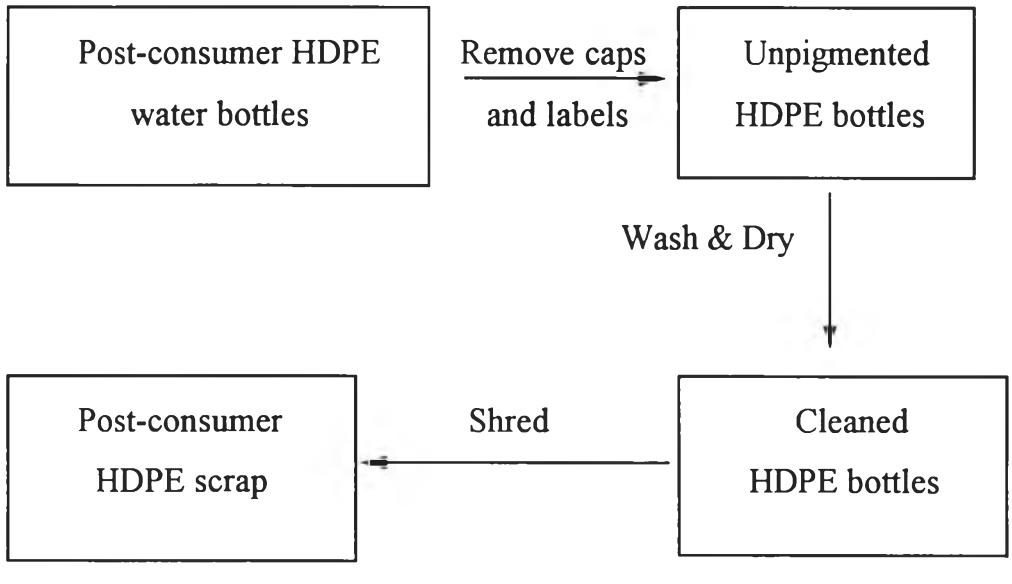
CHAPTER II

EXPERIMENTAL DETAILS

2.1 Materials

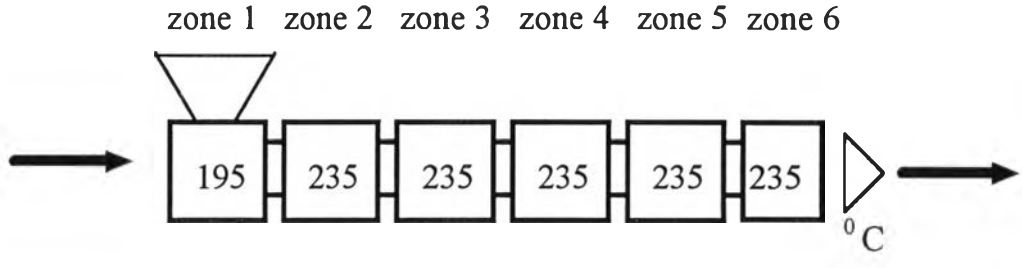
The High Density Polyethylene (HDPE) used was G-2855 Blow Molding grade from Thai Petrochemical Industrial Co., Ltd. with a reported density 0.955 g / $cm.^3$ and melt flow index (190 ° C / 2.16 Kg.) 0.35 g / 10 min.

Post-consumer HDPE from water bottles was obtained from the curbside in Bangkok, Thailand. The labels and caps were removed before cleaning. All bottles were washed with water and dried at 50 ° C for 1 hr. and then shreded into scrap by a Pallman Knife Mill as shown in the following diagram.



2.2 Processing

Virgin HDPE was mixed with bottle scrap in various ratios, namely 0 %, 25 %, 50 %, 75 % and 100 % (by weight) bottle scrap by a Lmx10 Lab Tech high-speed mixer .for 2 min. and then reprocessed each ratio for 10 passes in COLLIN co-rotating twin screw kneader ZK-25 (25 mm. x 30D). All processing passes were carried out with the following conditions based on the recommendation from supplier;



Screw speed	=	60	rpm.
Feed rate	=	50	g/min.

The extrudate was cooled in the water (~ 25 °C) and cut into pellet form by a Planetrol 075D2 pelletizer. The sample from each pass was collected for testing. The processed HDPE product was taken back into the hopper for the next pass with the same condition. The extruder was purged sufficiently to make sure that good material for each pass was attained.

2.3 Sample Preparation

Specimens for mechanical testing were prepared from sheets which were molded by Lab Tech compression. The pellets were heated up to 200 °C, 476 Kbar for 10min. and then cooled down at 23 °C for 2.5 min.

2.4 Testing Procedure

2.4.1 Melt Flow Index (MFI)

Melt Flow Index (MFI) of all samples was determined following ASTM D 1238 on a Zwick 405 Extrusion Plastometer with piston load weight of 2.16 kg. at 190 °C. The die diameter was 1.180 mm. and the die length was 8.00 mm.

2.4.2 Viscosity Measurement

The pellet samples were used to measure viscosity following ASTM D 3835-90. The tests were done on Instron Capillary Rheometer model 3213 with a 25 kN load cell and constant shear rate. L/D ratio of capillary die was 40 and the working temperature was 190 °C.

2.4.3 Tensile Test

For tensile test, dumbbell-shaped samples were die cut from sheets. Specimens were drawn in the Instron Universal testing machine at constant cross-head speed of 50.8 mm./min. The test followed the ASTM D 638-91.

2.4.4 Flexural Test

The specimens, arranged in a three-point bending configuration with L/D ratio 1/16, were loaded in an Instron Universal testing machine at a constant cross-head speed of 1.3 mm/min. The tests followed ASTM D 790-92.

2.4.5 Impact Resistance Test

The impact tests were conducted on specimens 12.75 mm wide x 63.5 mm long cut from the mouldings. The notch depth of 2.5 mm was machined. The test was [following ASTM D 256 (A)] izod type with "V" notch, using a Zwick pendulum impact tester.

2.4.6 Environmental Stress Cracking Test

The standard test is ASTM D1693-70. Ten specimens were cut from a sheet and the stress cracking reagents were absolute ethanol and glacial acetic acid. [following Schwartz and Goodman, 1982] The assembly was immersed in temperature controlled water-bath at 50 $^{\circ}$ C for 72 hours.

2.4.7 Differential Scanning Calorimetry (DSC)

Differential Scanning Calorimetry (DSC) was carried out on a DuPont 910S. Sample of 8-12 mg were prepared in aluminum sample pans. The temperature was programmed at a heating rate of 10 °C/min. from 50 to 200 °C. The chamber was purged with dry nitrogen at flow rate of 25 ml/min. The melting point (T_m), heat of fusion (ΔH) and relative degree of crytallinity were determined from the thermogram by using DSC standard data analysis V. 4.0 (DSC-4.0) software.