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Development of new lightweight polyvinyl chloride material formulation without calcium carbonate and chlorinated paraffin

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This study was carried with the view of developing a light weight PVC formula without $CaCO_3$ and chlorinated paraffin (CP). The general formula of shoe soles contained PVC resin, $CaCO_3$, Dioctyl phthalate (DOP), CP, Ca/Zn stabilizer, stearic acid, bisphenol-A and Azodicarbonamide (ADC). As the main objective is to develop the light weight PVC formula without fillers and CP, the study was carried out under three series. In series 1 the amount of $CaCO_3$ added to the sample batches changed as 5 phr, 3 phr, 1 phr, and 0 phr. Series 2 developed using the best results of series 1 and varying the amount of CP added to the sample batches as 7 phr, 5 phr, 3 phr, and 0 phr. Series 3 developed based on the best results obtained from series 2 and changed the amount of ADC added to the formula as 0.35 phr, 0.4 phr, 0.5 phr and 0.8 phr.

All the samples were evaluated for density, shore A, tensile strength, elongation at break and abrasion loss at room temperature. Series 1 exhibited reduce density, shore A and abrasion loss while increase elongation at break when reducing the amount of $CaCO_3$ gradually up to zero. Series 2 was found to reduce density, shore A and abrasion loss while increase elongation at break when reducing the amounts of CP gradually up to zero. Series 3 showed reduced density, shore A and elongation at break when increasing the amount of ADC gradually. Abrasion loss was reduced gradually, and at the level of 0.8 phr of ADC,an abnormal increment was found. Improvements observed from the optimized formula are density (from 1.34 to 0.97 g/cm^3), shore A (from 88.9 to 63.1), elongation at break (%) (from 264 to 286) and abrasion loss (from 232 to 198 mm^3). On the other hand, reduction of $CaCO_3$ and CP reduce the dust generation and the health risks respectively. The final formula leads to a good flexible and less abrasive light weight PVC formula without $CaCO_3$ and chlorinated paraffin (CP).

Keywords: PVC formula, weight reduction, ADC, Density

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