Natural Rubber (NR) in Rail and Agriculture Applications : Rubber Rail Crossing Panels and Reinforced Porous Pipes

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Thailand has been the world number 1 natural rubber (NR) producer making NR approx. 4.9 million tons/year. However, most of NR have been exported as raw rubbers (e.g. RSS and STR-20) with less value-added. Thai government has tried to solve low NR price by promoting domestic uses and searching for new NR applications. In this talk, some research works were demonstrated new uses of NR and value-added rubber products, i.e., "rubber rail crossing panels" and "reinforced porous pipes". The rubber rail crossing panels were designed by using finite element loading and fitted between rails and adjacent road to smooth traffic. Advantages of rubber panels include low noice, low maintenance, long product life and good track protection compared to concrete or other materials. Rubber formulas using blends of chloroprene rubber (CR) and NR for external skin were studied. In order to achieve optimum properties required from State Railway of Thailand (SRT), some factors affecting rubber properties were studied including CR/NR ratios and carbon black loadings. Several rubber properties were tested, such as, Mooney viscosity, cure characteristics, mechanical properties, physical properties and morphology. It was found that better resistance to oil, ozone and heat aging were achieved when CR/NR ratio was increased. Moreover, improved compression set, compression modulus, and abrasion resistance were also gained as CR loading was increased. Optimum formula was finally achieved. The formula met the standard of State Railway of Thailand (SRT) with exceptional cost. It has high potentials for commercial production.

Good waste management and needs of equipment for smart-precision farming system are two of the most important topics in the world nowadays. The second work was reinforced porous pipes as water irrigation for agriculture applications were studied. The pipes were made mostly from recycling wastes, i.e., reclaimed rubber (RR), ground rubber tire (GRT) and short waste tire fibers (WTF) from ply of worn-out tires. Natural rubber (NR) was also used as the matrix of the pipes. Rubber compounds were mixed by using a kneader and shaped into porous pipes by a single-screw extruder. Factors affecting of porous pipe properties were studied, e.g., carbon black (CB) loading and waste tire fibers (WTF) loading. Porous pipe properties were investigated, such as, cure characteristics, mechanical properties, morphology, burst pressure, %diameter swell and water permeability rate. It was found that open-cell porous pipe could be produced. CB loading was found at 50 phr as shown by the optimum tensile strength. By adding the WTF, %diameter swell and burst pressure were clearly improved. It can be proven that the reinforced porous pipes have a high potential for commercial use as water irrigation for smart-precision farming.