Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Biodiesel production waste as promising biomass precursor of reusable activated carbons for caffeine removal

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Description of pH_{PZC} and ash content determination

The determination of the pH at the point of zero charge (pHPZC) was made by preparing a slurry of a 10% mixture the activated carbon with ultra-pure water in a glass bottle, bubbled and sealed under N_2 (to eliminate CO_2). The pH of the slurry was measured (Symphony SP70P pH meter) after shaking for at least 24 h at room temperature. To obtain the pH values for lower solid weight fractions, this procedure was repeated for slurries of 8, 6, 4, 2 and 1% obtained by successive dilution of the initial 10 % slurry. The pH_{PZC} value corresponds to the plateau of the curve of equilibrium pH versus solid weight fraction.

The ash content of the activated carbons was evaluated with approximately 1 of activated carbon that was placed in a quartz boat and dried overnight at 105 °C. After weighting the dried sample in a Mettler AE 240 analytical balance, it was introduced in a horizontal furnace equipped with a Eurotherm 2416 controller. The temperature was first raised from ambient to 500 °C in 10 min, kept for 30 min and then raised to 815 °C in 15 min and kept for 2 h 30 min. After cooling the residue obtained was weighted. The ash content (mean of three essays) was expressed by dried mass of activated carbon.

Table S1. Chemical characteristics of the raw material and lab-made and commercial activated carbons.

Sample	wt.% dry ash free				pH_{PZC}
	%C	%H	%N	%O[a]	
Rapeseed	54.9	7.3	4.8	33.0	-
RS/1:1/700	65.5	2.1	1.5	30.9	7.1
RS/1:0.25/700	65.7	1.6	2.5	26.2	7.2
RS/1:0.25/600	67.1	1.4	2.4	25.1	7.3
RS/1:0.5/700	60.6	3.0	2.2	30.2	7.2
RS/1:0.5/600	64.2	2.5	4.2	25.1	7.1
RS/1:0.75/700	70.7	1.7	1.7	21.9	7.2
CP	93.5	0.5	0.4	5.6	10.3
NS	95.0	0.3	0.7	4.0	8.4

[a] Determined by difference between the total percentage (100 wt.%) and the sum of percentages

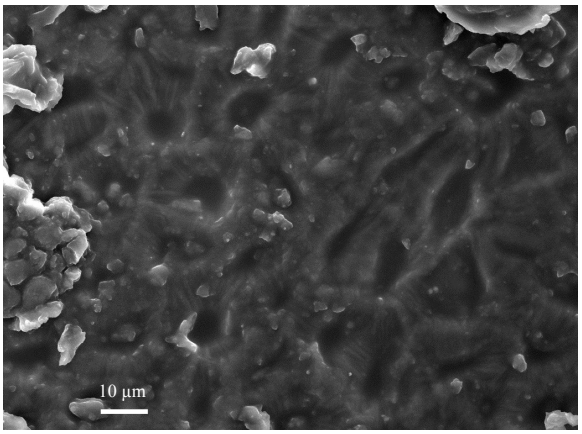

Figure S1. SEM photograph of rapeseed waste.

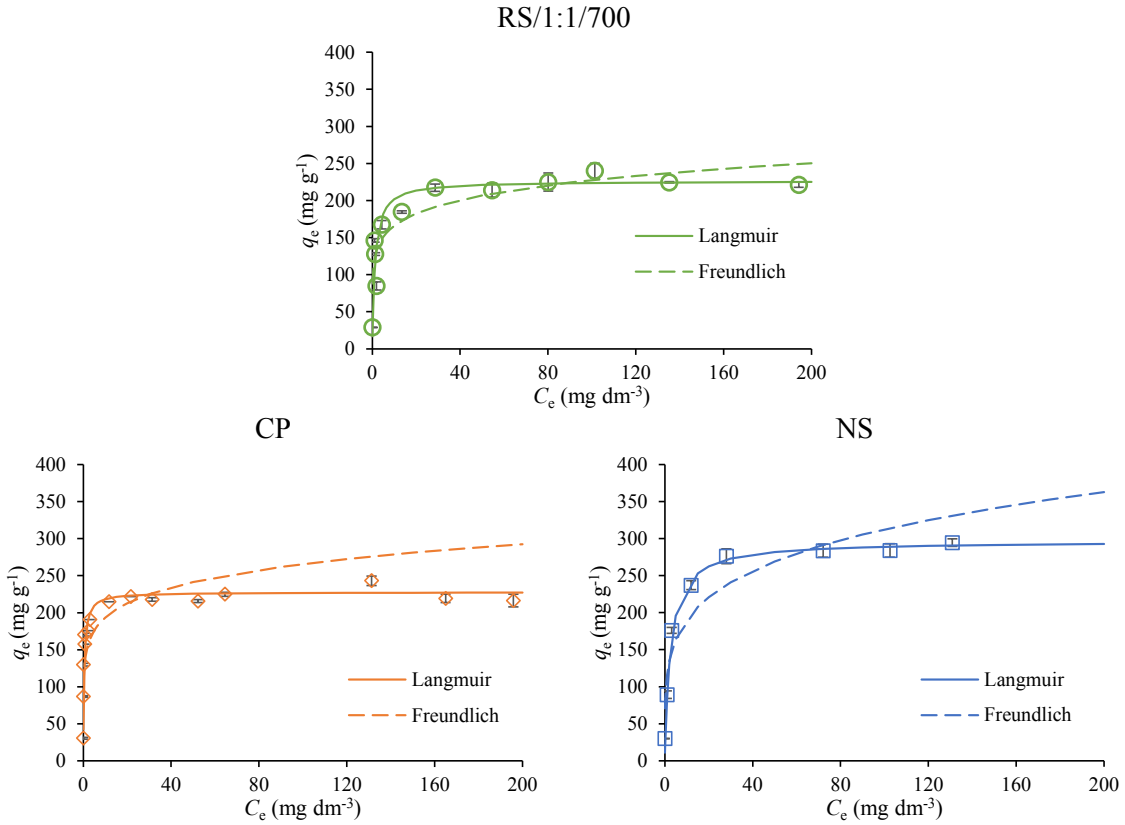

Figure S2. Caffeine adsorption isotherms at 30 ºC. Symbols correspond to the experimental points, whereas lines represent the fitting to the mentioned theoretical models.

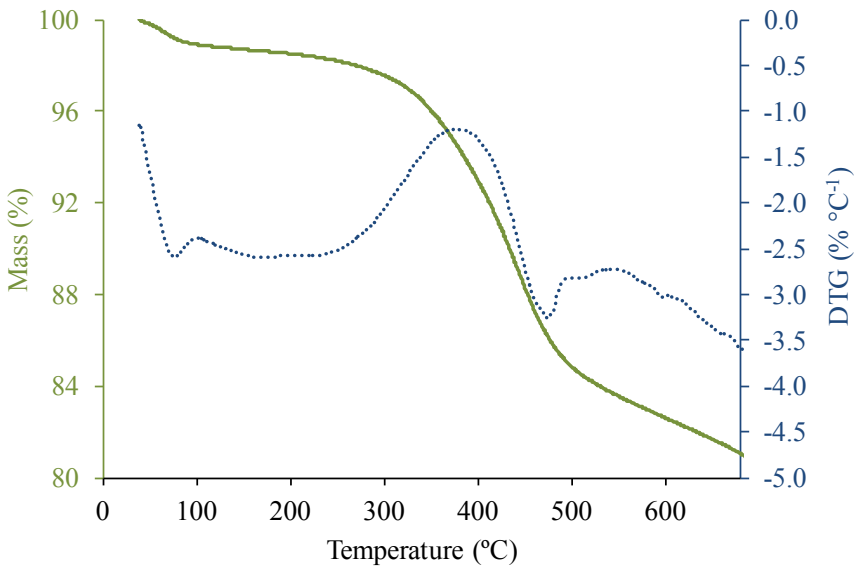

Figure S3. TGA and DTG of RSC_{exh}.

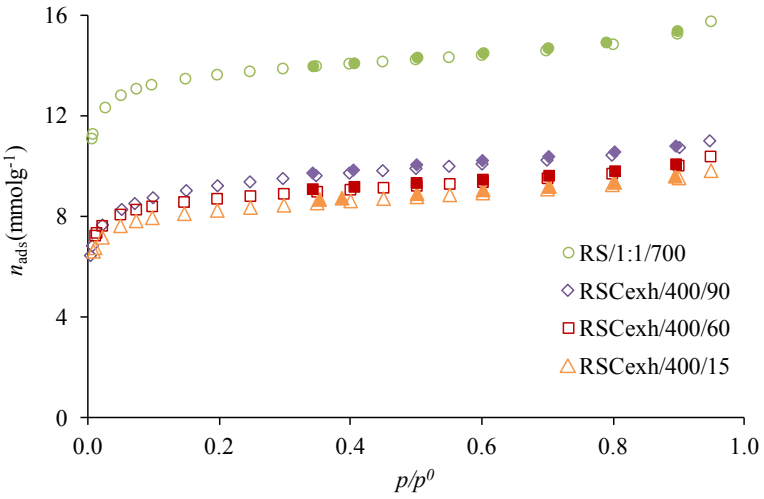

Figure S4. Nitrogen adsorption-desorption isotherms a -196 ºC in the mentioned carbon (closed symbols are desorption points). The nomenclature of the samples presents both the temperature and time of thermal treatment (RSCexh/Temp(ºC)/time(min)).

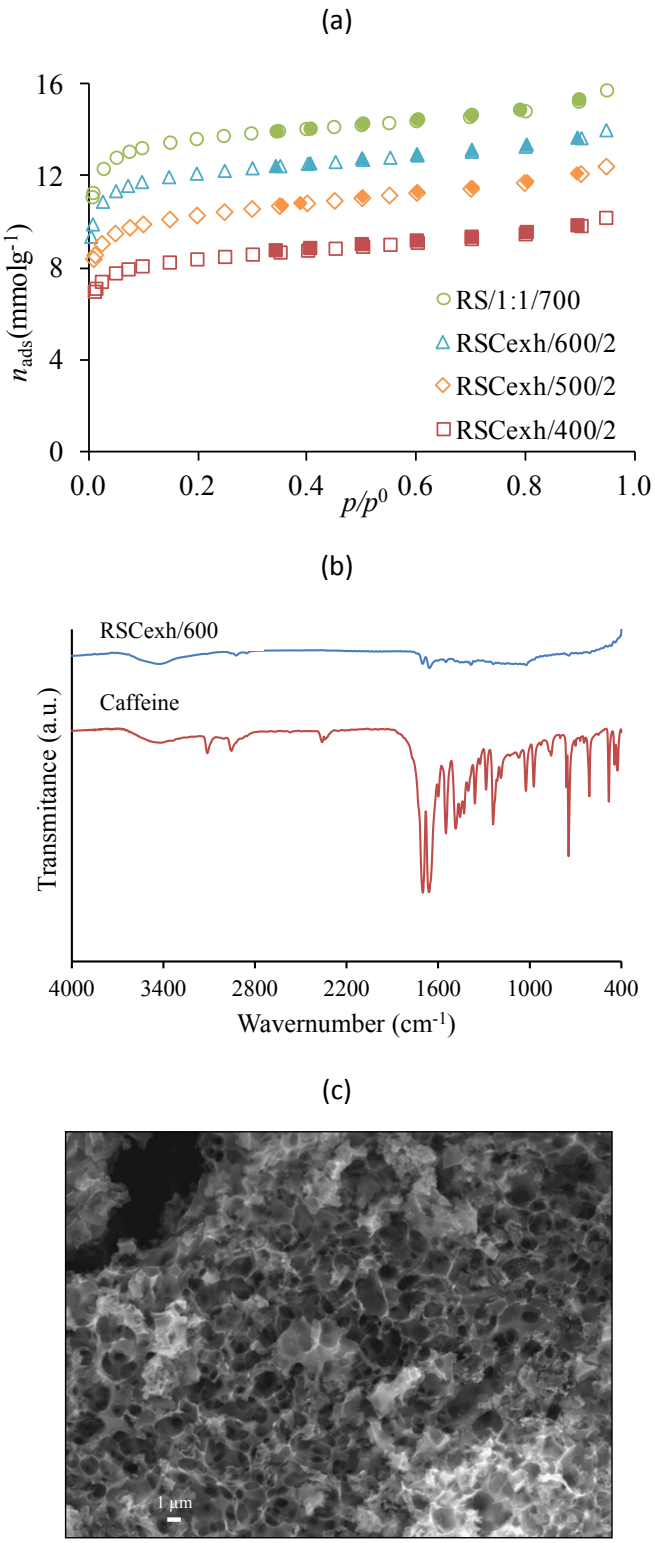

Figure S5. (a) N_2 adsorption/desorption isotherms at -196 ºC on the mentioned carbons. (closed symbols represent desorption points) (b) FTIR spectrum of caffeine and sample RSC$_{exh}$/600/2, (c) SEM photograph of sample RSC$_{exh}$/600/2.