

Table S1 Descriptive information of the spectral curves

Spectral type	Transformation	Spectral range	Nodes	Value range	Areas of change concentration
vis-NIR	RS	350-2500 nm	768	2.96-56.48	400-1000 nm
	CT		768	-29.15-19.82	400-1400 nm
	SNV		768	-2.48-1.56	450-1400 nm, 2100-2500 nm
	MSC		768	-27.35-16.63	450-1400 nm, 2100-2500 nm
	D1		767	-2.06-0.56	500-1000 nm
	D2		766	-0.60-0.33	1000-1500 nm
	DT		768	-17.72-15.58	500-1400 nm
	CR		768	0.16-1.01	400-1000 nm
	CL		768	0.57-3.52	400-700 nm
XRF	RS	0.39-53.205 keV	3522	-7.27-859.00	6-24 keV
	CT		3522	-19.21-847.08	3-24 keV
	SNV		3522	-0.81-20.33	3-24 keV
	MSC		3522	-24.82-594.95	3-24 keV
	D1		3521	-114.71-117.11	5-11 keV
	D2		3520	-43.95-20.55	5-10 keV
	DT		3522	-27.91-838.89	5-21 keV
	CR		3522	-137.46-340.23	5-12 keV