

Development of Polyolefin Recyclate Compounds for Packaging and Pipe Applications

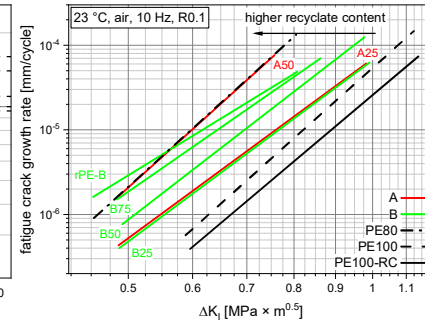
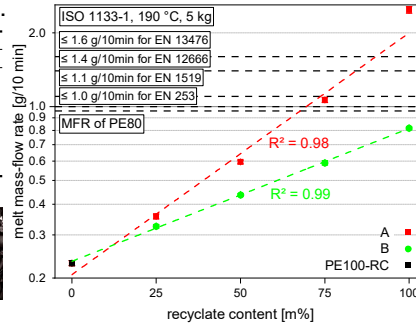
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Short- and Long-Term Performance of Pipe Compounds Containing Polyethylene Post-Consumer Recyclates from Packaging Waste by Freudenthaler, P.J.; Fischer, J.; Liu, Y.; Lang, R.W. in Polymers 2022, 14, 1581.

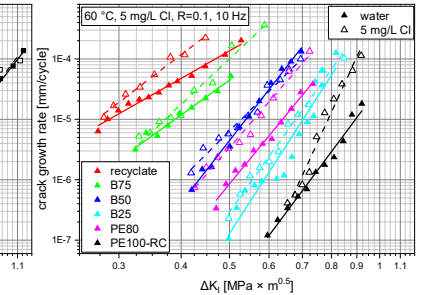
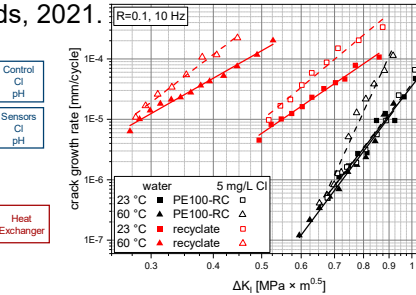
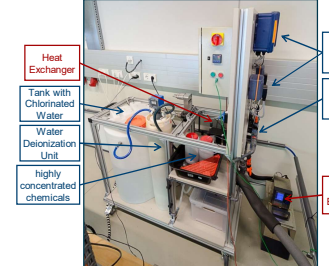
	PE100-RC	rPE-A	rPE-B
	m%	m%	m%
A25	75	25	-
A50	50	50	-
A75	25	75	-
B25	75	-	25
B50	50	-	50
B75	25	-	75



Compounds made of virgin PE100-RC pipe grade and commercially available PE-HD recyclates were tested terms of resistance to slow crack growth under cyclic loading according to ISO 18489 (cracked round bar method) and compared to virgin PE-HD pipe grades. Some compounds showed higher performance than the tested virgin PE80 pipe grade.



Effect of Chlorinated Water on the Fatigue Crack Growth Resistance of Polyethylene Compounds with Recyclate Content for Pipe Applications by Freudenthaler, P.J.; Fischer, J.; Eder M.; Lang, R.W. in Conference Proceedings of the 20th Plastic Pipes Conference and Exhibition, Amsterdam, The Netherlands, 2021.



PE-HD recyclate compounds were tested in water and chlorinated water (5 mg/L) at 23 °C and 60 °C in terms of slow crack growth under cyclic loading. The pure recyclate experienced accelerated crack growth by chlorinated water already at 23 °C, while the virgin grade was unaffected at this temperature. B25 showed a better performance than the tested virgin PE80 pipe grade.

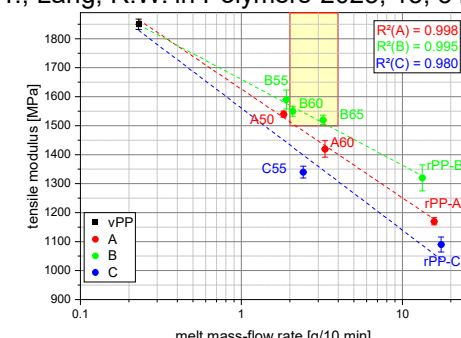


Polypropylene Post-Consumer Recyclate Compounds for Thermoforming Packaging Applications by Freudenthaler, P.J.; Fischer, J.; Liu, Y.; Lang, R.W. in Polymers 2023, 15, 345.

	vPP	rPP-A	rPP-B	rPP-C
	m%	m%	m%	m%
A50	50	50	-	-
A60	40	60	-	-
B55	45	-	55	-
B60	40	-	60	-
B65	35	-	65	-
C55	45	-	-	55

- Desired property-profile:**
- Recyclate content >50 %
 - MFR between 2 – 4 g/10 min
 - Tensile modulus >1500 MPa
 - Charpy notched impact strength >3.5 kJ/m²

	vPP	rPP-A	rPP-B	rPP-C
Melt mass-flow rate (230 °C/2.16 kg; g/10 min)	0.25	≥11	10.1–15.0	18
Tensile modulus (MPa)	2000	≥1100	1100–1400	1200
Yield stress (MPa)	36	≥25	23–27	28
Strain at break (%)	-	≥180	-	-
Charpy notched impact strength (kJ/m ²)	30	≥6	4–8	5.5



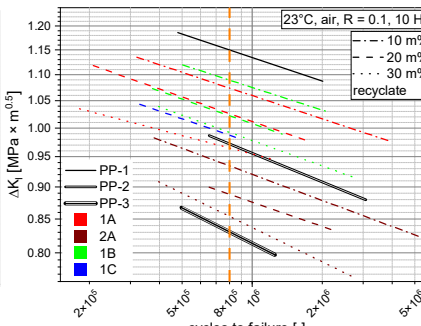
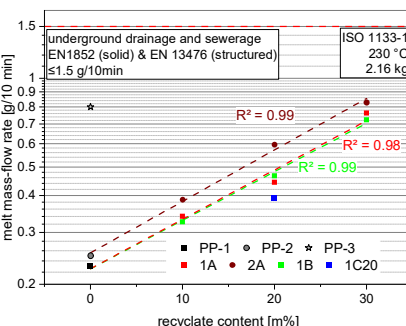
Commercially available PP post-consumer recyclates were compounded with a suitable virgin PP blending partner to create mixtures with properties in the desired property range for the high-stiffness thermoforming grades. While all compounds easily reached the required Charpy notched impact strength, only two compounds could fit into the melt mass-flow rate and tensile modulus window.



Polypropylene Pipe Compounds with Varying Post-Consumer Packaging Recyclate Content by Freudenthaler, P.J.; Fischer, J.; Liu, Y.; Lang, R.W. in Polymers 2022, 14, 5232.

	PP-1	PP-2	rPP-A	rPP-B	rPP-C
	m%	m%	m%	m%	m%
1A10	90	-	10	-	-
1A20	80	-	20	-	-
1A30	70	-	30	-	-
1B10	90	-	-	10	-
1B20	80	-	-	20	-
1B30	70	-	-	30	-
1C20	80	-	-	-	20
2A10	-	90	10	-	-
2A20	-	80	20	-	-
2A30	-	70	30	-	-

rPP-A & rPP-B are post-consumer PP recyclates
rPP-C is a post-consumer polyolefin recyclate made from PP and PE packaging waste



Commercially available post-consumer recyclates were mixed with two high performance virgin PP pipe grades for drainage and sewerage applications. Compounds created with the higher performing virgin material delivered even better performance than the pure next best virgin pipe grade. All compounds showed better performance than a third virgin injection-molding pipe grade, even at comparable MFRs.

