Development of Wet Ball Milling Process for Simultaneous Recovery of High Purity Copper and Polyvinyl Chloride from Wire Harness

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[Abstract]

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The wire harness assembly, used to conduct electricity to vehicle components and electrical and electronic appliances, is abundantly present in waste electrical and electronic equipment (WEEE) and end-of-life vehicles (ELVs). Wire harnesses usually consist of copper (Cu) strands coated with thin polyvinyl chloride (PVC) cables. Current technologies for recycling this waste are either ineffective or have significant limitations because they are currently only available for thick and uniform cables. Therefore, this project developed combined PVC swelling by organic solvent and ball or rod milling approaches for the recovery of high purity Cu and PVC from thin and ununiform cables in waste wire harnesses. We developed both lab-scale and bench-scale milling reactors to thoroughly investigate the milling efficiency and the separation mechanism, and the subsequent scaling up for the developed process. The PVC swelling behavior and the plasticizer removal from the PVC coatings by the selected organic solvents were thoroughly evaluated by employing Hansen solubility parameters (HSPs) and the effectiveness of the swelling ratio on the separation of PVC coatings and Cu wires were investigated by using lab-scale reactor. *n*-Butyl acetate and acetone were selected as the best solvents for PVC swelling and plasticizer removal. This project achieved complete recovery of PVC coatings, Cu wires, and plasticizers from the waste WH cables with a maximum length of 150 cm by the bench-scale reactors. In addition, the bench-scale reactor tests allowed us to identify practical issues such as cable entanglement and necessity of the pre-removal of other components (connectors, tape, cable cover, etc.). Thus, this project established both the academic and technical bases of the developed approaches combining PVC swelling and milling processes.

[References]

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