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Supporting information for article:

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Title: Examining a synchrotron-based approach for *in situ* analyses of Al speciation in plant roots

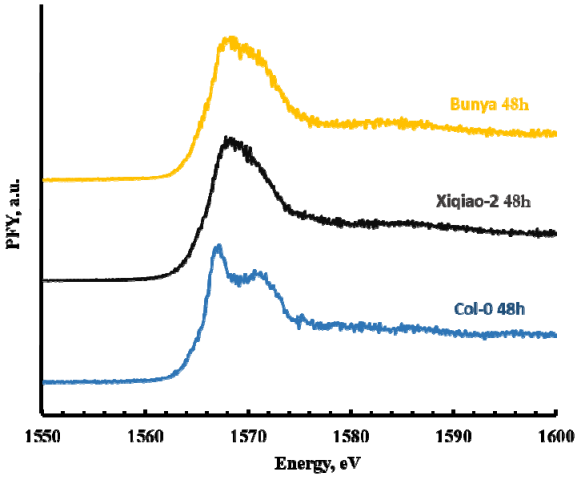
Zhigen Li[1], Peng Wang[1,2], Neal W. Menzies[1], Brigid A. McKenna[1], Chithra Karunakaran[3], James J. Dynes[3], Zachary Arthur[3], Na Liu[3], Lucia Zuin[3], Dongniu Wang[3], and Peter M. Kopittke[1,*]

[1] *The University of Queensland, School of Agriculture and Food Sciences, St. Lucia, Queensland, 4072, Australia*

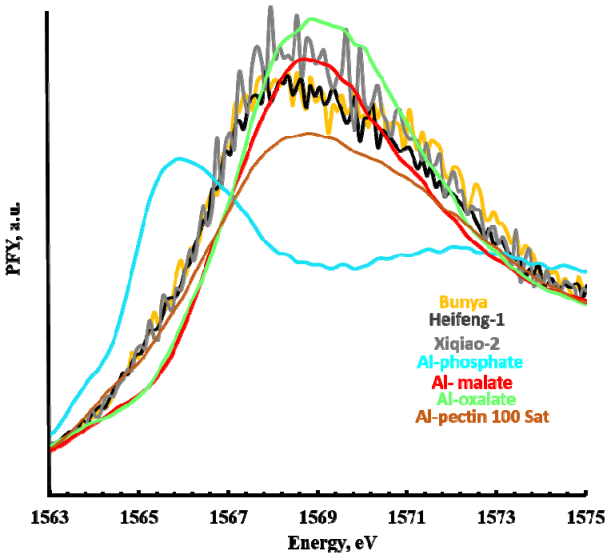
[2] *Nanjing Agricultural University, College of Resources and Environmental Sciences, Nanjing, Jiangsu, 210095, China*

[3] *Canadian Light Source Inc., 44 Innovation Boulevard, Saskatoon, SK, S7N 2V3, Canada*

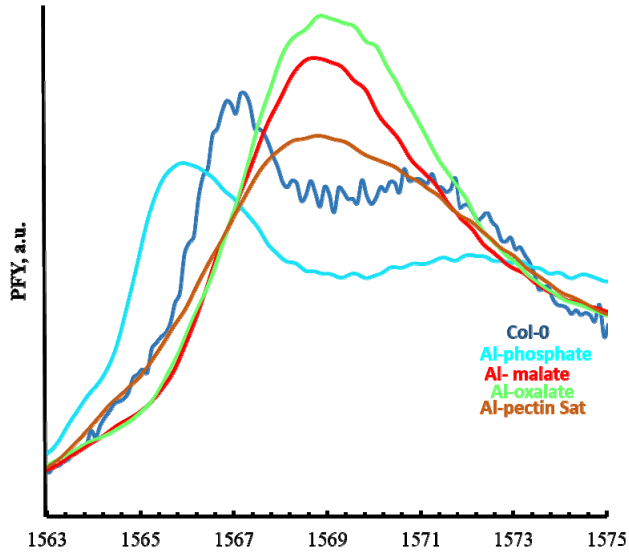
[*]Correspondence: p.kopittke@uq.edu.au, +61 7 3346 9149



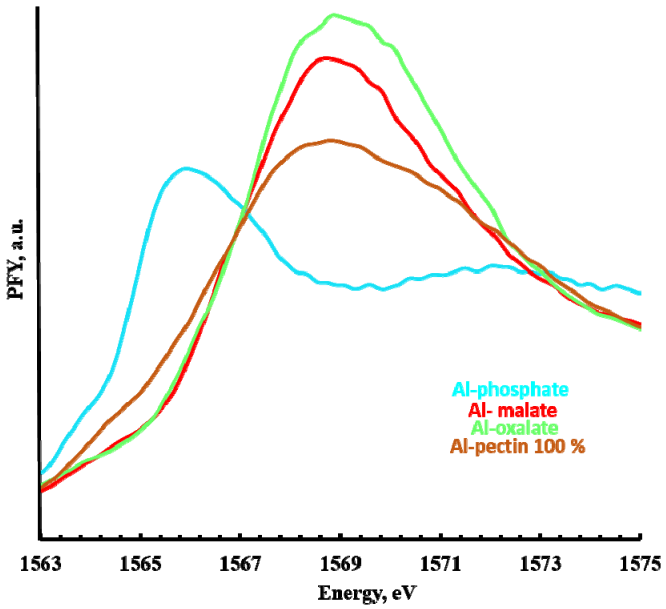
Supplementary Figure S1 *In situ* K-edge XANES spectra for the three plant species following exposure to Al in the rooting media for 48 h. The concentration of Al added was sufficient to reduce relative root elongation rate by 75% in soybean, 25% in buckwheat, and 60% in Arabidopsis over 48 h.



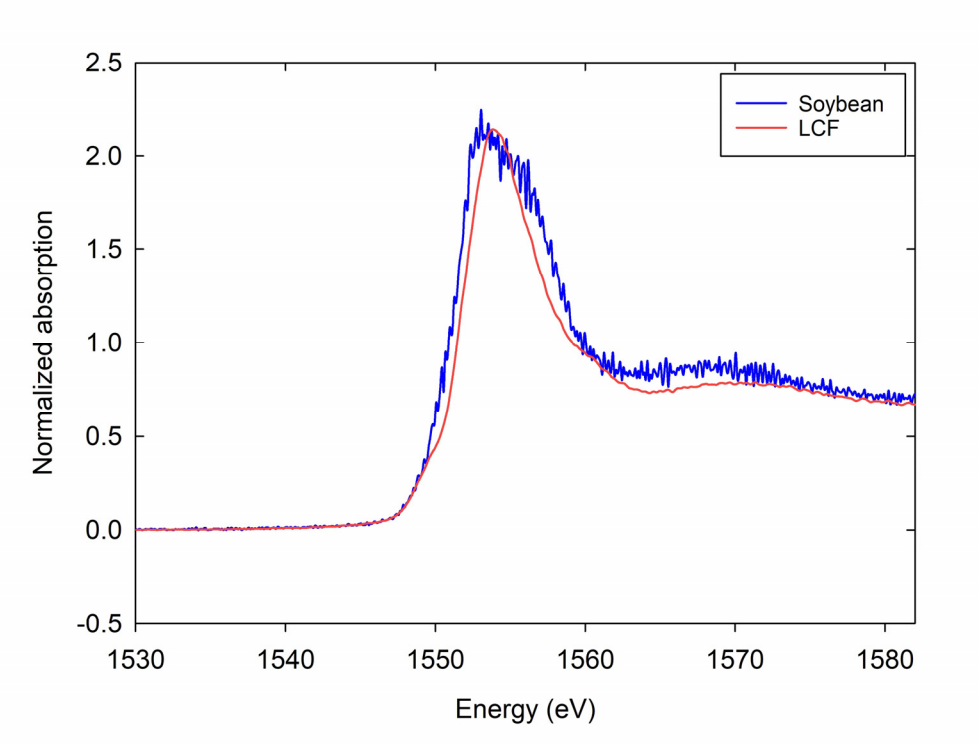
Supplementary Figure S2 *In situ* K-edge XANES spectra for soybean and buckwheat following exposure to Al in the rooting media for 48 h. The concentration of Al added was sufficient to reduce relative root elongation rate by 75% for soybean and 25% for buckwheat over 48 h. For reference, these spectra of the root tissues are compared to four standards, being Al-phosphate, Al-malate, Al-oxalate, and Al-pectin (100% saturation). Note the similarity between the spectra for the root tissues and the Al-malate, Al-oxalate, and Al-pectin (100% saturation) compared to Al-phosphate, for example



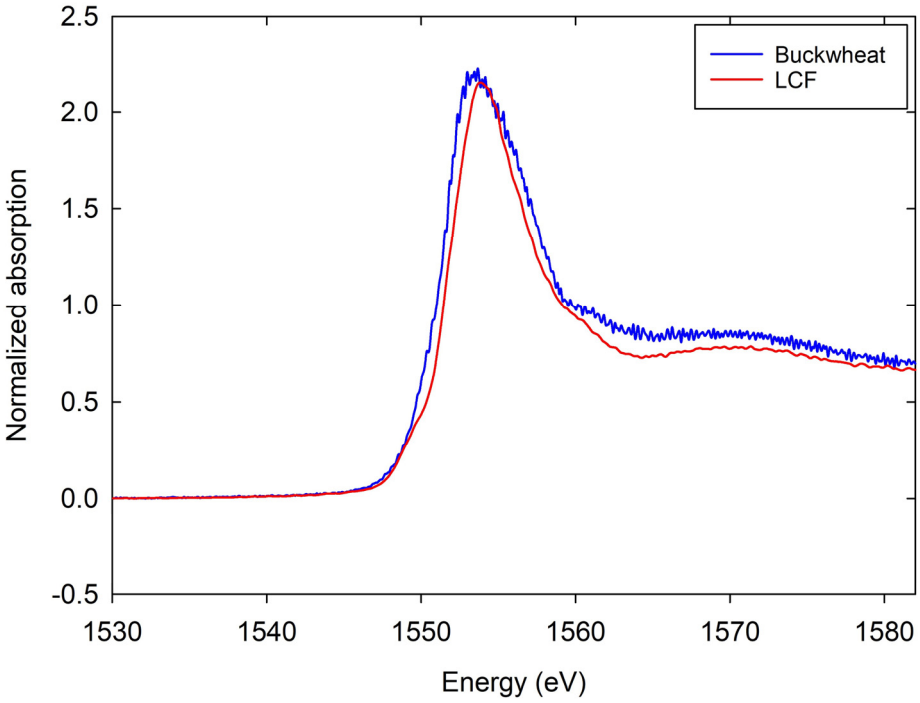
Supplementary Figure S3 *In situ* K-edge XANES spectra for soybean and buckwheat following exposure to Al in the rooting media for 48 h. The concentration of Al added was sufficient to reduce relative root elongation rate by 60% over 48 h. For reference, these spectra of the root tissues are compared to four standards, being Al-phosphate, Al-malate, Al-oxalate, and Al-pectin (100% saturation). Note the difference between the spectra for the root tissues and the Al-malate, Al-oxalate, and Al-pectin (100% saturation) compared to Al-phosphate, for example



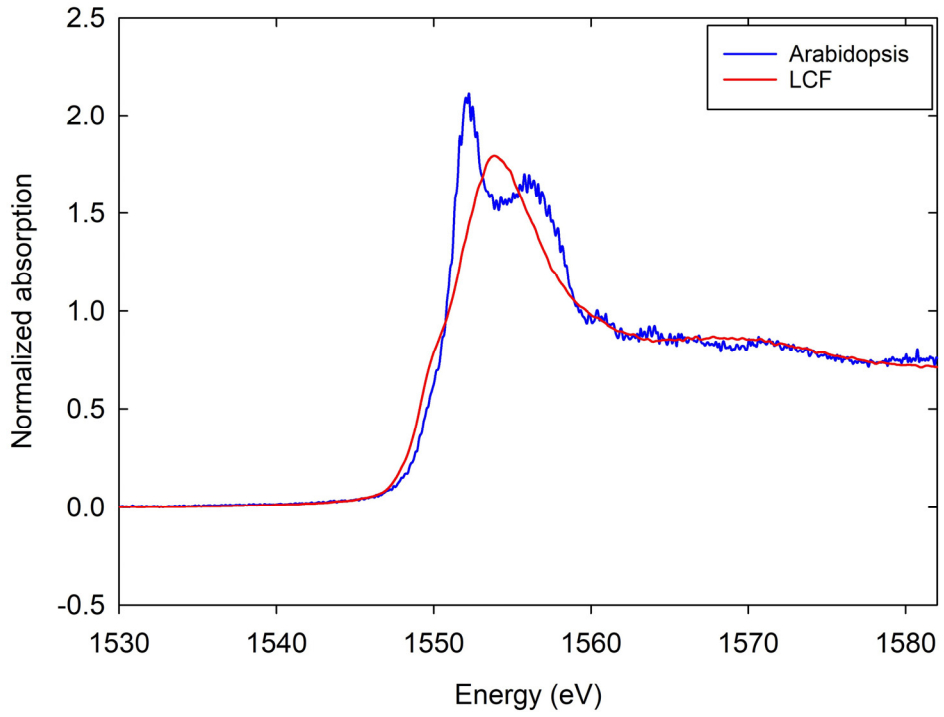
Supplementary Figure S4 *In situ* K-edge XANES spectra for four standards, being Al-phosphate, Al-malate, Al-oxalate, and Al-pectin (100% saturation)



Supplementary Figure S5 Linear combination fitting (LCF) of soybean spectra with reference compounds Al-phosphate, γ-Al_2O_3, hydroxyaluminosilicate, and Al-malate ('carboxyl-Al')



Supplementary Figure S6 Linear combination fitting (LCF) of buckwheat spectra with reference compounds Al-phosphate, γ-Al_2O_3, hydroxyaluminosilicate, and Al-malate ('carboxyl-Al')



Supplementary Figure S7 Linear combination fitting (LCF) of Arabidopsis spectra with reference compounds Al-phosphate, γ-Al_2O_3, hydroxyaluminosilicate, and Al-malate ('carboxyl-Al')

Supplementary Table S1 Results of linear combination fitting (LCF) for three plant species with the corresponding R-factor

	Al phosphate	γ-Al_2O_3	hydroxyaluminosilicate	carboxyl-Al	R-factor
Soybean	0%	5.4%	0%	94.6%	0.036
Buckwheat	0%	4.4%	0%	95.6%	0.030
Arabidopsis	0%	0%	46%	54%	0.051