DESIGN OF A HEATED TWIN SCREW AUGER CONVEYOR FOR SOLVENT REMOVAL IN A SOLVENT-BASED PLASTIC RECYCLING SYSTEM

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Abstract:

The Solvent Targeted Recovery and Precipitation (STRAP) process is novel approach to solving the issues involved in recycling mixed wastes streams by selectively recovering a specific polymer. STRAP works by selecting a solvent that the target polymer is soluble in while the other components remain undissolved. The polymer solution is then separated from the non-dissolved solids via mechanical filtration, and the target polymer is then recovered through adjusting the solution temperature allowing the polymer to precipitate out. The undissolved solids contain up to 35wt% solvent after filtration. It is critical to remove and recycle the residual solvent for both economical and safety reasons. We have developed a 25 kg/h STRAP Pilot-Scale Unit (PSU) to demonstrate the scalability and efficiency of this process. The PSU consists of several operational sub processes: (i) solid material conveying; (ii) dissolution and filtration; (iii) candle filtration; (iv) solid material drying; (v) precipitation; (vi) solvent recovery; (vii) outgassing extrusion; (vii) nitrogen generation; (ix) heating oil; (x) chilled water. The solid material drying is achieved with an inclined twin-screw auger that is heated via hot oil. There are three intermediate storage bins in total: the first at the inlet of the inclined auger chamber; the second is at the outlet of the auger chamber; and the third is positioned at the outlet of the second bin. The purpose of these bins is to create an air-locking mechanism that will allow for the dried material to be discharged from the system without introducing oxygen into the rest of the operation. Through commissioning and testing the dryer with water, the material has a 60-minute residence time inside of the main heating body (auger chamber) and can reach a moisture content of less than 0.5%. The next step is to test the solid material drying system for the undissolved solids from the STRAP pilot system, and demonstrate (i) solvent content <0.5%; and (ii) condense and recover 99.9% solvent from the drying system.