Supplementary Material

Exploring the adsorption of Pb on microalgae-derived biochar: a versatile material for environmental remediation and electroanalytical applications

Gilberto Binda[1,2], Davide Faccini[2], Martina Zava[2], Andrea Pozzi[2], Carlo Dossi[3], Damiano Monticelli[2,*], Davide Spanu[2,*]

[1] Norwegian Institute for Water Research (NIVA), Økernveien 94, 0579 Oslo, Norway; gilberto.binda@niva.no
[2] Department of Science and High Technology, University of Insubria, via Valleggio 11, 22100 Como, Italy; dfaccini@studenti.uninsubria.it (D.F.); mzava@studenti.uninsubria.it (M.Z.); andrea.pozzi@uninsubria.it (A.P.)
[3] Department of Theoretical and Applied Science, University of Insubria, via J.H. Dunant 3, 21100 Varese, Italy; carlo.dossi@uninsubria.it
* Correspondence: davide.spanu@uninsubria.it (D.S.); damiano.monticelli@uninsubria.it (D.M.)
Tel.: +39-0312386428 (D.S.); +39-0312386427 (D.M.)

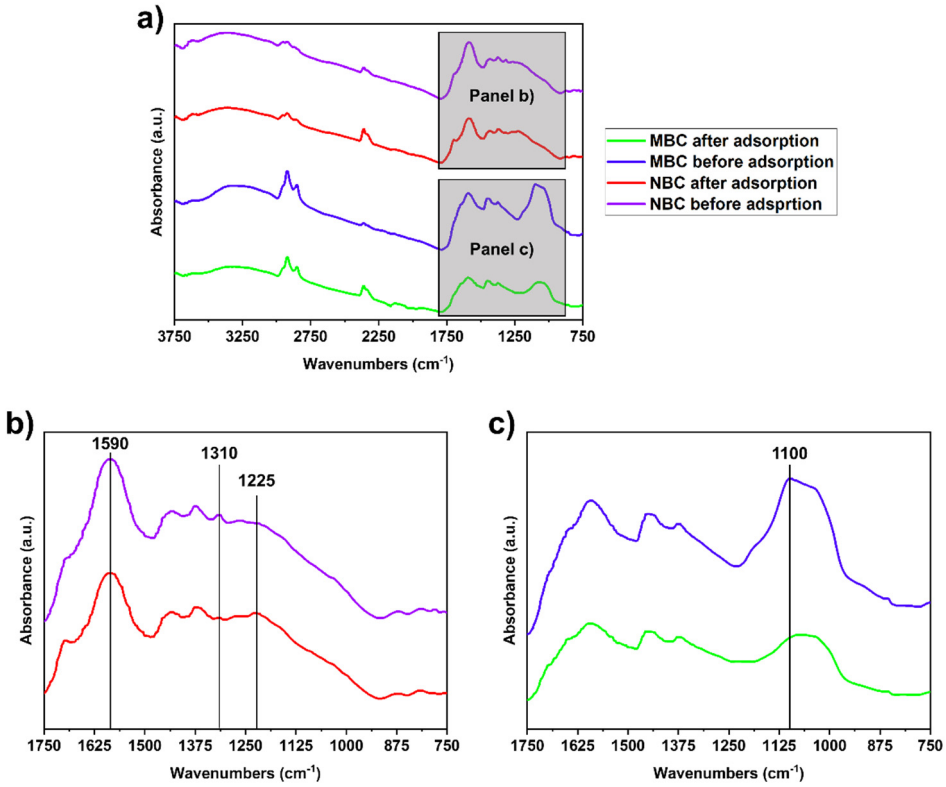

Figure S1. IR spectra of NBC and MBC before and after 24h of Pb adsorption in ultrapure water solution, with initial Pb concentration of 25 µmol/L. Panel a) show the whole IR spectra, while panels b) and c) show the detailed 1750-750 cm^{-1} window of NBC samples and MBC samples, respectively. IR bands of peaks showing changes before and after adsorption are highlighted as well.

Table S1. Physicochemical features and major ion concentration of lake water used for Pb adsorption experiments.

Variable	Unit	Value
Sampling date	-	18/02/2021
pH	-	8.2
Electrical conductivity	µS/cm	210
Alkalinity	mmol/l	1.5
Chemical Oxygen Demand	mg/L	18
Na^+	mg/L	2.84
NH_4^+	mg/L	0.95
K^+	mg/L	1.59
Mg^{2+}	mg/L	3.88
Ca^{2+}	mg/L	16.75
F^-	mg/L	1.30
Cl^-	mg/L	3.73
NO_3^-	mg/L	3.55
SO_4^{2-}	mg/L	15.7

Table S2. Estimated parameters of pseudo-first order and pseudo-second order kinetics, as well as of Langmuir and Freundlich isotherms.

Fitting	Parameter	MBC	NBC
Pseudo-first order kinetics	Q_e	1.96 ± 0.05	1.97 ± 0.03
	K_1	0.028 ± 0.003	0.02 ± 0.001
	R^2	0.855	0.907
Pseudo-second order kinetics	Q_e	2.03 ± 0.08	2.01 ± 0.03
	K_2	0.03 ± 0.01	0.014 ± 0.06
	R^2	0.950	0.972
Langmuir isotherm	Q_m	33.92 ± 4.32	11.08 ± 0.59
	K_L	0.2 ± 0.05	0.08 ± 0.01
	R^2	0.992	0.996
Freundlich isotherm	n	0.56 ± 0.002	0.48 ± 0.03
	K_F	6.57 ± 0.03	1.6 ± 0.01
	R^2	0.988	0.979

Table S3. Estimated regression coefficients and p-values of the predicted second order polynomial model (including parameters interaction, $R^2 = 0.916$) for Pb removal efficiencies obtained using NBC.

Variable	Regression Coefficient	p-value
(Intercept)	97.19	< 0.001
$NaNO_3$	-1.17	0.087
pH	0.99	0.12
$NaNO_3 \times NaNO_3$	0.52	0.57
pH × pH	-3.47	0.023
$NaNO_3$ × pH	0.99	0.18

Table S4. Estimated regression coefficients and p-values of the predicted second order polynomial model (including parameters interaction, $R^2 = 0.983$) for Pb removal efficiencies obtained using MBC.

Variable	Regression Coefficient	p-value
(Intercept)	98.36	<0.001
$NaNO_3$	-0.47	0.10
pH	2.16	0.0017
$NaNO_3 \times NaNO_3$	0.087	0.82
pH × pH	-2.36	0.0065
$NaNO_3$ × pH	0.74	0.056