. Together with a unique combination of additional features, UPM** BioMotion™ **RFF is a truly sustainable alternative replacing highly CO_2-intensive carbon black and precipitated silica in a broad range of applications enabling rubber industry to take the next step towards a lighter and more sustainable future.**

UPM BioMotion™ Renewable Functional Fillers (RFF) offer rubber compounders and producers of mechanical rubber goods an excellent solution helping customers to meet their sustainability goals. UPM BioMotion™ RFF contain 100% biogenic carbon and have a negative carbon footprint from cradle to gate considering biogenic carbon from our feedstock and buying 100% green electricity. Compared to traditional functional fillers, the density is more than 25% lower. Like white, inorganic fillers, and unlike industrial carbon blacks, they are 100% electrically insulating and do not contain polycyclic aromatic hydrocarbons (PAHs) above the thresholds of Commission Regulation (EU) No 1272/2013.

TABLE 1: **Comparison of RFF with industrial carbon black.**

Characteristics	**UPM** BioMotion™ **RFF**	Carbon Black
Origin	renewable	fossil-based
GWP (carbon footprint)	negative# (reduced climate impact)	highly positive (increased climate impact)
Specific gravity	1.3 g/cm³	1.8 g/cm³
Electrical properties	non-conductive	conductive
PAHs	absent	present##

from cradle to gate based on revised third-party validated LCA according to ISO 14040 and ISO 14044 considering biogenic carbon from our feedstock and buying 100% green electricity for the production process via GOs

for standard qualities

Due to their polar nature UPM BioMotion™ RFF work exceptionally well in combination with polar polymers like nitrile butadiene rubber (NBR). They are ideally suited to replace carbon black in NBR applications enabling compounders to increase the renewable material content which reduces both, carbon footprint and density of final products, while maintaining or even improving rubber performance at the same time.

COMPOUNDING AND RHEOLOGICAL PROPERTIES

In a sulfur cured model compound semi-reinforcing carbon black (N550) is used togehter with inactive thermal black and talc (#1). N990 was iso-gravimetrically replaced by UPM BioMotion™ X10. Slight compound adjustments (#3) significantly improved the processability in extrusion. All three investigated compounds show similar curing characteristics.

TABLE 2: **Composition of hose compounds using UPM** BioMotion™ **X10 as replacement of N990 (loadings in phr).**

Compound	#1	#2	#3
NBR 3945 | NBR 3345	100 | -	100 | -	60 | 40
N550	30	30	30
N990	80	-	-
Talc	80	80	60
UPM BioMotion™ X10	-	80	80
Plasticizer + Chemicals	24	24	29
Sulfur + Accelerators	0.5 + 4	0.5 + 4	0.5 + 4

PHYSICAL AND MECHANICAL PROPERTIES

Overall mechanical properties of all three compounds are comparable. Compounds containing UPM BioMotion™ X10, tend to have slightly higher hardness values. Rubber reinforcement of compound #2 and #3 is slightly lower in comparison to the reference compound, but still on an acceptable level. In addition, replacement of N990 by UPM BioMotion™ X10 had no impact on properties after heat ageing (100°C/72h) or swelling in non-polar media. The more sustainable NBR compounds using UPM BioMotion™ X10 provide the same excellent chemical and high temperature resistance like the fossil reference. Compound #3, was successfully converted to demonstrator hoses, which show excellent dimension stability and surface quality.

CLIMATE BENEFITS REPLACING CARBON BLACK WITH UPM BioMotion™ RFF

The iso-gravimetric exchange of N990 by UPM BioMotion™ X10 in compound #2 results already in a 7% lower rubber density compared to the reference (#1). Processability adjustments in compound #3 even yield a lower rubber density, mainly due to reducing heavy-weight talc by additional 25%. This will have a positive impact in all applications where lightweight construction is required. The weight loss is accompanied by a 26% increase of renewable material content, which helps to realize targets set in many different industries. The high share of renewable material is also reflected in the rubber compound carbon footprint. The GWP is reduced by 60% compared to the fossil-based reference.

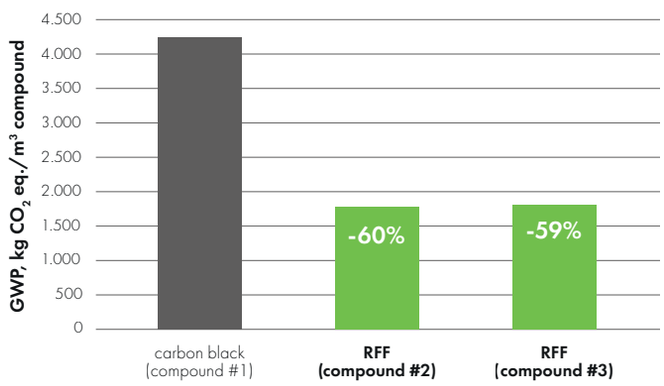

FIGURE 1: **Comparison of global warming potential of described compounds, showing a significant reduction when containing UPM** BioMotion™ **RFF.**

Source: UPM Biochemicals calculations using GaBi data sets

LEARN MORE ABOUT US

Contact us now to learn more and to explore possibilities for collaboration to jointly transform the rubber and plastics industries.

Contact us at:
RFF@upm.com

UPM Biochemicals GmbH
Am Haupttor, Bau 4614
06237 Leuna, GERMANY

Date: 06/2024