TITLE	SHORT PINEAPPLE LEAF FIBER AND PARTICULATE FILLER HYBRID REINFORCED RUBBER COMPOSITES
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ABSTRACT	The properties of highly aligned short pineapple leaf fiber (PALF) reinforced natural rubber (NR) and PALF reinforced nitrile rubber (NBR) composites were compared at first. The tensile properties, curing behavior, tear strength, shore A hardness, and swelling properties of these composites were determined. In addition, a scanning electron microscope (SEM) was used to compare the tensile fracture surface of two rubber composites. The results indicate that PALF has more influence on NBR than NR. However, the presence of PALF in both rubber composites can only improve the modulus at low strain of rubbers but causes failure to occur at relatively low strain. Hybrid fillers were then developed to enhance both low and high strain properties of PALF reinforced rubber composites. Particulate fillers of non-reinforcing and reinforcing types were hybridized with PALF. Calcium carbonate ($CaCO_3$) was selected for the former type, and carbon black as well as precipitated silica were used for the latter type. For PALF/silica hybridization, two different types of silica surfaces including bonded (silica with silane69) and non-bonded (silica with polyethylene glycol) were compared. The amount of PALF was fixed at 10 parts (by weight) per hundred of rubber (phr) while that of particulate filler was varied from 0 to 30 phr. The results of PALF/$CaCO_3$ hybridization show that the addition of $CaCO_3$ not only enhances the modulus but also reduces the cost of hybrid composites. For PALF/carbon black and PALF/silica hybridization, modulus, tensile strength, and elongation at break increase significantly with increasing amounts of particulate fillers.