Weathering Effects on Mechanical Properties of Low Density Polyethylene (LDPE) and High Density Polyethylene (HDPE) Pipes Used in Irrigation Networks

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Abstract

The effect of outdoor weathering conditions on the mechanical properties of Low and High Density Polyethylene (LDPE and HDPE) pipes used in irrigation networks have been studied. For LDPE, the test specimens were prepared from pipes exposed to outdoor weathering for different periods ranging from 2 years to 15 years. The obtained results showed that, the exposure to outdoor weathering conditions for two years $S_y$ and $E$ increased by 13% and 5.5% respectively, while, the elongation to break decreased by 4%. For three years, $S_y$ and $E$ increased by 14% and 12% respectively while the elongation to break decreased by 12%. For five years, $S_y$ and $E$ increased by 7% and 3% respectively while the elongation to break decreased by 6%. For seven years, $S_y$ and $E$ increased by 13% and 4% respectively while the elongation to break decreased by 23%. For eight years, $S_y$ and $E$ increased by 4% and 6% respectively while the elongation to break decreased by 14.5%. For ten years, $S_y$ decreased by 6%, $E$ increased by 5% while the elongation to break decreased by 66%. For fifteen years, $S_y$, $E$ and the elongation to break decreased by 12%, 16% and 65% respectively. For HDPE, test specimens were prepared from, a new pipe, a pipe used under outdoor weathering for 5 years and a pipe stored indoors inside unconditioned store for the same period. The obtained results showed that, the exposure to outdoor weathering conditions for five years increased the yield stress and the modulus of elasticity by 13.3% and 19% respectively while the elongation to break decreased by 11%. For the stored pipe, the yield stress and the modulus of elasticity increased by 12.8% and 16.8% respectively, while the elongation to break decreased by 3.2%.