Supplementary Material

Preparation of activated carbons from spent coffee grounds and coffee parchment and assessment of their adsorbent efficiency

Gustavo A. Figueroa Campos[1], Jeffrey Paulo H. Perez[2], Inga Block[3], Sorel Tchewonpi Sagu[1], Pedro Saravia Celis[2], Andreas Taubert[3] and Harshadrai M. Rawel[1]*

[1]Institute of Nutritional Science, University of Potsdam, Arthur-Scheunert-Allee 114-116, 14558 Nuthetal Germany; figueroacamp@uni-potsdam.de, sorelsagu@uni-potsdam.de, rawel@uni-potsdam.de

[2]GFZ German Research Centre for Geosciences, Telegrafenberg, 14473 Potsdam, Germany; jpperez@gfz-potsdam.de

[3]Institute of Chemistry, University of Potsdam, Karl-Liebknecht-Str. 24-25, 14476, Potsdam, Germany; iblock@uni-potsdam.de; ataubert@uni-potsdam.de

[4]Regional School of Sanitary Engineering and Water Resources (ERIS), University of San Carlos of Guatemala, Ciudad Universitaria zona 12, Guatemala; pcsaraviac@gmail.com

* Corresponding author.

Tel: +49-33200-88-5525/5578 (H.R.)

E-mail: rawel@uni-potsdam.de

Content

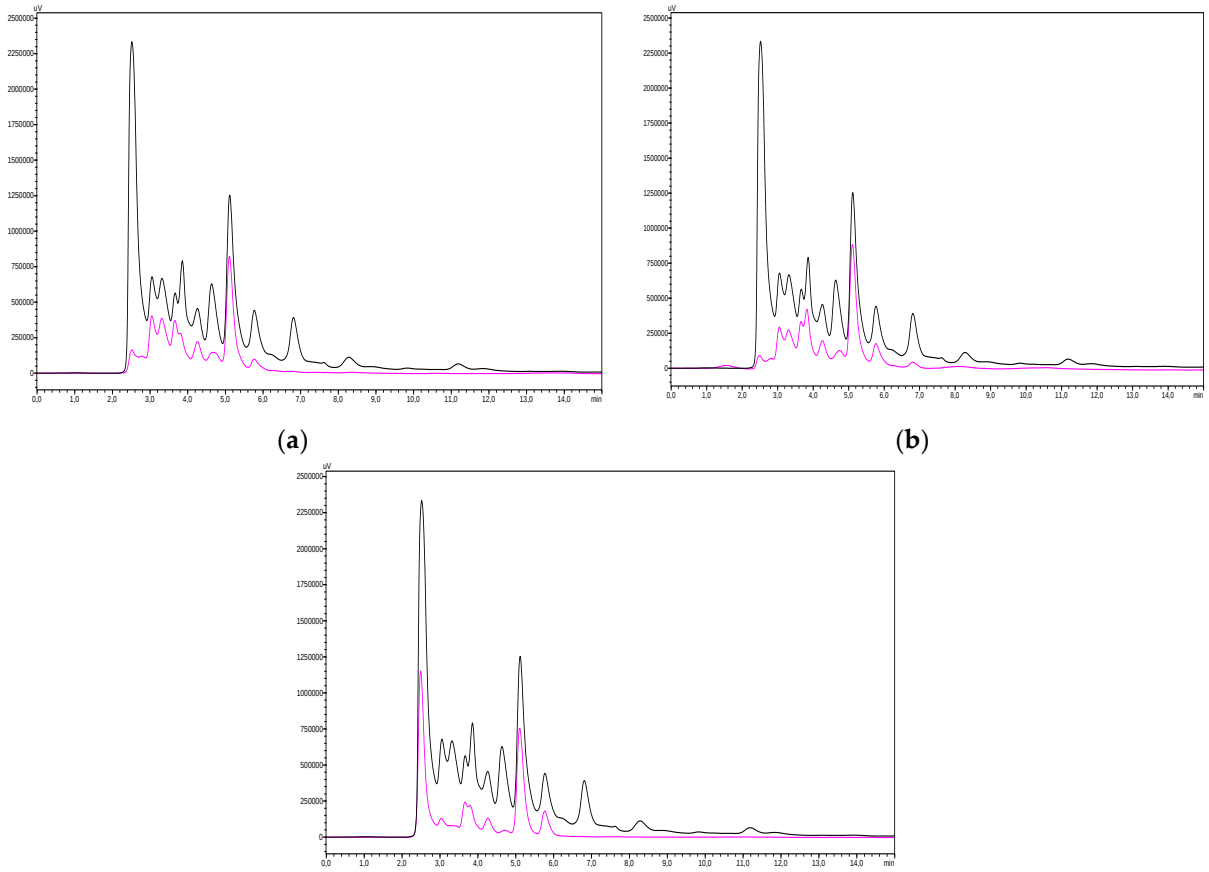
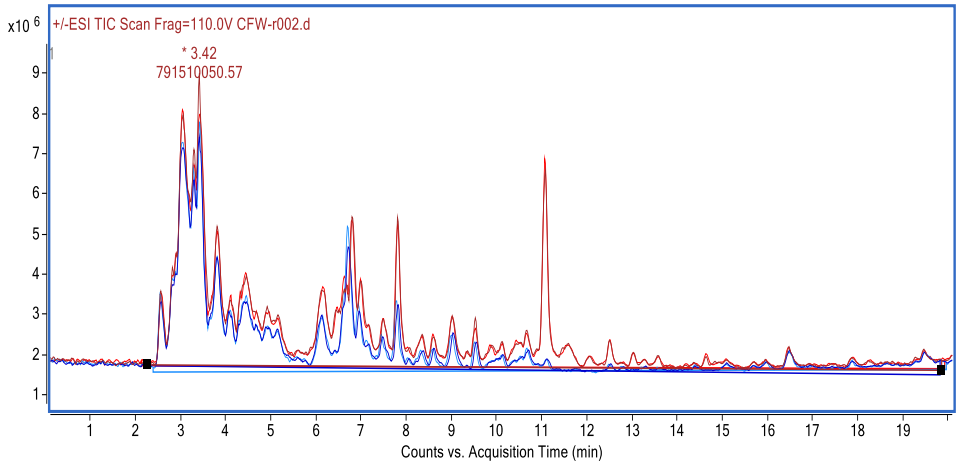
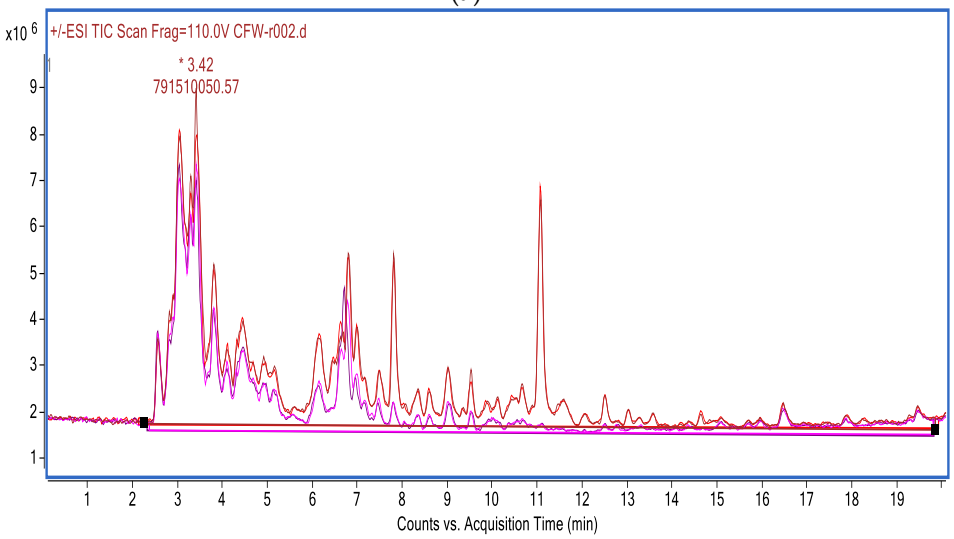


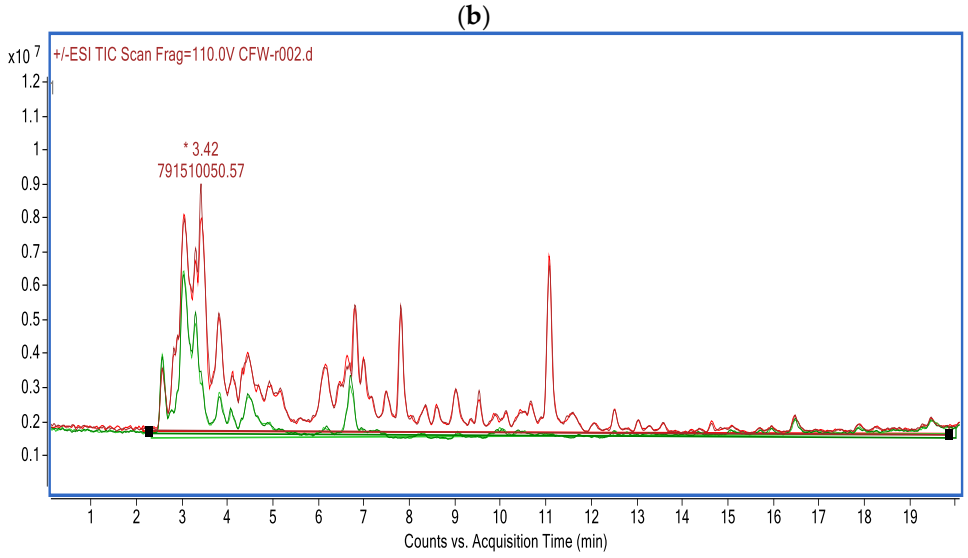
Figure S1 HPLC-MS chromatogram for organic acids comparing coffee wastewater after adsorption onto parchment (a), spent coffee grounds (b), and commercial activated carbons (c). Adsorbent dose of 10% (w/v) and 4 hours contact time at room temperature.



(**a**)



(**b**)



(**c**)

Figure S2 HPLC-MS/MS total ion current spectrum, comparing coffee wastewater after adsorption onto parchment (a), spent coffee grounds (b), and commercial activated carbons (c). Hydrophilic compounds from 2 – 6 minutes and hydrophobic compounds from 6 – 19 minutes. Adsorbent dose of 10% (w/v) and 4 hours contact time at room temperature.

Table S1 Classification of infrared bands

Wavenumber (cm^{-1})	Classification
3500–3300	O–H (stretching, intermolecular)
2930–2840	C–H (amorphous cellulose, caffeine), aromatic methoxyl and methylene groups, methyl groups
1740	C=O (stretching, esters)
1700–1600	caffeine, chlorogenic acids
1600–1300	C=C (aromatic compounds, oils, caffeine)
1430	C–H_2 (crystallinity bond of cellulose)
1284–1240	C–O (aromatic ethers, esters, phenol)
1100–900	C–O (polysaccharides)
900–800	B–glycosidic bond of cellulose

Table S2 Langmuir and Freundlich isotherm model parameters obtained from the nonlinear fitting for spent coffee grounds, parchment, and commercial activated carbon.

Isotherms	Coefficients	Units	Spent coffee grounds	Parchment	Commercial activated carbon
Langmuir	q_m	mg/g	13.99	29.89	93.48
	K_L	L/mg	0.0024	0.0049	3.07×10^{-4}
	R^2	-	0.89	0.87	0.96
Freundlich	n	-	7.07	9.62	2.39
	K_F	mg/g $(L/g)^n$	3.63	9.62	1.41
	R^2	-	0.63	0.54	0.88

Table S3 Adsorption efficiency of hydrophilic and hydrophobic compounds from coffee wastewater on spent coffee grounds, parchment, and commercial activated carbons.

Activated carbon	Adsorption efficiency of hydrophilic components	Adsorption efficiency of hydrophobic components
Spent coffee grounds	14.35 ± 1.44%	43.04 ± 1.99%
Parchment	12.45 ± 3.32%	44.43 ± 2.61%
Commercial	47.90 ± 1.19%	83.57 ± 1.96%