Supplementary Information

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Sample	RawPE	Combined	Qualified	Nochime	Base(nt)	Avglen(nt)	GC	Q20	Q30
PS07	206148	203534	196874	190659	81232456	426.06	52.07%	97.81%	93.04%
PET07	189277	188071	185521	179916	33542213	419.72	52.11%	97.95%	93.44%
PELD07	117812	117627	117151	116774	6973235	415.72	53.71%	98.24%	94.22%
PS15	206705	204590	199166	194157	81296374	418.71	52.48%	98.08%	93.81%
PET15	209586	207275	201641	187386	77350054	412.78	51.94%	98.01%	93.54%
PELD15	127070	126635	125862	124980	10241803	410.00	51.68%	97.96%	93.43%
PS21	205161	202790	197029	184836	75957790	410.95	52.27%	98.14%	93.90%
PET21	164632	163876	162098	159868	24429952	408.06	52.32%	98.20%	94.10%
PELD21	170944	168792	164171	159852	65337021	408.73	52.04%	98.17%	93.89%
PS31	203576	200005	194445	183513	75057675	409.00	50.96%	98.12%	93.81%
PET31	203085	200023	194737	149483	61642671	412.37	50.38%	98.05%	93.65%
PELD31	206714	201351	195663	175071	71974676	411.12	50.63%	98.01%	93.54%

Table S1: Summary of sequencing statistics for all samples across time points and plastic types. Metrics include raw and filtered read counts, base number, average read length, GC content, and quality scores (Q20, Q30).

Sample_name	chao1	dominance	goods_coverage	observed_features	pielou_e	shannon	simpson
PS07	638769	0.074	0.994	593	0.620	5.710	0.926
PET07	567486	0.014	0.997	537	0.822	7.451	0.986
PELD07	213000	0.029	1.000	213	0.805	6.226	0.971
PS15	438667	0.129	0.995	386	0.496	4.258	0.871
PET15	904750	0.024	0.993	840	0.761	7.397	0.976
PELD15	504500	0.194	0.999	504	0.593	5.320	0.806
PS21	758412	0.179	0.988	620	0.496	4.598	0.821
PET21	326812	0.081	0.999	311	0.659	5.460	0.919
PELD21	382357	0.258	0.998	369	0.497	4.242	0.742
PS31	462641	0.112	0.993	362	0.540	4.589	0.888
PET31	591398	0.054	0.992	504	0.649	5.823	0.946
PELD31	715177	0.105	0.988	594	0.554	5.105	0.895

Table S2: Alpha-diversity indices for microbial communities associated with PS, PET, and LDPE pellets at each time point. Reported metrics include Chao1 richness, dominance, Good's coverage, observed features, Pielou's evenness, Shannon index, and Simpson index.

	Day	*Sulfitobacter*	*Psychrobacter*	*Oceanobacillus*	*Yoonia-Loktanella*	*Polaribacter*	*Virgibacillus*	unidentified Chloroplast	*Thalassobacillus*	*Sphingomonas*	*Deinococcus*	Others
PS	7	0.0088	0.3787	0.1090	0.0012	0.0124	0.0055	0.0327	0.1257	0.0178	0.0000	0.3080
	15	0.2735	0.0095	0.3087	0.0454	0.0007	0.1735	0.0239	0.0032	0.0024	0.0000	0.1590
	21	0.4422	0.0390	0.0368	0.1223	0.0014	0.1106	0.0103	0.0024	0.0045	0.0001	0.2310
	31	0.3271	0.0000	0.0034	0.1961	0.1758	0.0018	0.0566	0.0003	0.0005	0.0000	0.2390
PET	7	0.0497	0.0266	0.0575	0.0064	0.0071	0.0389	0.0898	0.0348	0.0230	0.0000	0.6660
	15	0.1581	0.0029	0.0411	0.1139	0.0161	0.0051	0.0966	0.0016	0.0169	0.0000	0.5480
	21	0.2818	0.0034	0.0033	0.2381	0.0068	0.0057	0.0413	0.0318	0.0216	0.0000	0.3660
	31	0.1140	0.0001	0.0057	0.2174	0.1950	0.0029	0.0404	0.0005	0.0003	0.0000	0.4240
LDPE	7	0.0440	0.0430	0.1140	0.0230	0.0120	0.0040	0.0630	0.0000	0.1140	0.1130	0.4700
	15	0.4510	0.0080	0.0100	0.0310	0.0060	0.0010	0.1650	0.0030	0.0220	0.0000	0.3010
	21	0.5320	0.0060	0.0170	0.0830	0.0040	0.0010	0.0100	0.0000	0.0310	0.0000	0.3150
	31	0.2810	0.0010	0.0050	0.1170	0.2020	0.0000	0.0850	0.0000	0.0030	0.0000	0.3060

Table S3: Relative abundance (%) of the top 10 bacterial genera across time points (days 7, 14, 21, 31) and plastic types (PS, PET, LDPE).

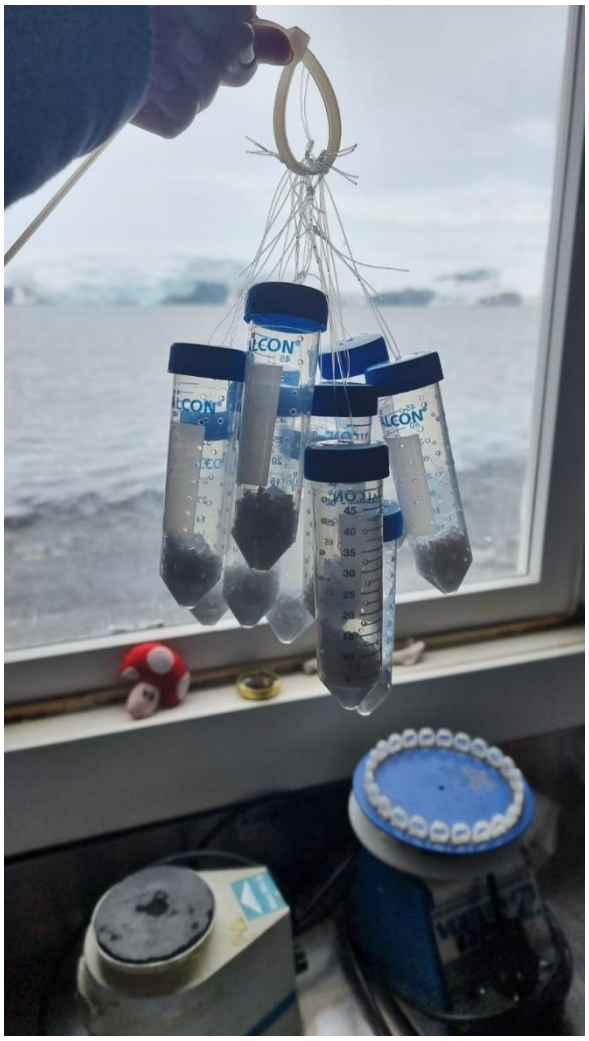


Fig S1: Experimental deployment system prior to immersion in Antarctic coastal waters. Each replicate included three incubation chambers containing PS, PET, and LDPE pellets.

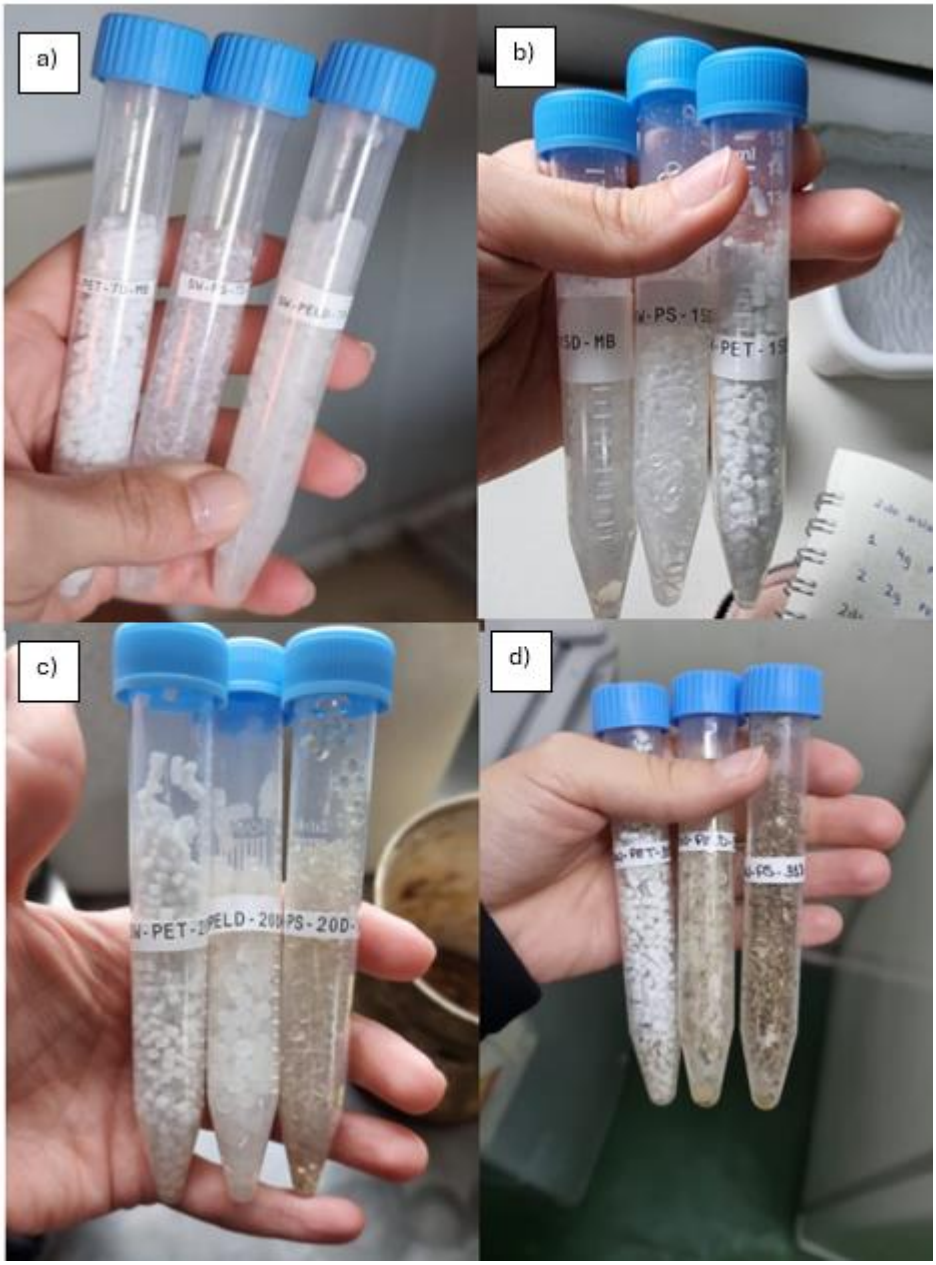


Fig S2: Plastic pellets (PS, PET, LDPE) after exposure in Antarctic waters for (a) 7, (b) 14, (c) 21, and (d) 31 days.

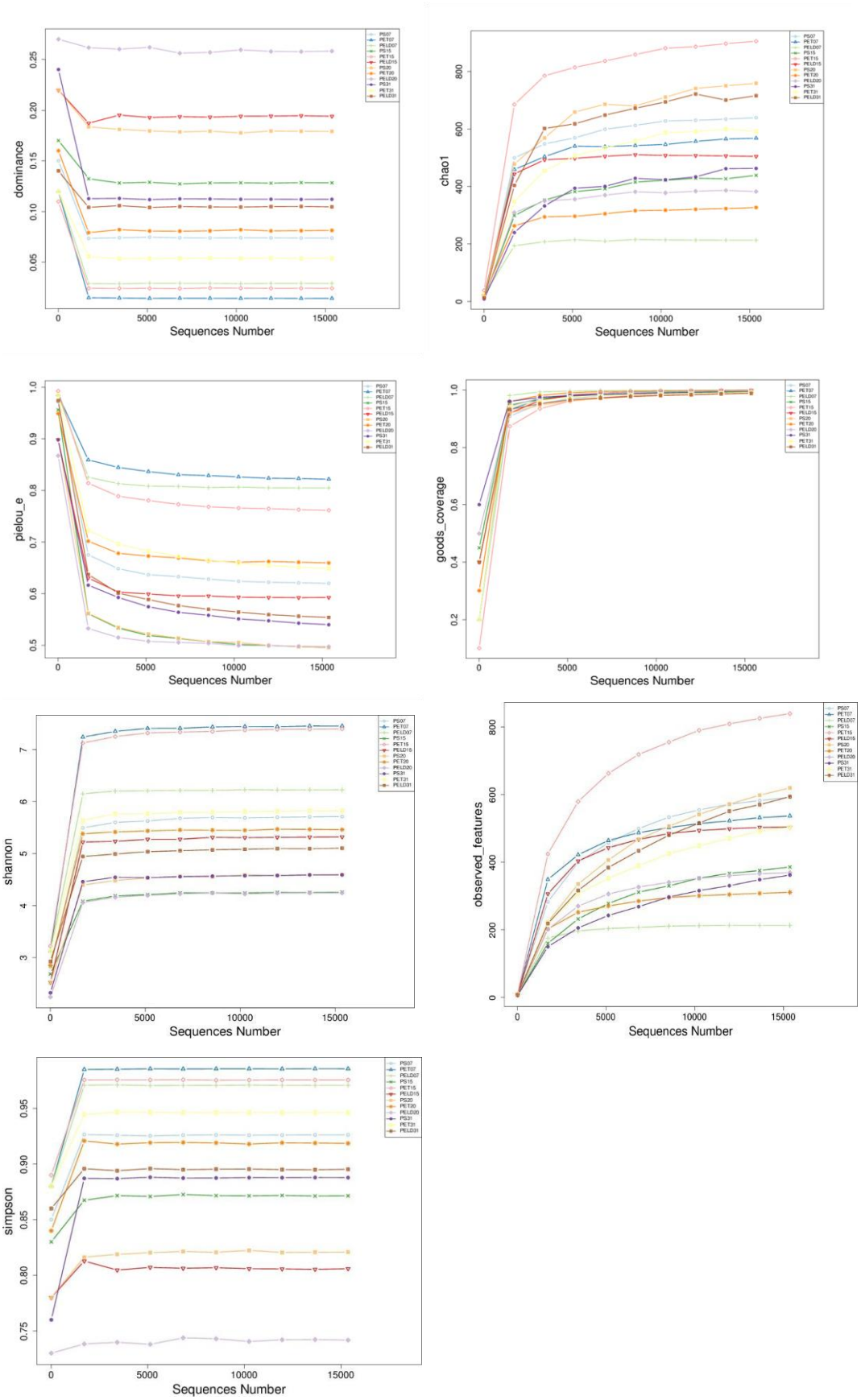


Figure S3: Rarefaction curves for all samples. All samples were rarefied to 15 366 reads (cutoff).

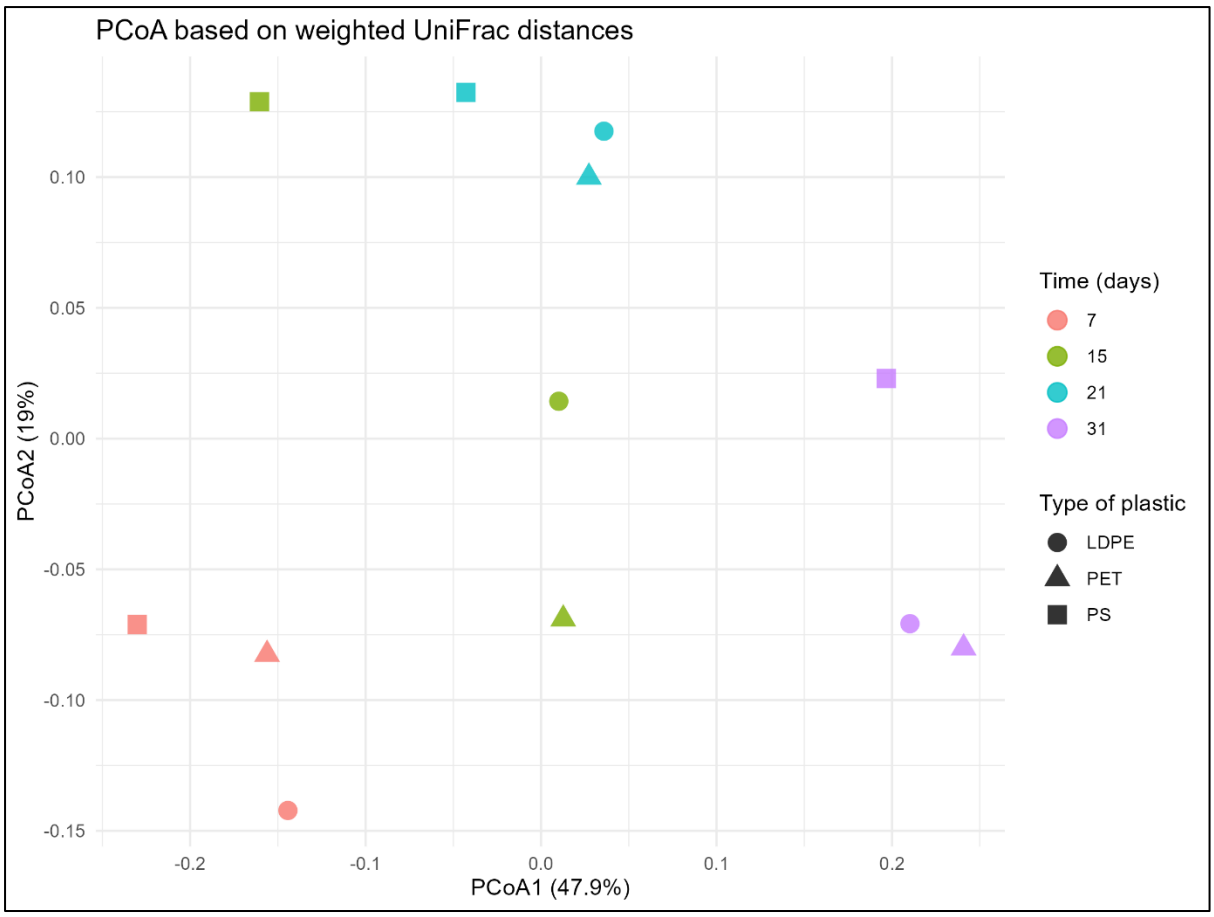


Fig. S4. Principal Coordinates Analysis (PCoA) based on weighted UniFrac distances, showing the composition of microbial communities associated with the three polymer types (LDPE, PET, and PS) over the exposure period (7, 15, 21, and 31 days). The first two axes together explain 66.9% of the total variation in community structure (PCoA1 = 47.9%, PCoA2 = 19.0%). Samples cluster primarily along the PCoA1 axis according to exposure time, indicating that temporal succession was the main structuring factor of the biofilm communities, while no clustering by polymer type was observed.

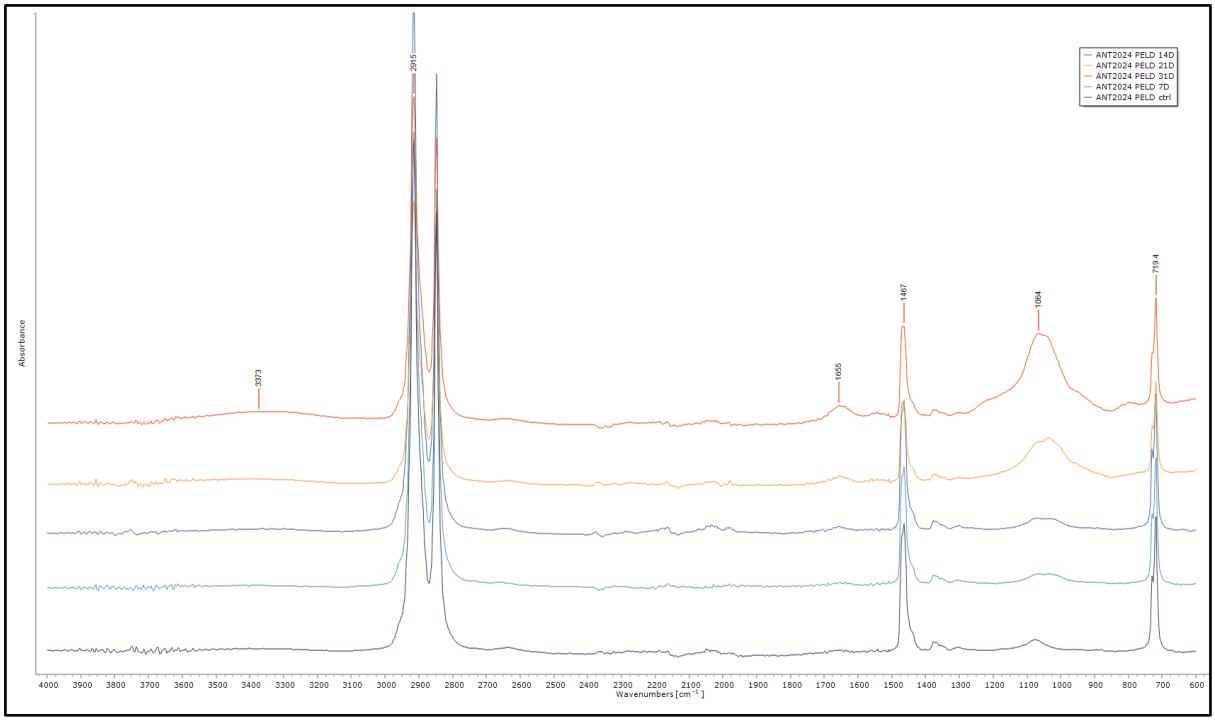


Figure S5: Representative FTIR-ATR spectra of LDPE pellets at different exposure times in Antarctic coastal waters.

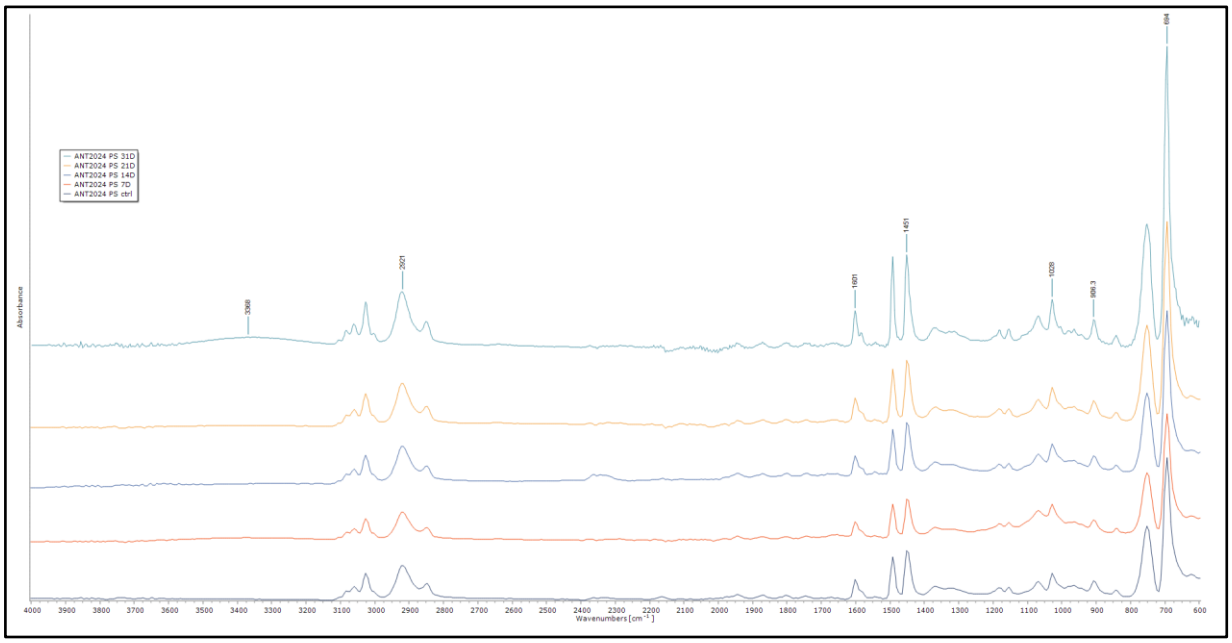


Figure S6: Representative FTIR-ATR spectra of PS pellets at different exposure times in Antarctic coastal waters.

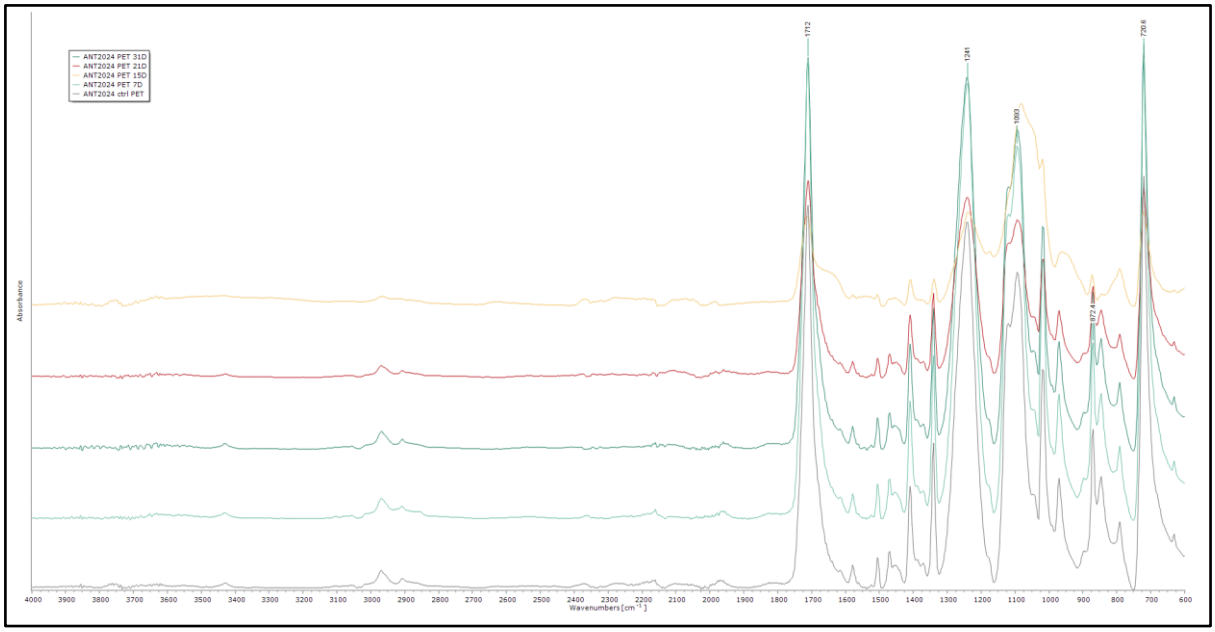


Figure S7: Representative FTIR-ATR spectra of PET pellets at different exposure times in Antarctic coastal waters.