Supporting information

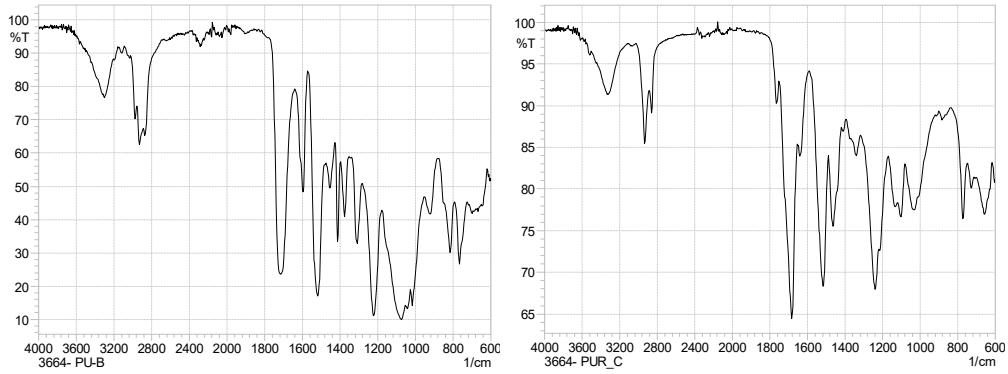


Figure S1. Spectra obtained by ATR-FTIR spectroscopy of RPUF-B (left) and RPUF-C (right) residues.

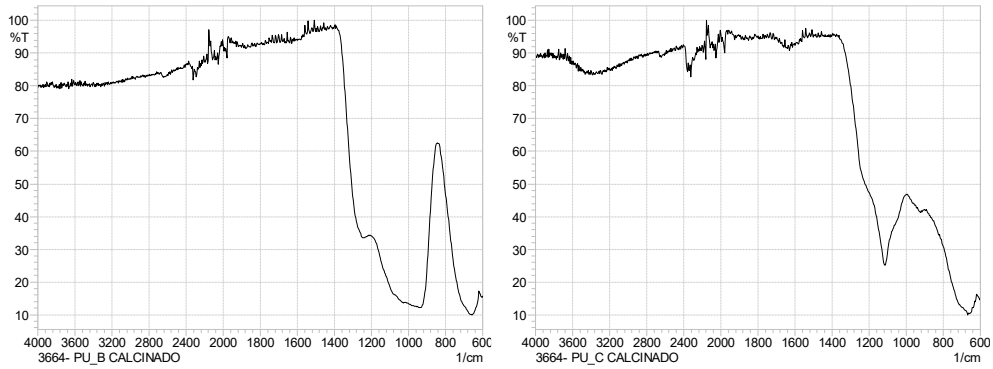
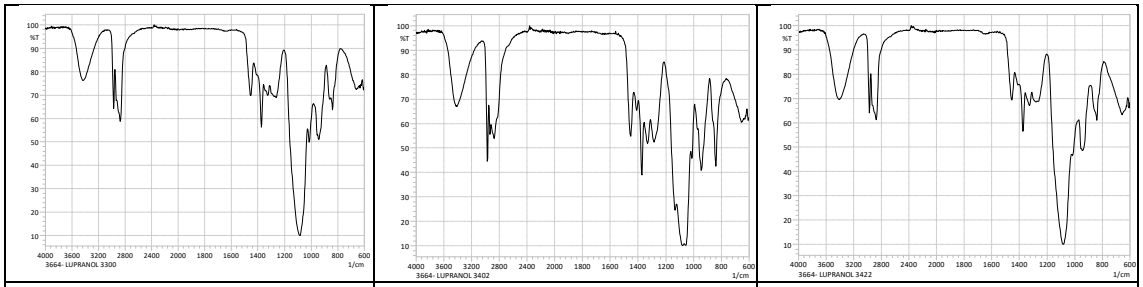
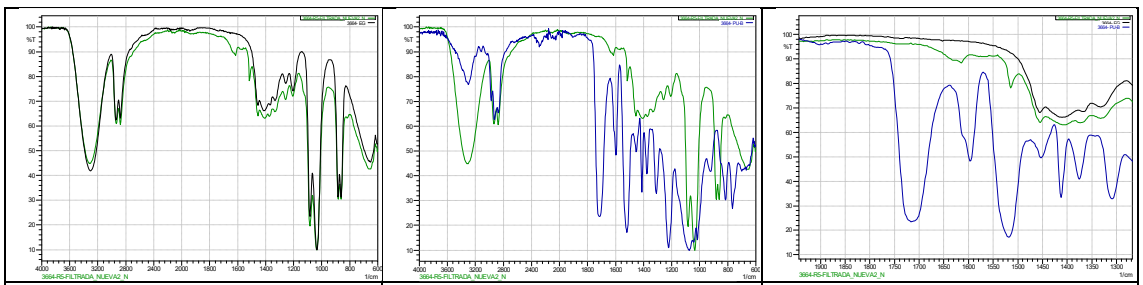


Figure S2.Spectra obtained by ATR-FTIR spectroscopy of the ashes resulting from the calcination of RPUF residues. RPUF-B (left) and RPUF-C (right).



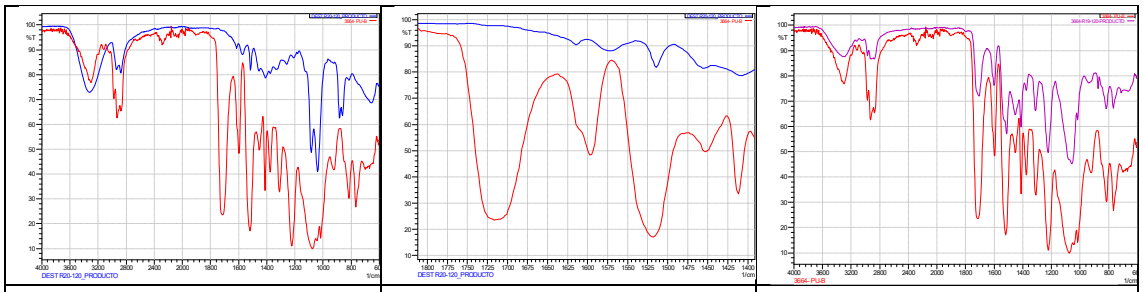
Lupranol 3300	Lupranol 3402	Lupranol 3422

Figure S3. ATR-IR spectrum of comercial reference polyols.



R5 – 120 and EG	R5 – 120 and PURF-B	R5 – 120, EG and PURF-B (Zoom)

Figure S4. ATR-IR spectrum of Reaction 5 (green) compared wit EG (black) and PURF-B (blue).



R20-120 distilled and RPUF-B	R20-120 distilled and RPUF-B (zoom)	R19-120 and RPUF-B

Figure S5. ATR-IR spectrums of the products of Reactions 20 and 19 compared with and RPUF-B (red).

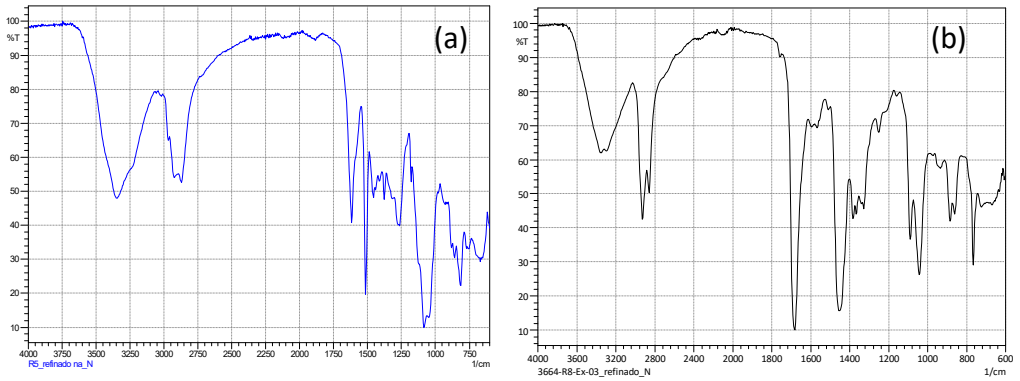


Figure S6. IR spectra of the refined products of the reactions R5 and R8 at 200ºC, 2h, PUR/solvent ratio = 1/4, and NaOH (0.002 mol/g): (a) R5, PURF-B and (b) R8, PURF-C.

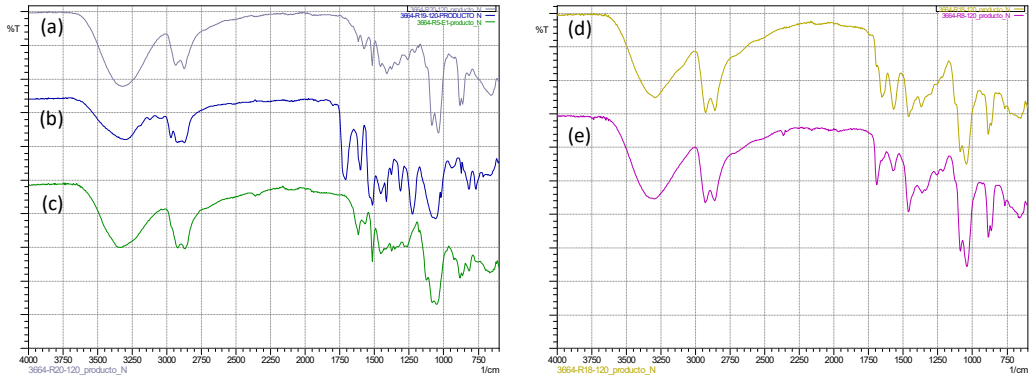
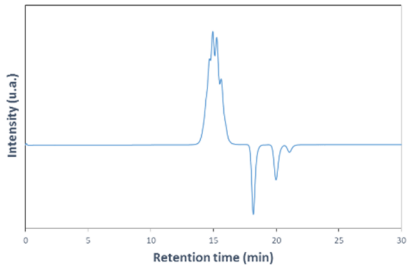
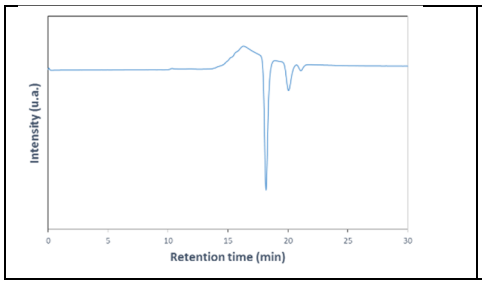


Figure S7. IR spectra of the reactions at 200ºC, 2h and PUR/solvent ratio = 1/4, after removal of the EG by distillation: RPUF-B (a) with Na acetate (0.002 mol/g), (b) without catalyst, (c) with NaOH (0.002 mol/g); RPUF-C (d) with Na acetate (0.002 mol/g) and (e) with NaOH (0.002 mol/g).



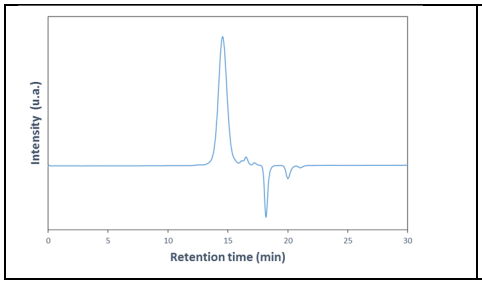
CONCENTRATION
27.321
26.572
25.934
20.172

Figure S8. GPC of Lupranol 3300, one of the polyols used in PURF-B parts and its components concentration.



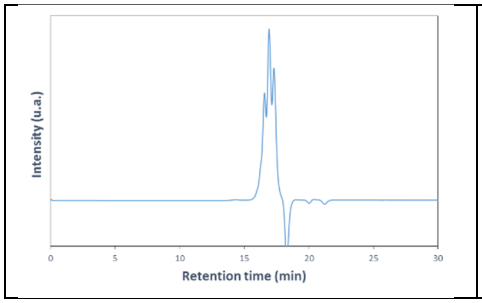
CONCENTRATION
69.416
30.584

Figure S9. GPC of Lupranol 3402, one of the polyols used in PURF-B parts and its components concentration



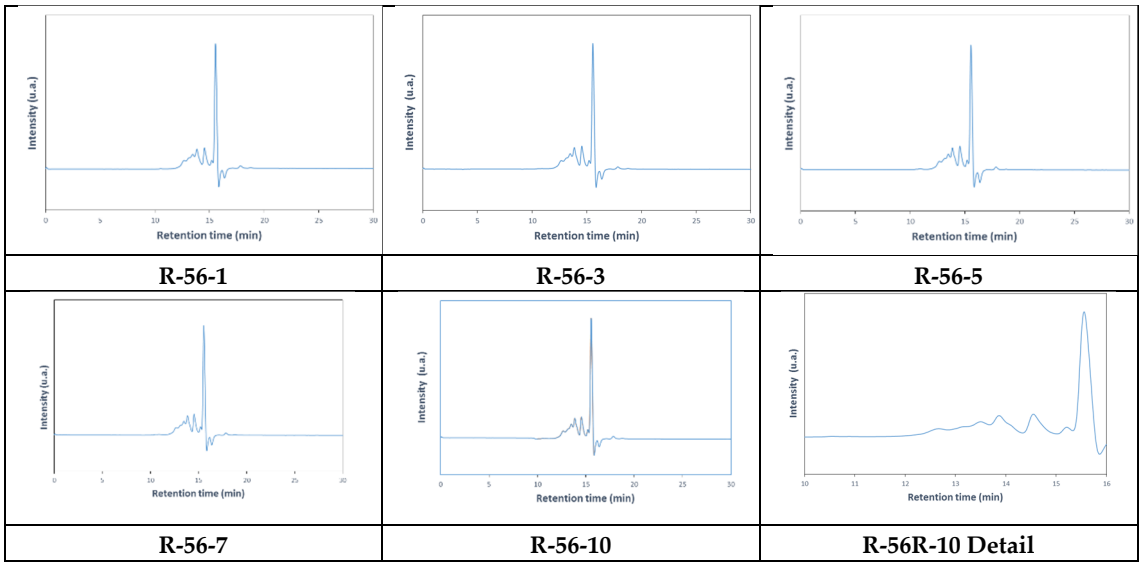
CONCENTRATION
89.504
1.227
2.553
6.717

Figure S10. GPC of Lupranol 3422, one of the polyols used in PURF-B parts and its components concentration



CONCENTRATION
27.687
36.170
36.141

Figure S11. GPC of Lupranol 3505-1, polyol used in PURF-C parts and its components concentration



R-56-1	R-56-3	R-56-5
R-56-7	**R-56-10**	**R-56R-10 Detail**

Figure S12. GPC of reaction 56, min 1, 3. 5, 7 and 10.

Chemical product	mg/Kg sample	%	mg/Kg sample	%	mg/Kg sample	%	mg/Kg sample	%
Furan, tetrahydro-2-methyl-	3996,172648	0,399617265	4048,250023	0,404825002	4009,571885	0,400957189	4180,405934	0,418040593
Peroxide, dipropyl	79391,58525	7,939158525	58581,83635	5,858183635	59568,40671	5,956840671	87345,41346	8,734541346
2-Furanol, tetrahydro-	140616,5221	14,06165221	128928,7775	12,89287775	120093,2261	12,00932261	138877,9914	13,88779914
1,3-Propanediol	1894,437303	0,18944373	1090,622085	0,109062209	1642,697729	0,164269773	2428,196503	0,24281965
Butanoic acid, 4-hydroxy-	47219,85388	4,721985388	26544,07706	2,654407706	23861,83002	2,386183002	27402,23655	2,740223655
Furan, tetrahydro-2-methyl-	0	0	23303,82875	2,330382875	28932,56526	2,893256526	38156,34828	3,815634828
1,3-Propanediol, 2-ethyl-2-(hydroxymethyl)-	1183,798888	0,118379889	4420,287197	0,44202872	3464,91991	0,346491991	3690,213684	0,369021368
3-Amino-4,5,6,7,8,9-hexahydrocyclooct(c)isoxazole							763,5831038	0,07635831
Pyrrolizine-7-methanol, 2,3,5,7a-tetrahydro-1-hydroxy-, (1S-cis)-							30,0198052	0,003001981
1,3-Propanediol, 2-ethyl-2-(hydroxymethyl)-	514,4212085	0,051442121	5089,753363	0,508975336	10126,51682	1,012651682	2341,890758	0,234189076
Cyclopropanetetradecanoic acid, 2-octyl-, methyl ester			0	0	979,8361515	0,097983615	11966,40967	1,196640967
Octaethylene glycol monododecyl ether			0	0	968,7880511	0,096878805	1239,990102	0,12399901
1H-Pyrrole, 1-butyl-			1054,248391	0,105424839	3988,857385	0,398885738	1190,305435	0,119030544
Hexanedioic acid, bis(2-ethylhexyl) ester			0	0	0	0	7127,106069	0,712710607
	274816,7913	27,48167913	253061,6807	25,30616807	257637,216	25,7637216	326740,1107	32,67401107

Figure S13. Screening (GPC) of polyols with the residue RPUF-C at 500 microns

	30 min		60 min		90 min		120 min	
Chemical product	mg/Kg sample	%	mg/Kg sample	%	mg/Kg sample	%	mg/Kg sample	%
Furan, tetrahydro-2-methyl-	6947,569339	0,694756934	7050,718717	0,705071872	7106,461941	0,710646194	4587,935227	0,458793523
Peroxide, dipropyl	64867,64566	6,486764566	73528,27035	7,352827035	68579,17733	6,857917733	65360,54688	6,536054688
2-Furanol, tetrahydro-	106551,0563	10,65510563	124006,6168	12,40066168	116844,5741	11,68445741	87332,14442	8,733214442
2-Furanol, tetrahydro-							60950,04746	6,095004746
2-Furanol, tetrahydro-	245063,6248	24,50636248	198977,019	19,8977019	198846,933	19,8846933	27079,0621	2,70790621
1,3-Propanediol	8047,359881	0,804735988	7482,117292	0,748211729	8112,027929	0,811202793	2777,037268	0,277703727
Butyrolactone	122089,687	12,2089687	105135,5173	10,51355173	105881,8447	10,58818447	0	0
Furan, tetrahydro-2-methyl-	56790,32907	5,679032907	85024,78021	8,502478021	124277,2049	12,42772049	99586,89143	9,958689143
1,3-Propanediol, 2-ethyl-2-(hydroxymethyl)-	1567,762112	0,156776211	1909,118294	0,190911829	4221,427035	0,422142703	3227,514786	0,322751479
1,3-Propanediol, 2-ethyl-2-(hydroxymethyl)-			3629,914692	0,362991469	7095,149585	0,709514959	10699,19631	1,069919631
Cyclopropanetetradecanoic acid, 2-octyl-, methyl ester							357,5480273	0,035754803
Octaethylene glycol monododecyl ether							710,1276505	0,071012765
1H-Pyrrole, 1-butyl-							2374,220203	0,23742202
	611925,0341	61,19250341	606744,0727	60,67440727	640964,8004	64,09648004	350901,1796	35,09011796

Figure S14. Screening (GPC) of polyols with the residue RPUF-C at 2 mm

	30 min		60 min		90 min		120 min	
Chemical product	mg/Kg sample	%	mg/Kg sample	%	mg/Kg sample	%	mg/Kg sample	%
Furan, tetrahydro-2-methyl-	3175,150577	0,317515058	2844,901109	0,284490111	3373,524697	0,33735247	2360,116965	0,236011696
Peroxide, dipropyl	59250,70032	5,925070032	101718,0511	10,17180511	55579,87916	5,557987916	66912,35186	6,691235186
Toluene	9460,265751	0,946026575	0	0	0	0	0	0
2-Furanol, tetrahydro-	104575,4285	10,45754285	114942,5579	11,49425579	98274,33565	9,827433565	98095,76493	9,809576493
1,3-Propanediol	104,8407983	0,01048408	0	0	0	0	0	0
Butanoic acid, 4-hydroxy-	11389,13446	1,138913446	10994,6978	1,09946978	9621,739728	0,962173973	10373,26248	1,037326248
Furan, tetrahydro-2-methyl-	21829,67221	2,182967221	25142,75111	2,514275111	21294,75696	2,129475696	23303,00791	2,330300791
1,3-Propanediol, 2-ethyl-2-(hydroxymethyl)-	7983,554621	0,798355462	6929,695152	0,692969515	8800,993015	0,880099301	4235,142966	0,423514297
1,3-Propanediol, 2-ethyl-2-(hydroxymethyl)-	9645,658904	0,96456589	6641,483922	0,664148392	14674,9614	1,46749614	18760,63495	1,876063495
Cyclopropanetetradecanoic acid, 2-octyl-, methyl ester		0		0	1679,301084	0,167930108	2332,652654	0,233265265
Octaethylene glycol monododecyl ether	821,8464656	0,082184647	290,3104066	0,029031041	1815,623209	0,181562321	3159,153696	0,31591537
1H-Pyrrole, 1-butyl-		0	0	0	0	0	0	0
Hexanedioic acid, bis(2-ethylhexyl) ester	0	0	0	0			2682,643393	0,268264339
Phenol, 2,2'-methylenebis[6-(1,1-dimethylethyl)-4-methyl-	0	0	601,5494312	0,060154943	0	0	0	0
Bis(2-ethylhexyl) phthalate	0	0	6517,296736	0,651729674	12430,07922	1,243007922	73235,55049	7,323555049
	228236,2526	22,82362526	276623,2947	27,66232947	227545,1941	22,75451941	305450,2823	30,54502823

Figure S15. Screening (GPC) of polyols with the residue RPUF-C at 5 mm

Figure S16. Images of GP-B (left) and GP-C obtained with the initial waste at 500 microns, 5 mm and 2 mm (right)

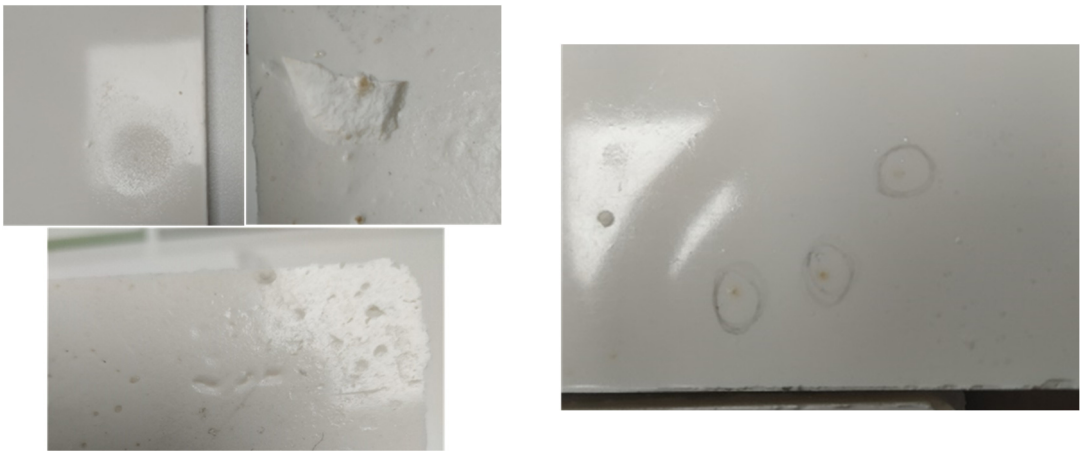


Figure S17. Some defects found in plates of GP-B at 10% (left) and GP-C at 5% (right)

Figure S18. Free foaming for ref. 3 (up left), ref. 4 (up right), ref. 5 (down left) and ref. 6 (down right). Plate for ref. 3 (right)

Table S1. Conditions of the glycolysis reactions RPUF-C.

Glycolysis Reaction Code	Particle size [mm].	Solvent	Solvent:PU [g:g].	Temperature [°C]	Catalyst	Catalyst :PU [mol:g]	Time [h]	Conversion (%) g reacted /g PURF
R8	2	E.G.	4:1	198	NaOH	0.002	2	48
R9	2	D.E.G.	4:1	200	NaOH	0.002	2	0
R13	2	E.G.	4:1	198	NaOH	0.001	2	64
R15	2	E.G.	4:1	198	-	0.002	2	47
R18	2	E.G.	4:1	198	Na Acetate	-	2	69
R24	2	E.G.	4:1	180	NaOH	0.002	2	0
R25	2	E.G.	2:1	198	NaOH	0.002	2	0
R27	2	E.G.	4:1	180	Na Acetate	0.002	2	0
R34	2	E.G.	4:1	198	DEA	0.002	2	38
R36	2	E.G.	4:1	198	NaOH	0.002	2	63
R40	2	E.G.	4:1	198	NaOH	0.002	2	53
R41	5	E.G.	4:1	198	Na Acetate	0.002	5	77
R45	2	E.G.	4:1	198	NaOH	0.002	2	100
R48	2	E.G.	4:1	198	NaOH	0.002	2	94

R49	5	E.G.	4:1	198	NaOH	0.002	2	90

Table S2. Inorganic matter content after muffle calcination of the wastes.

Waste type	RPUF-B	RPUF-C
Inorganic fillers (%)	1.2	9.3
Standard deviation	0.0	0.0

Table S3. TG and dTG curves of the residues RPUF-B and RPUF-C.

Waste Type	Degradation range [°C]	Solid residue [°C]	Maximum degradation T [°C]	Glass transition T [°C]
RPUF-B	250-540	14.8	349	78
RPUF-C	250-490	11.4	393	66

Table S4. Percentage by weight of elements present in RPUF residues analyzed by XRF.

Element/ % Weight	RPUF-B	RPUF-C
Ag, As, Au, Bi, Br, Ca, Cd, Cl, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Sb, Se, Sr, Zn, Zr	0.0	0.0
Ba	0.0	0.1
Sn	0.0	0.1
Ti	0.4	1.3
Total	0.4	1.5
Standard Deviation (%)	0.0	0.3

Table S5. Results of the quantity of polyols obtained in each of the glycolysis reactions for 500 microns, 2 mm and 5 mm RPUF-C waste

	Glycolysis reaction time		
RPUF-C wasted	60 min	90 min	120 min
500 microns	60,51 g	67,51 g	75,53 g
2 mm	43,52 g	62,73 g	42,36 g
5 mm	25,34 g	68,14 g	65,35 g

Table S6. Hydroxyl number of the polyols obtained

Polyols	Hydroxyl number (mgKOH/g)
500 microns/90 min	632
500 microns/120 min	682
2mm/90min	815
2mm/120 min	929

Polyols	Hydroxyl number (mgKOH/g)
5 mm/ 5 min	764
5 mm/ 30 min	Insoluble, no measure
5 mm/ 60 min	
5 mm/ 90 min	673
5 mm/ 120 min	821

Table S7. Formulations with recycled paste.

Reference sample	Recycled paste in the total formulation	Polyol for RPUF-C	Catalyst	Espumation time (s)
1	0%	100%	0,16%	60s
2	5,0%	95,0%	0,00%	No activación
3	5,0%	95,0%	0,16%	100s
4	5,0%	95,0%	0,32%	41s
5	10,0%	90,0%	0,16%	45s

6	15,0%	85,0%	0,16%	42s
7	30,0%	70,0%	0,16%	0s