

## Automated catalytic spectrophotometric method for manganese analysis using a chip-multisyringe flow injection system (Chip-MSFIA)

Piyawan Phansi<sup>a, b</sup>, Camelia Henríquez<sup>c</sup>, Edwin Palacio<sup>c</sup>, Prapin Wilairat<sup>a,b</sup>, Duangjai Nacapricha<sup>a,b</sup>, Víctor Cerdà<sup>c</sup>

### Appendices. Supporting information

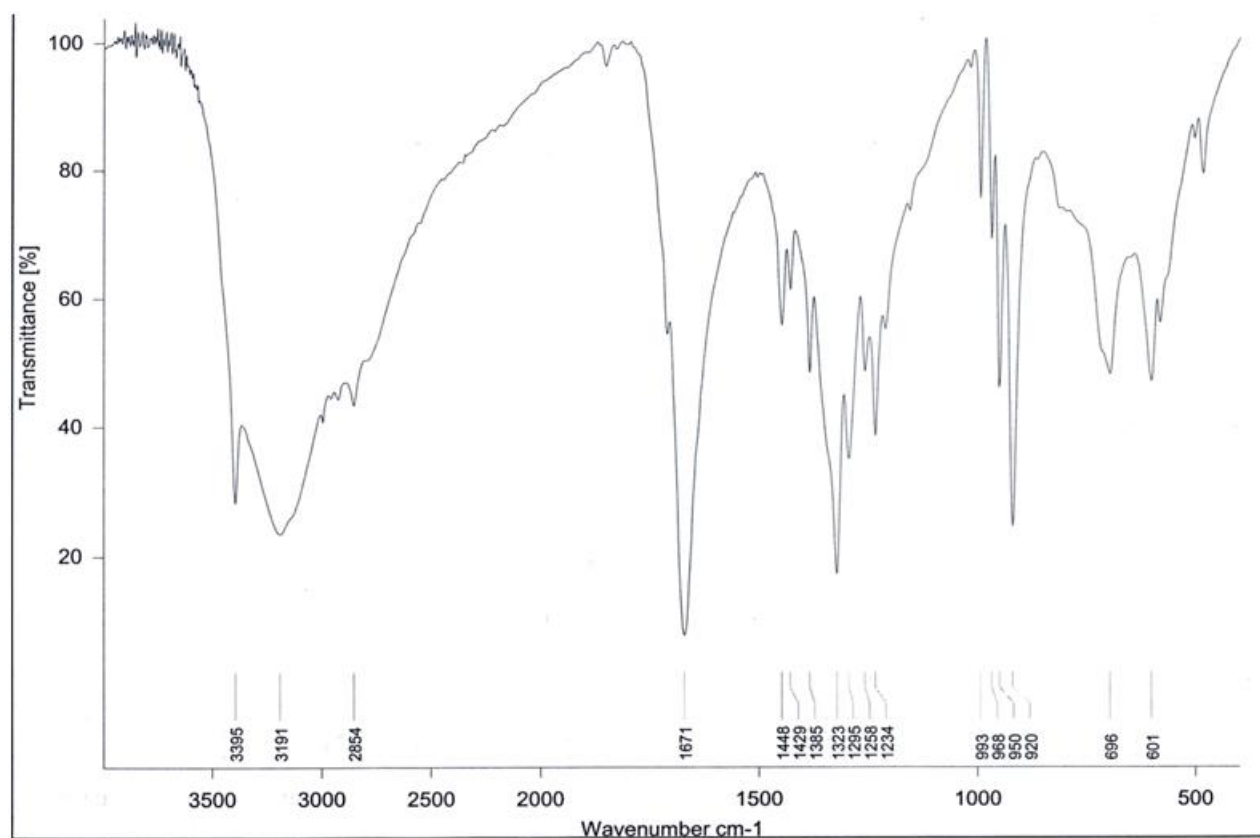


Fig. A-1. IR spectrum of succinimidedioxime (SIDO).

Probe: 5 mm TBI 1H/13C/D-BB Z-GRD Z8618/0027 Sample depth:20 Gas: nitrogen  
Sample: succinimidodioxima in H2O:D2O(5%) (T=298K)  
experiment: zggpw5 <sup>1</sup>H (1.013)  
Experiment fet: 23/05/13

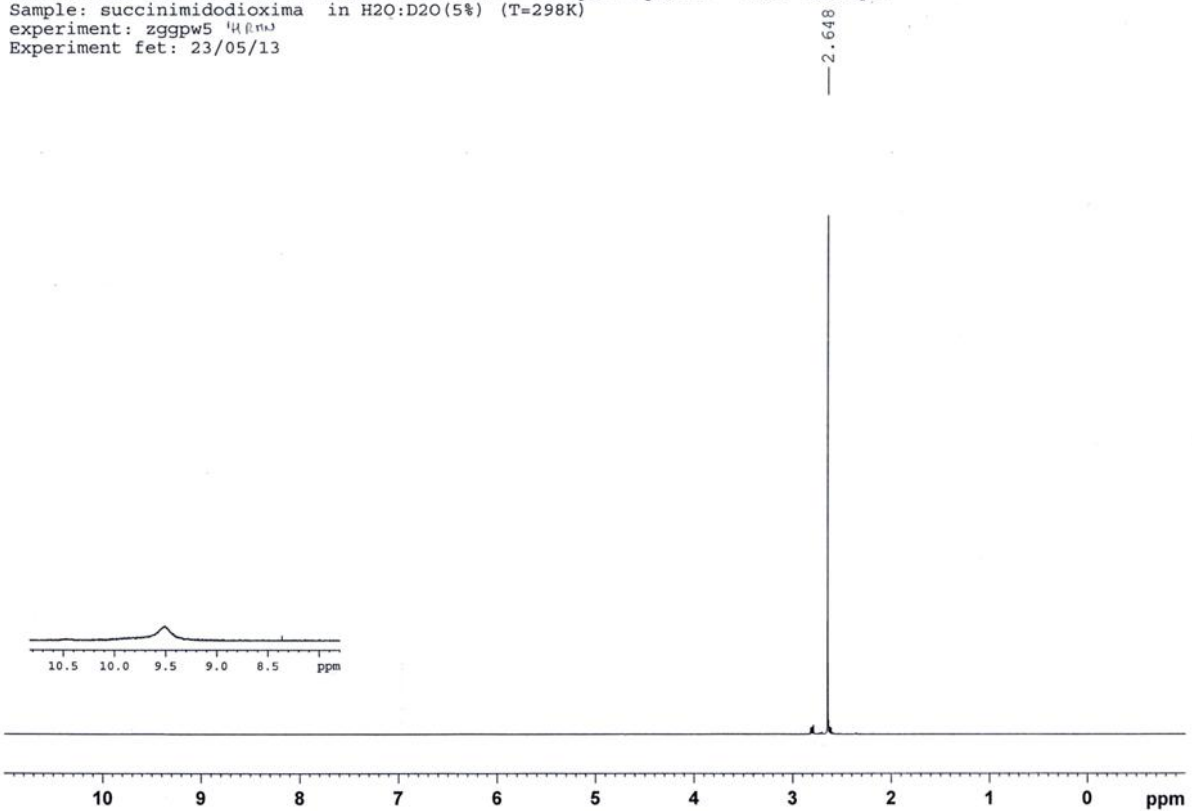
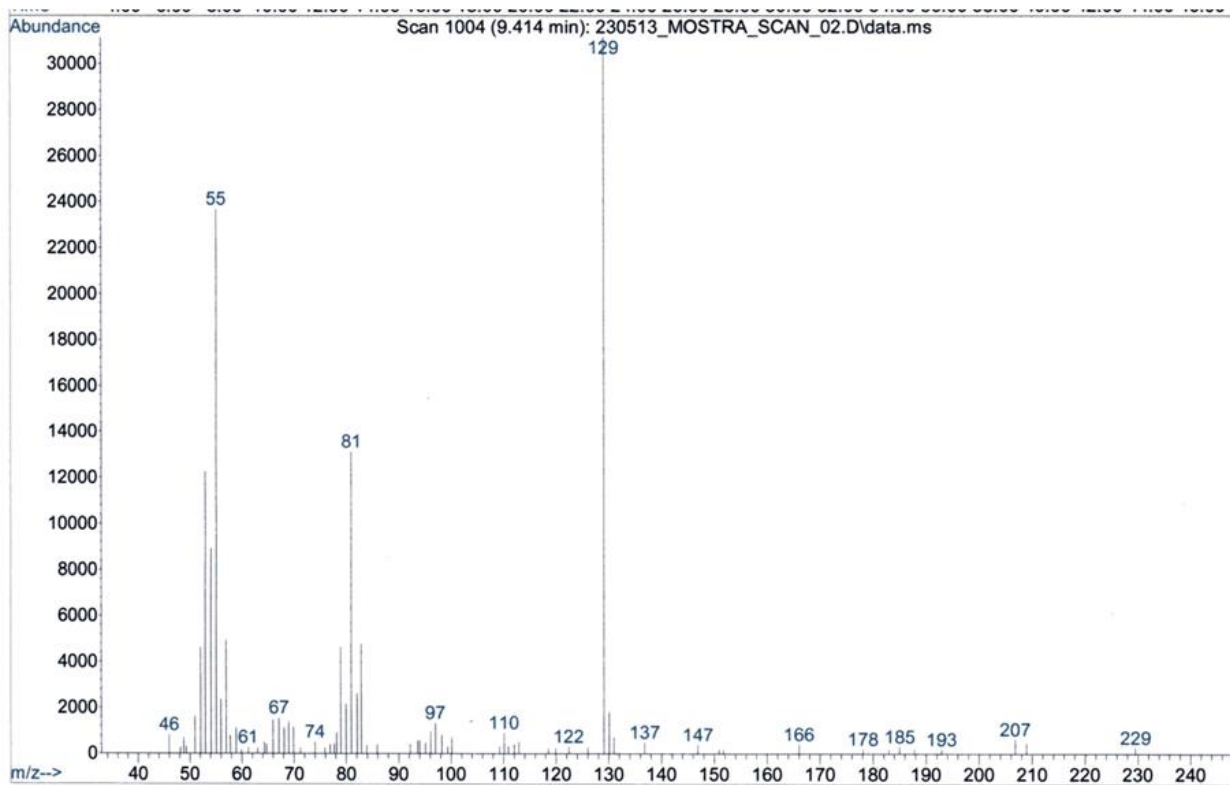


Fig. A-2. <sup>1</sup>H-NMR spectrum of succinimidodioxime (SIDO).



**Fig. A-3.** GC-MS spectrum of succinimidedioxime (SIDO).

**Table A-1.** Results of multivariate analysis. Screening ( $2^3$ ) full factorial design observe std/blank ratio

Factor and interaction	Fixed time method			Factor and interaction	Initial rate method		
	Exp Domain	Pareto's coefficient	p-value		Exp Domain	Pareto's coefficient	p-value
Temp ( $^{\circ}\text{C}$ )	27-35	15.28	0.0043	Temp ( $^{\circ}\text{C}$ )	27-35	82.52	0.0001
SIDO ( $\text{m mol L}^{-1}$ )	2.8-4.8	-0.75	0.5337	SIDO ( $\text{mM}$ )	2.8-4.8	-0.49	0.6719
NaOH ( $\text{mol L}^{-1}$ )	0.2-0.6	-3.91	0.0595	NaOH ( $\text{M}$ )	0.2-0.6	50.06	0.0004
Temp vs NaOH		-11.71	0.0072	Temp vs NaOH		34.13	0.0009
Temp vs SIDO vs NaOH		-7.13	0.0191	Temp vs SIDO vs NaOH		16.11	0.0038
SIDO vs NaOH		4.25	0.0511	SIDO vs NaOH		-13.38	0.0055
Temp vs SIDO		1.38	0.3015	Temp vs SIDO		13.08	0.0058

*Fixed time method:* The std/blank results fitted well with 3-way interaction, without a significant lack of fit ( $r^2 = 0.99574$ , adj. 0.9787), and a pure error of 0.000122.

*Initial rate method:* The std/blank results fitted well with 3-way interaction, without a significant lack of fit ( $r^2 = 0.99983$ , adj. 0.99915), and a pure error of 0.0000345.

**Table A-2.** Results of multivariate analysis. Screening ( $2^3$ ) full factorial design observe slope [(slope of std  $5 \mu\text{g L}^{-1} \text{Mn(II)}$  – slope of blank)/5].

Factor and interaction	Fixed time method			Factor and interaction	Initial rate method		
	Exp Domain	Pareto's coefficient	p-value		Exp Domain	Pareto's coefficient	p-value
Temp ( $^{\circ}\text{C}$ )	27-35	33.84	0.0009	Temp ( $^{\circ}\text{C}$ )	27-35	77.91	0.0002
SIDO ( $\text{m mol L}^{-1}$ )	2.8-4.8	16.79	0.0035	SIDO ( $\text{mM}$ )	2.8-4.8	10.23	0.0094
NaOH ( $\text{mol L}^{-1}$ )	0.2-0.6	58.04	0.0003	NaOH ( $\text{M}$ )	0.2-0.6	72.92	0.0002
Temp vs NaOH		4.86	0.0397	Temp vs NaOH		46.43	0.0005
Temp vs SIDO vs NaOH		-3.74	0.0647	Temp vs SIDO vs NaOH		22.71	0.0019
SIDO vs NaOH		8.72	0.0128	SIDO vs NaOH		-2.48	0.1307
Temp vs SIDO		3.81	0.0624	Temp vs SIDO		20.01	0.0025

*Fixed time method:* The slope results fitted well with 3-way interaction, without a significant lack of fit ( $r^2 = 0.99959$ , adj. 0.99797), and a very low pure error.

*Initial rate method:* The slope results fitted well with 3-way interaction, without a significant lack of fit ( $r^2 = 0.99987$ , adj. 0.99933), and a very low pure error.

**Table A-3.** Results of multivariate analysis. Screening ( $3^2$ ) full factorial design observe std/blank ratio

Factor and interaction	Fixed time method			Factor and interaction	Initial rate method		
	Exp Domain	Pareto's coefficient	p-value		Exp Domain	Pareto's coefficient	p-value
SIDO (L+Q) (mmol L <sup>-1</sup> )	4.1 – 5.5	(L) -18.55	0.0001	SIDO (L+Q) (mM)	4.1 – 5.5	(L) 30.98	0.000045
NaOH (L+Q) (mol L <sup>-1</sup> )	0.4 – 0.8	(Q) -38.89 (L) -31.63	0.0002	NaOH (L+Q) (M)	0.4 – 0.8	(Q) -37.45 (L) -117.68	0.000001
SIDO (Q) vs NaOH (Q)		(Q) 36.95 40.60		SIDO (Q) vs NaOH (Q)		(Q) 160.16 70.56	
SIDO (Q) vs NaOH (L)		-24.97		SIDO (Q) vs NaOH (L)		-70.05	
SIDO (L) vs NaOH (L)		4.63		SIDO (L) vs NaOH (L)		-23.93	
				SIDO (L) vs NaOH (Q)		-20.19	

*Fixed time method:* The std/blank results fitted well with 2-way interaction, without a significant lack of fit ( $r^2 = 0.99949$ , adj. 0.99814), and a pure error of 0.0000052.

*Initial rate method:* The std/blank results fitted well with 2-way interaction (linear, quadr), without a significant lack of fit ( $r^2 = 0.99995$ , adj. 0.99983), and a pure error of 0.000004.

**Table A-4.** Results of multivariate analysis. Screening ( $3^2$ ) full factorial design observe slope [(slope of std 5  $\mu\text{g L}^{-1}$  Mn(II) – slope of blank)/5].

Factor and interaction	Fixed time method			Factor and interaction	Initial rate method		
	Exp Domain	Pareto's coefficient	p-value		Exp Domain	Pareto's coefficient	p-value
SIDO (L+Q) (mmol L <sup>-1</sup> )	4.1 – 5.5	(L) -	0.0094	SIDO (L+Q) (mM)	4.1 – 5.5	(L) 49.95	0.000038
NaOH (L+Q) (mol L <sup>-1</sup> )	0.4 – 0.8	(Q) -7.60 (L) 7.79	0.0001	NaOH (L+Q) (M)	0.4 – 0.8	(Q) -13.12 (L) -15.65	0.000007
SIDO (Q) vs NaOH (Q)		(Q) 12.53 11.05		SIDO (Q) vs NaOH (Q)		(Q) 59.91 13.65	
SIDO (Q) vs NaOH (L)		-7.42		SIDO (Q) vs NaOH (L)		-7.56	
				SIDO (L) vs NaOH (L)		-21.63	
				SIDO (L) vs NaOH (Q)		12.49	

*Fixed time method:* The slope results fitted well with 2-way interaction (linear, quadr), without a significant lack of fit ( $r^2 = 0.99825$ , adj. 0.99358), and a very low pure error.

*Initial rate method:* The slope results fitted well with 2-way interaction (linear, quadr), without a significant lack of fit ( $r^2 = 0.99977$ , adj. 0.99917), and a very low pure error.