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Production of Hydrophilic PVC Surfaces with Microwave Treatment for its Separation from Mixed Plastics by Froth Floatation

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Abstract : Organic polymeric materials (plastics) are widely used in our daily life and various industrial fields. The separation of waste plastics is important for its feedstock and mechanical recycling. One of the major problems in incineration for thermal recycling or heat melting for material recycling is the polyvinyl chloride (PVC) contained in waste plastics. This is due to the production of hydrogen chloride, chlorine gas, dioxins, and furans originated from PVC. Therefore, the separation of PVC from waste plastics is necessary before recycling. The separation of heavy polymers (PVC 1.42, PMMA 1.12, PC 1.22 and PET 1.27 g/cm3) from light ones (PE and PP 0.99 g/cm3) can be achieved on the basis of their density. However it is difficult to separate PVC from other heavy polymers basis of density. There are no simple and inexpensive techniques to separate PVC from others. If hydrophobic the PVC surface is selectively changed into hydrophilic, where other polymers still have hydrophobic surface, flotation process can separate PVC from others. In the present study, the selective surface hydrophilization of polyvinyl chloride (PVC) by microwave treatment after alkaline/acid washing and with activated carbon was studied as the pre-treatment of its separation by the following froth flotation. In presence of activated carbon as absorbent, the microwave treatment could selectively increase the hydrophilicity of the PVC surface (i.e. PVC contact angle decreased about 19o) among other plastics mixture. At this stage, 100% PVC separation from other plastics could be achieved by the combination of the pre- microwave treatment with activated carbon and the following froth floatation. The hydrophilization of PVC by surface analysis would be due to the hydrophilic groups produced by microwave treatment with activated carbon. The effect of optimum condition and detailed mechanism onto separation efficiency in the froth floatation was also investigated.

Keywords : Hydrophilic, PVC, contact angle, additive, microwave, froth floatation, waste plastics
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