가지 달린 poly (ethylene terephthalate) (PET)의 제조와 물성에 관한 연구

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Preparation and characterization of Poly (ethylene terephthalate) (PET)

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1. Introduction

Generally, polymeric foam has many advantages, such as light-weight, good impact absorptivity and adiabatic properties. Poly (ethylene terephthalate) PET has good recyclability and no toxicity. Hence, if we make foam of PET, it could be used for various applications such as heat insulating material, recyclable packing material, and food vessel. Thus these properties are attractive interests to manufacturers. In this standpoint, high molecular weight and the introduction of branch are most important factors manufacturing desirable PET foam.
Methods to introduce the branch are as follows: (1) introducing the branches into polymer chain by in-situ polymerization with branching agent, (2) introducing the branches into PET chain by reactive extrusion[1-3].

2. Experimental

2.1. Material

PET pre-polymer were kindly supplied by Honam Petrochemical Corporation. poly (ethylene-co-acrylic acid) (PEAA) and 3,3',4,4'-Benzophenone-tetracarboxylic dianhydride (BPDA) was purchased from Sigma-Aldrich Chemical Co. All samples were used after drying for over 24 hrs in vacuum.

2.2. preparation of branched PET

Branched PET was prepared by reactive extrusion with PEAA (1 wt%) as a branching agent. reactive extrusion of PET and PEAA was performed using twin-screw extruder (Thermo Haake minilab Rheomex CTW5) at 270 ℃ under nitrogen atmosphere. Solid-state polymerization was carried out in the glass tube reactor, at 225 ℃ under the vacuum of below 0.1 torr for 5 hrs duration and we studied possibility of substitute chain extension process for SSP process.

3. Result & Discussion

table 1 shows sample code. the end number of sample code represents the SSP time.

Fig. 1 shows the intrinsic viscosity and gel content of PET/PEAA blend. gel was not formed in the sample of SSP0 and SSP1. intrinsic viscosity of these samples is 0.77 g/dL, 0.81 g/dL respectively. but gel formation was observed in the other samples. as the SSP time increased, gel content extremely increased in the point of SSP2. on account of decrease of gel content at higher temperature, gel formation is caused by physically (temporary) cross-linking, not chemically cross-linking.

Effect of chain extension was summarized in Table 2. after chain extension, intrinsic viscosity increases up to 77%.

4. Conclusion

Poly (ethylene terephthalate)/Poly (ethylene-co-acrylic acid) (PET/PEAA) blends were successfully prepared by employing reactive extrusion and then in addition solid-state polymerization (SSP) were performed. resulting PET/PEAA samples exhibited physically cross-linking behavior. so, it is suitable for foaming process. and I.V. increases up to 77% after chain extension. so, this process has possibility of substitute chain extension process for SSP process.

5. References

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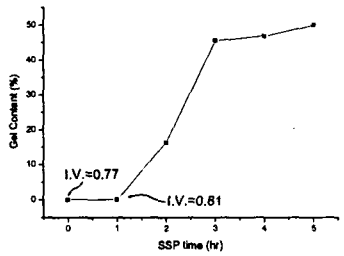

Fig. 1 The intrinsic viscosity and gel content of branched PET.

Table 1 sample identification

sample code	
SSP0	before SSP
SSP1	SSP for 1 hr
SSP2	SSP for 2 hr
SSP3	SSP for 3 hr
SSP4	SSP for 4 hr
SSP5	SSP for 5 hr

Table 2 intrinsic viscosity of before and after chain extension

	I.V. [g/dL]
before chain extension	0.47
after chain extension	0.83