

ADSORPTION OF GLYPHOSATE IN A FOREST SOIL: A STUDY USING MÖSSBAUER AND FT-IR SPECTROSCOPY

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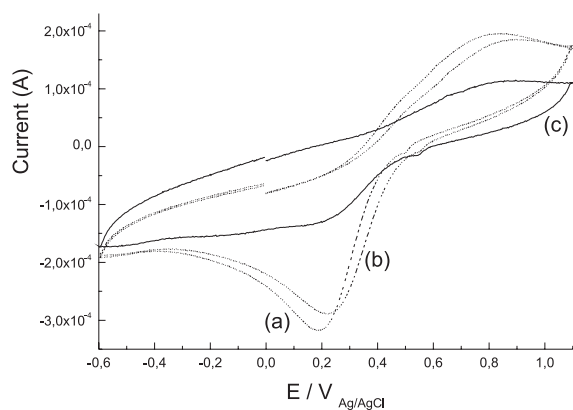


Figure 1S. Cyclic voltammograms (a) $1.0 \times 10^{-4} \text{ mol L}^{-1}$ of glyphosate plus $1.0 \times 10^{-2} \text{ mol L}^{-1}$ of $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ in $\text{KCl } 0.10 \text{ mol L}^{-1}$, (b) $1.0 \times 10^{-3} \text{ mol L}^{-1}$ of glyphosate plus $1.0 \times 10^{-2} \text{ mol L}^{-1}$ $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ in $\text{KCl } 0.10 \text{ mol L}^{-1}$ and (c) $1.0 \times 10^{-2} \text{ mol L}^{-1}$ of glyphosate plus $1.0 \times 10^{-2} \text{ mol L}^{-1}$ of $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ in $\text{KCl } 0.10 \text{ mol L}^{-1}$

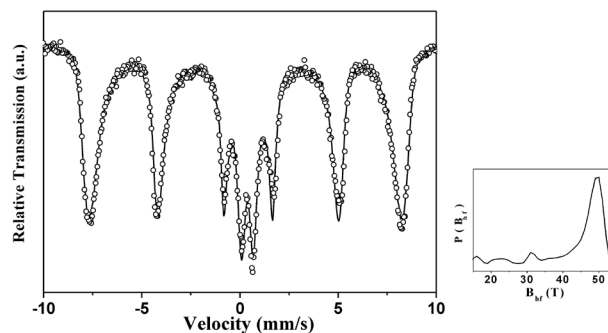


Figure 2S. RT Mössbauer spectrum for the Londrina area farm soil sample without adsorbed GPS. The insert shows the hyperfine magnetic field distribution

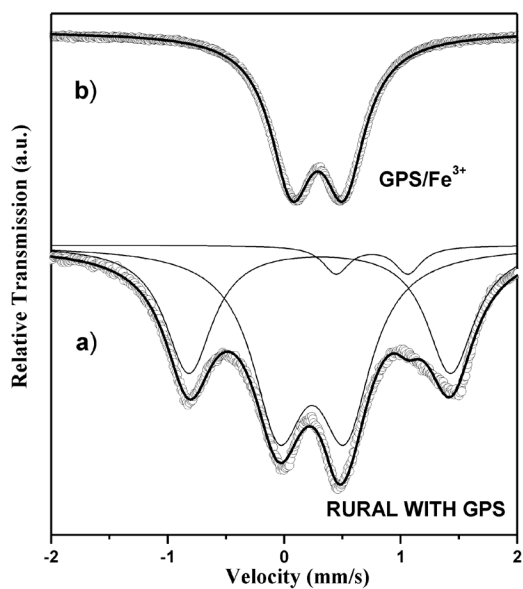


Figure 3S. Mössbauer spectra taken at RT for GPS adsorbed onto Londrina area farm soil (a) and GPS/Fe³⁺ complex (b) samples. The farm soil sample was tumbled for 24 h with saturated glyphosate solution dissolved in KCl 0.10 mol⁻¹. The sample spun for 15 min at 2,000 rpm, the aqueous phase was discharged and solid phase was dried in oven at 40 °C for 24 h

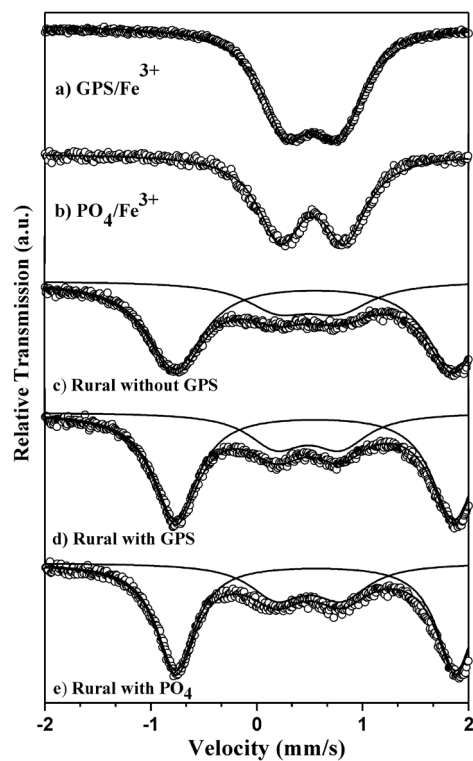


Figure 4S. Mössbauer spectra taken at 88 K for the GPS/Fe³⁺ (a) and PO₄³⁻/Fe³⁺ (b) complexes, and farm soil samples without Gly (c), with GPS (d), and with PO₄³⁻ (e). Farm soil samples were tumbled for 24 h with either saturated GPS or PO₄³⁻ solution dissolved in KCl 0.10 mol L⁻¹. All samples were spun for 15 min at 2,000 rpm, the aqueous phases were discharged and the solids were dried in oven at 40 °C for 24 h

Table 1S. Mössbauer hyperfine parameters and subspectral areas for the complexes and soil samples

Sample	Temperature	Subspectrum	IS ^a (mm/s)	QS (mm/s)	B _{hf} ^b (T)	Γ (mm/s)	Area ^c (%)
Farm soil without GPS	300 K	Magn. Dist.	0.35	0.13	47.7	0.50	79.7
		Doublet (Fe ³⁺)	0.38	0.60	-	0.53	18.7
		Doublet (Fe ²⁺)	0.86	0.64	-	0.27	1.6
	88 K	Magn. Compn. ^d	0.54	-	-	0.64	94.2
		Doublet (Fe ³⁺)	0.49	0.57	-	0.75	5.8
		Magnetic Dist.	0.41	0.13	47.7	0.49	79.3
Farm soil with GPS	300 K	Doublet (Fe ³⁺)	0.38	0.61	-	0.51	19.1
		Doublet (Fe ²⁺)	0.86	0.61	-	0.27	1.6
		Magn. Compn. ^d	0.54	-	-	0.50	93.9
	88 K	Doublet (Fe ³⁺)	0.49	0.62	-	0.61	6.1
		Magnetic Dist.	0.36	0.11	46.9	0.46	77.8
		Doublet (Fe ³⁺)	0.37	0.60	-	0.49	21.2
Farm soil with PO ₄	300 K	Doublet (Fe ²⁺)	0.83	0.70	-	0.36	1.0
		Magn. Compn. ^d	0.53	-	-	0.48	93.1
		Doublet (Fe ³⁺)	0.48	0.63	-	0.54	6.9
	88 K	Magnetic Dist.	0.34	0.11	47.2	0.30	78.7
		Doublet (Fe ³⁺)	0.38	0.60	-	0.61	19.3
		Doublet (Fe ²⁺)	0.88	0.60	-	0.29	2.0
Forest Reserve without GPS	300 K	Magn. Compn. ^d	0.54	-	-	0.46	93.7
		Doublet (Fe ³⁺)	0.49	0.60	-	0.61	6.3
		Magnetic Dist.	0.35	0.11	47.2	0.30	78.2
	88 K	Doublet (Fe ³⁺)	0.39	0.59	-	0.59	20.9
		Doublet (Fe ²⁺)	0.89	0.62	-	0.28	1.9
		Magn. Compn. ^d	0.54	-	-	0.48	95.1
Forest Reserve with GPS	300 K	Doublet (Fe ³⁺)	0.46	0.66	-	0.53	4.9
		Magnetic Dist.	0.38	0.13	47.8	0.49	77.9
		Doublet (Fe ³⁺)	0.34	0.61	-	0.51	21.0
	88 K	Doublet (Fe ²⁺)	0.80	0.65	-	0.32	1.1
		Magn. Compn. ^d	0.51	-	-	0.52	93.1
		Doublet (Fe ³⁺)	0.44	0.60	-	0.55	6.9
PO ₄ /Fe ³⁺	300 K		0.45	0.56	-	0.39	100
	88 K		0.52	0.61	-	0.49	100
GPS/Fe ³⁺	300 K		0.40	0.44	-	0.44	100
	88 K		0.53	0.49	-	0.56	100

IS = Isomer Shift; QS = Quadrupole Splitting; B_{hf} = Hyperfine Magnetic Field; ^aRelative to α-Fe foil at room temperature; ^bAverage value of the distribution; ^cThe areas were renormalized from the fitted values by considering the two apparent lines of the magnetic contributions as 1/6 of a sextet or magnetic distribution; ^dThe magnetic component was fitted as a discrete (pseudo) doublet and, hence, no hyperfine magnetic field or quadrupole splitting is ascribed to it.