

A Study on Mechanical Behaviours of Strapping Tapes Made from Polypropylene – Scrap

Weerasak Moocharoen¹, Ming Lokitsangtong², Chavalit Sangswasd¹**Abstract:**

The objective of this study on Polypropylene – recycling is to try to use all industrial scrap (no mixing with the virgin plastic). The Polypropylene-scrap that used in this work have been brought from the Textile factory (woven sack). The procedure will start with granulation, testing mechanical properties such as melt flow index, viscosity, modification with additives, finding of process-condition and comparative-testing for tension and scratching resistances with standard goods. This research work will deal with the plastic (strapping tape) which is employed in the factory. Finally, it is expected that the result obtained will be used for reducing the factory-cost and use recycled plastics.

Keywords: pp scrap, strapping tape.

Introduction

Polypropylene (PP) is a thermoplastic material which is world wide used in many fabrications such as blown film, blow molding, injection and so on. There are many scraps and waste in the PP product manufacturing line which results on discarding problem. Hence, it is necessary to increase the recycling potential.

In this work, the scrap from 100 % PP woven sack manufacturing process was recycled as the raw material for strapping tapes. It should be noted that this is a small scale project. Therefore, it is needed to integrate for bigger scale and confirm the results.

Experimental procedures

Materials The raw materials used in this work are summarized in Table 1, and the composition of recycled PP are given in table 2.

Table 1 Raw materials

Raw Materials	Suppliers	Grades	Application
Strapping Tapes	Dong Seo Inc.	-	Tapes
POLENE PP	TPI Co.,Ltd.	1102K	Woven sack
EL-Pro PP	TPE Co.,Ltd.	P400S	Rope

¹ Department of Materials and Metallurgical Engineering, Faculty of Engineering, Rajamangala Institute of Technology (RIT), Pathumthani 12110, THAILAND.

² Department of Mechanical Engineering, Faculty of Engineering, King Mongkut's Institute of Technology Ladkrabang (KMITL), Bangkok 10520, THAILAND.

Table 2 The composition of recycled PP (1102 K)

Materials	Weight percentage (%)	AO-additive (Wt %)	Lubricant oil (Wt %)
Formula 1	99.95	0	0.05
Formula 2	99.90	0.05	0.05
Formula 3	99.85	0.10	0.05

Characterization

FT-IR: Fourier Transform Infrared Spectroscopy analyses were carried out using the Nicolet (Model 470) Infrared Spectrophotometer. The samples were scanned in the ranges of 4,000–400 cm^{-1} .

DSC: The Differential Scanning Calorimetry measurements were determined according to standard ASTM D3417-83. The measurements were taken under nitrogen atmosphere using the Perkin-Elmer (Model 132752). The scanning rate was constant at 10°C/minute.

MFI: The melt flow index of raw materials was measured according to standard ASTM D 1238 using the Ceast (Model 8331) apparatus. The measurements were taken at T= 230°C, M= 2.16 kg for reference time of 10 minutes.

Tensile test: Tensile testing was performed on the Testometric (Model Micro 500 AX). The tests were carried out as per ASTM D 3950-01 method.

Hardness test: Rockwell (scale R) hardness measurement was determined according to ASTM D 785-86 using the Matsuzawa seiki (Model DXT-1) tester.

Results and Discussion

FT-IR: The results obtained for FT-IR indicate that the main composition in Dong Seo strapping tapes is PP. The percentage of PP is about 74.03 % which is identical to TPE materials (74.00 %).

DSC: The information given for the thermal analysis also confirms that the Dong Seo strapping tapes is pure PP (no blend). The melting temperature of the Dong Seo sample is 167.01°C.

MFI: The melt flow index of the Dong Seo strapping tapes and the recycled materials were shown in Figure 1, the Dong Seo strapping tapes have MFI= 4.0206 g/10min, TPI = 4.3998 g/10min and TPE= 3.7164 g/10min. The MFI of recycled PP (1102K) as Formula 1 = 5.943, Formula 2 = 5.9562, Formula 3 = 5.9736 g/10 minute.

Tensile: The tensile properties of the given samples were compared as shown in Figure 2. It is apparently that the tensiles properties of the recycled tapes are identical.

Hardness: Figure3 presents the hardness of the given samples. The hardness of Dong Seo = 104.48, TPI = 107.59 and TPE = 103.75. The hardness for

recycled PP as Formula 1 = 103.65, Formula 2 = 103.32 and Formula 3 = 104.69.

Conclusions

It can be concluded that the properties of the recycled tapes using Formula 2 are comparable to the Dong Seo strapping tapes. However, it is necessary to add 0.05 % AO- antioxidant to prevent degradation due to heat. Thus, this project presents another recycle resolution for packaging industries which can reduce the cost for waste treatment and minimize environmental problem.

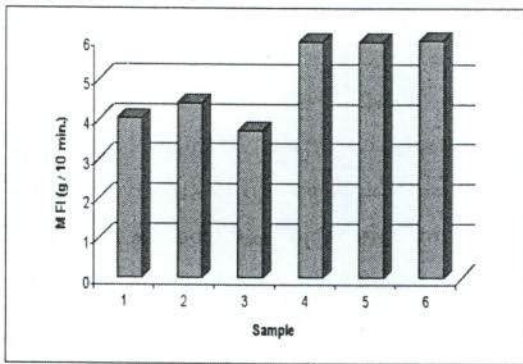


Fig. 1 Comparison of melt flow index for the given materials. (1). Dong Seo, (2). TPI(1102K), (3). TPE (P400S), (4). Formula 1, (5). Formula 2, (6). Formula 3

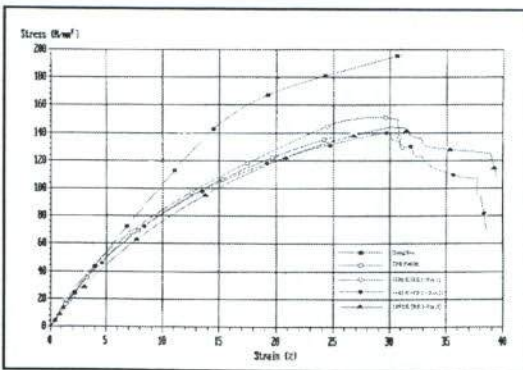


Fig. 2 Comparison of stress – strain curves for the given strapping tapes.

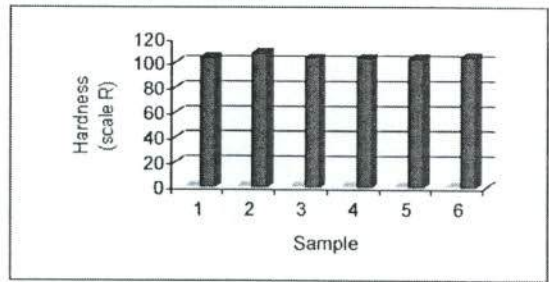


Fig. 3 Comparison of hardness for the given materials. (1). Dong Seo, (2). TPI(1102K), (3). TPE (P400S), (4). Formula 1, (5). Formula 2, (6). Formula 3

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