TPS (Thermoformed Plastic with Sand): Recycling Material as Coarse Aggregate in Concrete Mix

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Conventional concrete is a mix of water, cement and aggregates (sand and gravel). Extraction of gravel contributes to environmental problems like erosion, and PET (Polyethylene terephthalate) is one of the most commonly used materials in Colombia (with 84,000 tons produced/year) as well as one of the largest contaminants (only 28% is recycled). A new artificial aggregate was manufactured through the bonding of PET with sand using heat (TPS: thermoformed plastic with sand), presenting environmental benefits as its use increases the lifespan of aggregate quarries, construction materials and final deposit sites. The TPS was characterized taking into consideration resistance to abrasion, absorption and granulometry. Subsequently, in order to evaluate resistance to compression and ease of use of TPS as a replacement for coarse aggregates in concrete, test cylinders were produced and cured with four different mixtures: one control, and three replacing gravel with TPS at different percentages (10%, 20%, 40%). The 40% TPS mixture did not meet the mechanical characteristics established in regulations ASTM C39 and C143. The 10% and 20% mixtures, while presenting low ease of use (settling of 1 cm and 2 cm), exhibit greater resistance than the control (27 and 26 MPa on day 28, respectively). In conclusion, if this aggregate were to be introduced on an industrial scale as an environmental strategy, the porosity of the TPS as evaluated in the absorption would need to be diminished, improving the ease of use of the mixture.