Surface micro-alcoholysis treatment : a novel approach towards froth flotation based separation for binary mixtures of polyethylene terephthalate and polyvinyl chloride

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ABSTRACT

It is known that selective separation is the prerequisite of recycling pathways for waste plastics, which brings the potential economic and environmental benefits for cleaner production. A novel approach, surface micro-alcoholysis treatment (SMAT), was proposed for improvement of froth flotation towards the separation of plastics. By means of the SMAT, binary mixtures of polyethylene terephthalate (PET) and polyvinyl chloride (PVC) were selective modified to achieve effective separation. The mechanism of SMAT was examined by multiple characterization tests, response surface methodology was employed for its statistical optimization and simulation of pilot plant was first applied. The results suggested that selective wetting could be achieved through SMAT. PET surface was partially replaced by hydrophilic oligomers after ester exchange reaction, leading to the final flotation separation. Based on Plackett-Bueman design, zinc acetate concentration, temperature and operating time were identified as the significant factors controlled in SMAT. The maximum validation separation purity of PET could even reach 99.25% under the optimal condition predicated by Box-Behnken design. Such condition was performed in detail as the mass volume ratio of 1:5 (poly mixtures: 2-ethylhexanol), 0.3 wt% addition of zinc acetate, temperature of 346.5 K, stirring intensity of 100 rpm and operating time of 84.13 min. The PET purity was verified to be steady around 95% in simulation of pilot plant. The proposed technology is efficient, reliable in operation, widespread of application and potential of industrialization.

KEYWORDS

Plastics; Pretreatment; Flotation; Wetting selectivity; Ester exchange

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