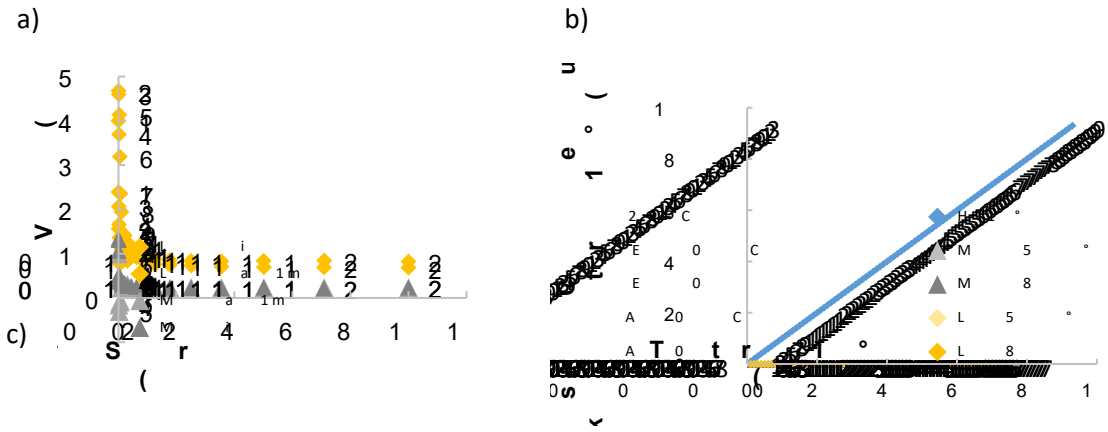

Solvent	λ_{max} absorption (nm) NB in Water	λ_{max} absorption (nm) NB in EtOH	Conductivity (mS/cm)	Density (g/cm^3)
Water	638.21	635.42	$0.05*10^{-3}$	0.997
Ethanol	629.54	626.35		0.789
Methanol	628.24	X	$2*10^{-3}$	0.791
LA:Gly:W	**639.39**	**X**	**2.96**	**1.21 ± 0.01**
Men:Lau	**X**	**624.28**	**$0.1*10^{-3}$**	**0.87 ± 0.02**

Figure S.1. a) Apparent viscosity of the NaDES right after their synthesis and after one month at room temperature. b) Cumulative energy used to heat up to 170 °C water only and the NaDES at two different concentrations by microwave. Polarity through Nile Blue A spectrophotometric assay, conductivity, and density of the selected NaDES.

Table S1. Central composite design 1 NaDES LA:Gly:W on the carbohydrate content determined by the Anthrone method of the extract

	Estimate	Std. Error	t value	Pr(< abs (t))
INTERCEPT	20.6009	1.2160	16.9418	3.903×10^{-8}
TEMPERATURE	8.6522	1.4259	6.0681	1.863×10^{-4}
MULTIPLE R-SQUARED	0.8036			
ADJUSTED R-SQUARED	0.7818			
F- STATISTIC	36.82			
P-VALUE	0.0001863			

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
F0(X2)	1	598.89	598.89	36.8214	0.0001863
RESIDUALS	9	146.38	16.26		
LACK OF FIT	3	43.07	14.36	0.8338	0.5223834
PURE ERROR	6	103.31	17.22		

Table S2. Central composit design 1 NaDES LA:Gly:W on the carbohydrate content determined b HPLC

	Estimate	Std. Error	t value	Pr(< abs (t))
INTERCEPT	22.6482	1.3804	16.4065	5.167×10^{-8}
TEMPERATURE	5.1794	1.6187	3.1997	0.01084
MULTIPLE R-SQUARED	0.5322			
ADJUSTED R-SQUARED	0.4802			
F- STATISTIC	10.24			
P-VALUE	0.01084			

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
F0(X2)	1	214.607	214.607	10.2381	0.01084
RESIDUALS	9	188.655	20.962		
LACK OF FIT	3	85.744	28.581	1.6664	0.27191
PURE ERROR	6	102.910	17.152		

Table S3. Central composit design 1 NaDES LA:Gly:W on the total protein content of the extrac

	Estimate	Std. Error	t value	Pr(< abs (t))
INTERCEPT	1.76412	0.15158	11.6384	2.424×10^{-5}
NWP	0.78125	0.12757	6.124	0.0008661
TEMPERATURE	1.17647	0.12757	9.222	9.174×10^{-5}
NWP * TEMPERATURE	0.655	0.18041	3.6305	0.010958
TEMPERATURE²	0.28559	0.14512	1.9679	0.0966336
MULTIPLE R-SQUARED	0.9588			
ADJUSTED R-SQUARED	0.9313			
F- STATISTIC	34.9			
P-VALUE	0.0002712			

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
F0(X1, X2)	2	15.9555	7.9777	61.2748	0.0001017
TWI(X1, X2)	1	1.7161	1.7161	13.1809	0.0109580
PQ(X2)	1	0.5042	0.5042	3.8726	0.0966335
RESIDUALS	6	0.7812	0.1302		
LACK OF FIT	4	0.6243	0.1561	1.9899	0.361292
PURE ERROR	2	0.1569	0.0784		

Table S4. Central composit design 1 NaDES LA:Gly:W on the TEAC value

	Estimate	Std. Error	t value	Pr(< abs (t))
INTERCEPT	20.63471	0.96772	21.323	1.257×10^{-7}
NWP	3.22193	0.81446	3.9559	0.0054902
TEMPERATURE	5.81627	0.81446	7.1413	0.0001868
TEMPERATURE²	-2.45147	0.92652	-2.6459	0.0331388
MULTIPLE R-SQUARED	0.9132			
ADJUSTED R-SQUARED	0.876			
F- STATISTIC	24.55			
P-VALUE	0.0004331			

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
F0(X1, X2)	2	353.68	176.839	33.3237	0.0002647
PQ(X2)	1	37.15	37.151	7.0007	0.0331388
RESIDUALS	7	37.15	5.307		
LACK OF FIT	5	14.72	2.945		0.9010911
PURE ERROR	2	22.42	11.212	0.2627	

Table S5. Central composite design 1 using Men:Lau on the TEAC value

	Estimate	Std. Error	t value	Pr(< abs (t))	
INTERCEPT	18.1318	1.99	15.1221	5.273 * 10^-6	
NWP	-5.3402	1.0091	-5.2919	0.0018441	
TEMPERATURE	8.3342	1.0091	8.2588	0.0001704	
NWP * TEMPERATURE	-3.5725	1.4271	-2.5033	0.0463219	
TEMPERATURE²	3.2763	1.148	2.854	0.0299292	
MULTIPLE R-SQUARED	0.9486				
ADJUSTED R-SQUARED	0.9143				
F- STATISTIC	27.66				
P-VALUE	0.0005237				
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
F0(X1, X2)	2	783.81	391.90	48.1056	0.0002023
TWI(X1, X2)	1	51.05	51.05	6.2664	0.0463219
PQ(X1)	1	66.36	66.36	8.1453	0.0290292
RESIDUALS	6	48.88	8.15		
LACK OF FIT	4	47.58	11.89	18.2511	0.526191
PURE ERROR	2	1.30	0.65		

Table S6. Central composit design 2 NaDES LA:Gly:W on the total sugar content of the extract

	Estimate	Std. Error	t value	Pr(< abs (t))	
INTERCEPT	10.75941	0.87703	12.2680	1.811×10^{-6}	
TEMPERATURE	16.03242	0.73813	21.7203	2.128×10^{-8}	
TEMPERATURE²	8.06956	0.83969	9.6101	1.141×10^{-5}	
MULTIPLE R-SQUARED	0.986				
ADJUSTED R-SQUARED	0.9825				
F- STATISTIC	282.1				
P-VALUE	3.823×10^{-8}				
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
F0(X2)	1	2056.31	2056.31	471.7727	2.128×1
PQ(X2)	1	402.55	402.55	92.3550	1.141×1
RESIDUALS	8	34.87	4.36		

LACK OF FIT	2	4.55	2.27	0.4499	0.6576
PURE ERROR	6	30.32	5.05		

Table S7. Central composit design 2 NaDES LA:Gly:W on the carbohydrate content determined b

	Estimate	Std. Error	t value	Pr(< abs (t))
INTERCEPT	13.62118	0.76894	17.7142	1.055×10^{-7}
TEMPERATURE	12.50062	0.64716	19.3161	5.354×10^{-8}
TEMPERATURE²	3.96588	0.73621	5.3869	6.562×10^{-4}
MULTIPLE R-SQUARED	0.9805			
ADJUSTED R-SQUARED	0.9756			
F- STATISTIC	201.1			
P-VALUE	1.448×10^{-7}			
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
F0(X2)	1	1250.12	1250.12	373.1113	5.354×10^{-8}
PQ(X2)	1	97.23	97.23	29.0189	6.562×10^{-5}
RESIDUALS	8	26.80	3.35		
LACK OF FIT	2	3.63	1.82	0.4699	0.6463
PURE ERROR	6	23.17	3.86		

Table S8. Central composit design 2 NaDES LA:Gly:W on the total protein content of the extrac

	Estimate	Std. Error	t value	Pr(< abs (t))
INTERCEPT	0.477273	0.056717	8.4151	3.029×10^{-5}
NWP	0.140119	0.066506	2.1069	0.0682052
TEMPERATURE	0.438759	0.066506	6.5973	1.699×10^{-4}
MULTIPLE R-SQUARED	0.857			
ADJUSTED R-SQUARED	0.8213			
F- STATISTIC	23.98			
P-VALUE	0.0004176			
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
F0(X1, X2)	2	1.69714	0.84857	23.9815	0.00041

RESIDUALS	8	0.28308	0.03538		
LACK OF FIT	6	0.26301	0.04383	4.3689	0.19794
PURE ERROR	2	0.02007	0.01003		

Table S9. Central composit design 2 NaDES LA:Gly:W on the TEAC value.

	Estimate	Std. Error	t value	Pr(< abs (t))	
INTERCEPT	7.91091	0.85347	9.2691	6.705×10^{-6}	
TEMPERATURE	5.51379	1.00078	5.5095	3.756×10^{-4}	
MULTIPLE R-SQUARED	0.7713				
ADJUSTED R-SQUARED	0.7459				
F- STATISTIC	30.35				
P-VALUE	0.0003756				
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
F0(X2)	1	243.215	243.215	30.354	0.0003756
RESIDUALS	9	72.113	8.013		
LACK OF FIT	3	31.623	10.541	1.562	0.2933871
PURE ERROR	6	40.490	6.748		

Table S10. Central composit design 2 NaDES Men:Lau on the total sugar content of the extract.

	Estimate	Std. Error	t value	Pr(< abs (t))
INTERCEPT	10.46000	0.43288	24.1640	2.262×10^{-6}
NWP	2.31249	0.26508	8.7237	3.277×10^{-4}
TEMPERATURE	10.18153	0.26508	38.4091	2.254×10^{-7}
NWP * TEMPERATURE	2.28750	0.37488	6.1019	0.0017119
NWP²	0.75188	0.31551	2.3831	0.0629268
TEMPERATURE²	3.70188	0.31551	11.7330	7.907×10^{-5}
MULTIPLE R-SQUARED	0.9971			
ADJUSTED R-SQUARED	0.9942			

F- STATISTIC	345.5				
P-VALUE	2.423×10^{-6}				
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
F0(X1, X2)	2	872.09	436.04	775.6822	5.85×10^{-7}
TWI(X1, X2)	1	20.93	20.93	37.2336	0.001712
PQ(X1, X2)	2	78.09	39.04	69.4559	2.25×10^{-4}
RESIDUALS	5	2.81	0.56		
LACK OF FIT	3	2.55	0.85	6.5458	0.135393
PURE ERROR	2	0.26	0.13		

Table S11. Central composit design 2 NaDES MEN:LAU on the polymer extraction yield

	Estimate	Std. Error	t value	Pr(< abs (t))	
INTERCEPT	14.71855	0.34008	43.280	9.371×10^{-12}	
TEMPERATURE	9.39346	0.39878	23.556	2.135×10^{-9}	
MULTIPLE R-SQUARED	0.984				
ADJUSTED R-SQUARED	0.9823				
F- STATISTIC	554.9				
P-VALUE	2.135×10^{-9}				
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
F0(X2)	1	705.90	705.90	554.8732	2.135×10^{-9}
RESIDUALS	9	11.45	1.27		
LACK OF FIT	3	6.85	2.28	2.9736	0.1187
PURE ERROR	6	4.60	0.77		

Table S.12. Central composit design 2 NaDES Men:Lau on the TEAC value

	Estimate	Std. Error	t value	Pr(< abs (t))
INTERCEPT	11.56909	0.40899	28.2871	2.636×10^{-9}
NWR	-1.26972	0.47958	-2.6476	0.029337
TEMPERATURE	6.03499	0.47958	12.5839	1.491×10^{-6}
MULTIPLE R-SQUARED	0.9539			
ADJUSTED R-SQUARED	0.9423			
F- STATISTIC	82.68			
P-VALUE	4.535×10^{-6}			

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
F0(X1, X2)	2	304.267	152.133	82.6817	4.535×10^{-6}
RESIDUALS	8	14.720	1.840		
LACK OF FIT	6	11.596	1.933	1.2373	0.5111
PURE ERROR	2	3.124	1.562		

Table S.13. Experimental design matrix and dependent variables related to the rheological characterization of the biopolymer recovered from the aqueous phase after the hydrothermal extraction with Men:Lau at low percentages.

Exp	Uncoded variable		Coded variable		Men:Lau			
	NP (%)	Temp (°C)	X1	X2	Viscosity$_{1\ s^{-1}}$ (mPa·s)	Elastic modulus$_{10\ Hz}$ (Pa)	Viscous modulus$_{10\ Hz}$ (Pa)	$tan\ \delta_{10\ Hz}$
1	15	120	1	-1	100962	1938.7	381.18	0.20
2	17	145	1.41	0	19344	230.65	156.22	0.68
3	10	145	0	0	19344	235.61	183.91	0.78
4	10	110	0	-1.41	116523	3588.4	502.59	0.14
5	5	170	-1	1	17766	240.82	87.209	0.36
6	5	120	-1	-1	827504	13574	1569.3	0.12
7	15	170	1	1	25702	119.32	55.678	0.47
8	10	180	0	1.41	114.2	Too liquid to measure		
9	3	145	-1.41	0	15269	105.61	93.226	0.88
10	10	145	0	0	19695	169.5	99.672	0.59
11	10	145	0	0	32058	405.24	173.15	0.43

Table S.14. Central composit design 2 NaDES Men:Lau on the polymer logarithm of the viscous modulus

	Estimate	Std. Error	t value	Pr(< abs (t))
INTERCEPT	2.217518	0.076444	29.0086	2.159×10^{-9}
TEMPERATURE	- 0.46244	0.098688	-4.6859	0.00157
MULTIPLE R-SQUARED	0.733			
ADJUSTED R-SQUARED	0.6996			

F- STATISTIC	21.96				
P-VALUE	0.00157				
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
F0(X2)	1	1.24033	1.24033	21.957	0.00157
RESIDUALS	8	0.45191.	0.05649		
LACK OF FIT	2	0.16715	0.08358	1.761	0.25019
PURE ERROR	6	0.28475	0.04746		

Table S.15. Central composit design 2 NaDES Men:Lau on the polymer logarithm of the elastic modulus

	Estimate	Std. Error	t value	Pr(< abs (t))	
INTERCEPT	2.60133	0.14083	18.4718	7.602×10^{-8}	
TEMPERATURE	-0.71839	0.18181	-3.9514	0.004228	
MULTIPLE R-SQUARED	0.6612				
ADJUSTED R-SQUARED	0.6189				
F- STATISTIC	15.61				
P-VALUE	0.004228				
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
F0(X2)	1	2.99332	2.99332	15.6136	0.004228
RESIDUALS	8	1.53370	0.19171		
LACK OF FIT	2	0.94663	0.47332	4.8374	0.56085
PURE ERROR	6	0.58707	0.09785		

Table S.16. Central composit design 2 NaDES Men:Lau on the polymer logartithm of viscosity

	Estimate	Std. Error	t value	Pr(< abs (t))	
INTERCEPT	4.38572	0.34008	43.280	9.371×10^{-12}	
TEMPERATURE	-0.81467	0.39878	23.556	2.135×10^{-9}	
MULTIPLE R-SQUARED	0.6089				
ADJUSTED R-	0.5655				

SQUARED					
F- STATISTIC	14.01				
P-VALUE	0.004601				
	Df	Sum Sq	Mean Sq	F value	Pr(>F)
F0(X2)	1	5.3095	5.3095	14.014	0.004601
RESIDUALS	9	3.4100	0.3789		
LACK OF FIT	3	2.9228	0.9743	11.999	0.006026
PURE ERROR	6	0.04872	0.0812		