The Optimization of an Industrial Recycling Line: Improving the Durability of Recycled Polyethylene Blends

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Abstract: This study applies Taguchi’s design of experiment methodology and grey relational analysis (GRA) for multi-objective optimization of an industrial recycling line. This last is composed mainly of a mono and twin-screw extruder and a filtration system. Experiments were performed according to L₁₆ standard orthogonal array based on five process parameters, namely: mono screw design, screw speed of the mono and twin-screw extruder, melt pump pressure, and filter mesh size. The objective of this optimization is to improve the durability of the Polyethylene (PE) blend by decreasing the loss of Stress Crack resistance (SCR) using Notched Crack Ligament Stress (NCLS) test and Unnotched Crack Ligament Stress (UCLS) in parallel with increasing the gain of Izod impact strength of the Polyethylene (PE) blend before and after recycling. Based on Grey Relational Analysis (GRA), the optimal setting of process parameters was identified, and the results indicated that the mono-screw design and screw speed of both mono and twin-screw extruder impact significantly the mechanical properties of recycled Polyethylene (PE) blend.

Keywords: Taguchi, recycling line, polyethylene, stress crack resistance, Izod impact strength, grey relational analysis

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