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Mechanical Properties of Tri Sustainable NBR/Cement Waste/Rice Husks Silica Blend

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ABSTRACT

The accumulation of agricultural and industrial manufacturing waste is an important environmental problem of the most countries in which the means of recycling these waste is not available. Therefore, it is important to find sustainable green engineering applications for the integration of these waste in the industry and be an environmental, economic and industrial competitor and alternative to materials existing now. Cement waste and rice husks silica were added as a weight nanoscale particle (1µm /0-40pphr) and (10µm /20pphr) respectively to the Acrylonitrile - butadiene rubber (NBR) for making tri sustainable blend. Elongation and modulus of elasticity were measured before and after the addition of cement waste and rice husks to NBR by Tansometer device, the results showed improved the value of the modulus of elasticity after reinforced by cement waste and rice husks, but and at the same time, elongation was decreased.

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1- Introduction

Recycling is a series of processes that convert waste into new products usable again to prevent the accumulation of waste and reduce the consumption of fresh raw materials, energy use, air pollution (burning) and water pollution (from landfilling) by reducing the need to "get rid emissions conventional waste "and cut greenhouse gases [1]. The most important industries that can use the recycled waste is elastomers industry, because it presence in many countries that suffer from pollution and the accumulation of waste [2]. Elastomers used today in many industrial applications, such as cable, wire and cars, for its light weight, ease of maintenance and processing, high toughness and low manufacturing costs [3]. The waste can be used as a filler in addition the presence the original fillers which including carbon black, silica, resins, calcium oxide, calcium carbonate and other stimulant, which can be increased the vulcanized rubber strength up to ten times [4]. By adding fillers, we can use elevated temperatures to strengthen, reduce the degree of active substances emitted by reducing heat, fillings as well as working to reduce the tendency of the polymer cracking during hardening in addition to shorthand the proportion of deflation and help to produce a soft

molded surfaces [5].

2. Methodology

2.1. Materials

Acrylonitrile-butadiene rubber (NBR), cement waste with nano particles (1µm) from the southern general company/IRAQ and its chemical composition shown in Table.1, silica extracted from the rice husks of with nano particles (10µm). Percentages of materials shown in Table.2.

2.2. The Batch

The batch was prepared from NBR with addition of some of materials, cement waste with (0-40pphr) and silica extracted from the rice husks (20pphr) .

Table.1: Chemical composition of cement waste

Compounding ingredients	pphr
SiO_2	21.14
R_2O_3	5.44
Al_2O_3	2.80
FeO_3	2.64
SO_3	9.83
CaO	37.97
L.O.I	18.50
MgO	1.68

Table.2: Materials content in the rubber batch, pphr

Compounding ingredients	pphr
NBR	100
Carbon black	0-40
Zinc oxide	3
Stearic acid	1
Dop	1
TMTD	1.5
Antioxidant	1.5
Sulfur	1.5
Cement waste	0-40
Rice husk silica	20

2.3. Mechanical Tests

Elongation and modulus of elasticity: Test was carried out according to the)ASTM D413) by Tensometer T10 devise (Fig.1).

3. Results and Discussion

Fig.2 represents modulus of tri sustainable NBR/cement waste/rice husks silica blend. We note from the figure that the modulus of elasticity will Increase almost linearly, due to the increasing in the proportion of silica is working to increase the penetration of them and the rubber particles and fill intra-blanks in each material by the other in the mixing during a manufacturing process. So, the material mass relative to its size will become bigger and the waste particles become more neighboring to rubber molecules. Therefore, an elasticity of rubber will decrease and on other hand increases modulus of elasticity. As a result, and the decreased elasticity in rubber, the elongation will also decrease dramatically and will continue to decline with the increase in the proportion of silica added as showed in Fig.3 which represents the elongation of tri sustainable NBR/cement waste/rice husks silica blend [2].

Fig.1: Tensometer T10 Devise

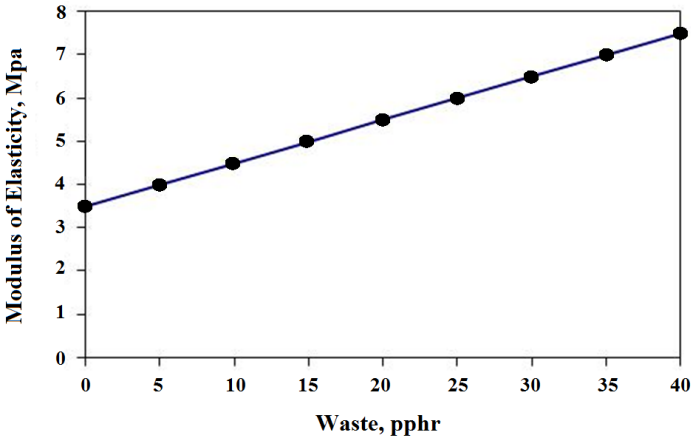

Fig.2: Modulus of Tri Sustainable NBR/Cement Waste/Rice Husks Silica Blend

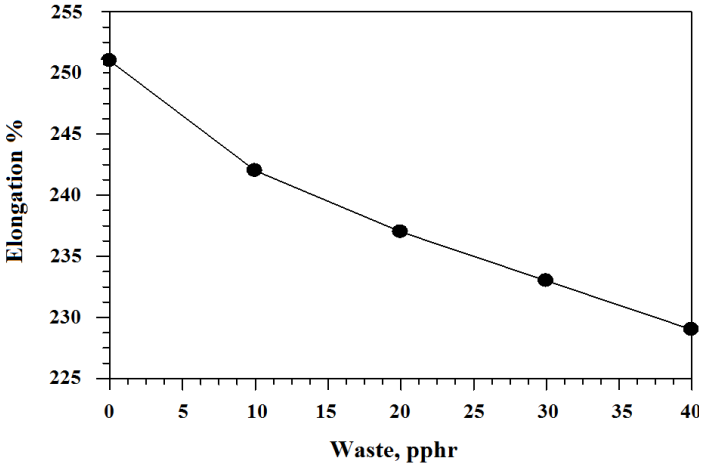

Fig.3: Elongation of Tri Sustainable NBR/Cement Waste/Rice Husks Silica Blend

4. Conclusion

The use of cement waste and rice husks silica will enhance modulus of elasticity of NBR, and at the same time decreased elongation due to the high contact area between cement waste- rubber. The cost of manufacturing NBR parts will decrease due to the cheapness this waste, as well as Reduces the environmental and health impacts of cement waste because of the rubber works as an insulator which surrounding of cement waste and prevent it from spreading and even stop decomposition because.

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