

EFFECT OF PHOTO ACCELERATORS ON THE DEGRADATION OF POLYSTYRENE FOAM WASTE

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Abstract

The Polystyrene (PS) foam has been widely used as food packaging and insulators. The former application has been commonly seen as take-away meal boxes. When it reaches the end-users, it would be discarded as municipal solid waste (MSWs). It would readily undergo photodegradation if it was disposed in the open-air dumping. It would take months to be degraded in the natural condition. In the present study, the degradation rate of the PS-foam in open-air dumping and in the artificial exposure, using Standard weatherometer, was investigated. Benzoyl peroxide and AIBN were used as photo accelerators. The concentration of these chemicals varied from 1% to 3% by weight. The decrease in the number average molecular weight of the samples, characterised by GPC technique, was monitored and used to calculate the reaction rate. By using the degradation rate mathematical modelling the order of reaction (b), rate constant (k') and the half-life ($t_{1/2}$) of the photo reactions were obtained. The results showed that the b was increased with the increase of concentration of the accelerators. Likewise, the k' decreased. However, by considering the $t_{1/2}$ it was found that the half life of photo reaction using peroxide as the accelerator slightly decreased when the concentration increased from 1% to 3%. Nevertheless, the value decreased significantly when the AIBN was employed.

Keywords: Polystyrene foam waste, photodegradation, accelerators, mathematical modelling

Introduction

The polystyrene (PS) foam is widely used as food container, especially as the take-away meal boxes. When it reaches the end users, it would be discarded as municipal solid waste (MSWs). A few of them go through the recycling processes. This plastic material is difficult to decompose in the environment. The best known methods for managing the MSWs are recycling, incinerating, landfill and open-air dumping. Each method has a definite limitation in respect of

economic and engineering point of view. Without an environmental awareness, tons of the foam would be left in the open-air environment as a pollutant and would take years to be degraded by the natural causes.

Polymer products can be degraded under the exposure to certain natural environment conditions. Its degradation rate depends largely on the environmental weather and on the generic of polymers. Solar radiation is one of the

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