

## Supporting Information

### ***Quantitative assessment on intra/extracellular Dimethyl sulfoxide concentration during freezing with low-temperature confocal Raman micro-spectroscopy***

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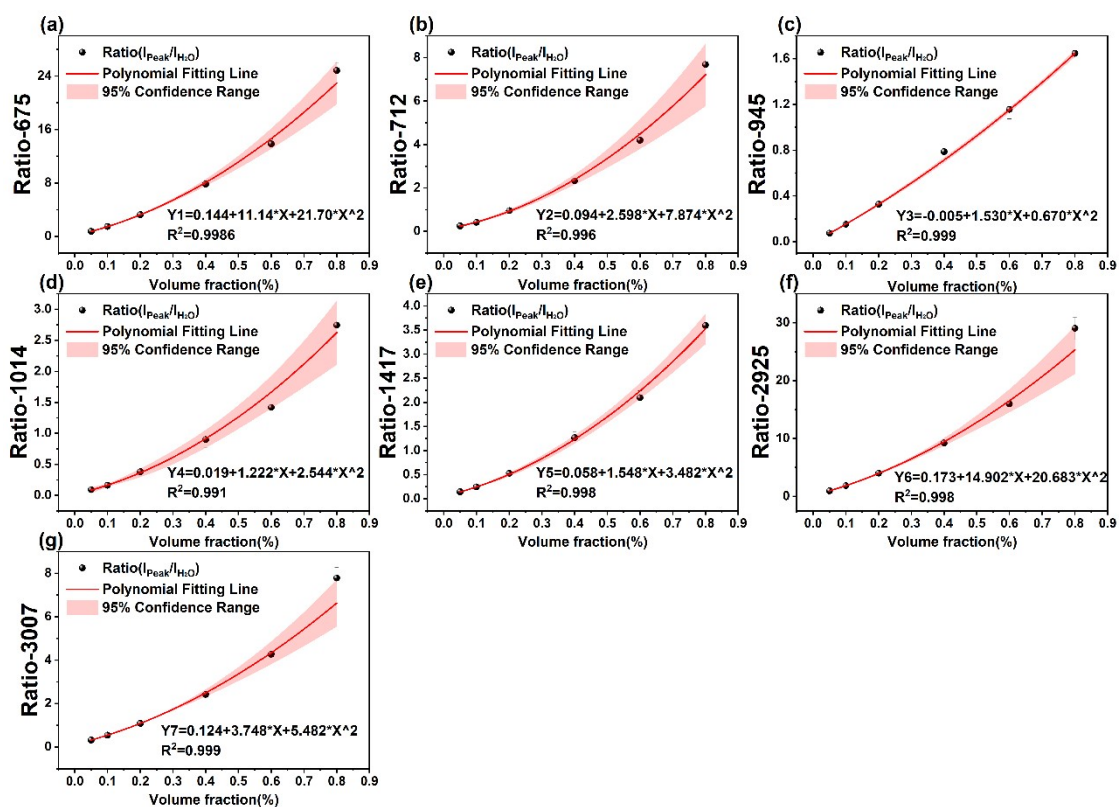


Fig.S1 Relationship between DMSO concentration and labeled peak intensity (a)~(f) correspond to each labeled peak respectively.

**Tabel.S1** Verification of the accuracy of quantitative analysis equations

Peak/cm-1	~675	~712	~947	~1014	~1417	~2925	~3007	
Relationship	$Y1=0.144+11.14*X$ $Y2=0.094+2.598*Y3=-0.005+1.530*X$ $Y4=0.019+1.222*Y5=0.058+1.548$ $Y6=0.173+14.902*Y7=0.124+3.748*$							
	$X+21.70*X^2$	$*X+7.874*X^2$	$+ 0.670*X^2$	$X+2.544*X^2$	$*X+3.482*X^2$	$X+20.683*X^2$	$X+5.482*X^2$	
<b>15 %</b>	<b>Ratio of intensity</b>	2.4582	0.8709	0.4061	0.4148	0.4813	2.9493	0.8470
	<b>Concentration</b>	15.89 %	18.99 %	24.29 %	22.23 %	19.13 %	15.35 %	15.68 %
	<b>Deviation</b>	0.89 %	3.99 %	9.29 %	7.23 %	4.13 %	0.35 %	0.68 %
	<b>SD</b>	5.94 %	26.58 %	61.92 %	48.23 %	27.50 %	2.30 %	4.56 %
	<b>RMSE</b>	<b>4.97 %</b>			<b>Rate of recovery</b>	<b>125.29 %</b>		
<b>25 %</b>	<b>Ratio of intensity</b>	5.1267	1.5089	0.5351	0.5514	0.8433	5.9867	1.5211
	<b>Concentration</b>	28.71 %	28.99 %	31.07 %	27.72 %	30.21 %	28.04 %	26.78 %
	<b>Deviation</b>	3.71 %	3.99 %	6.07 %	2.72 %	5.21 %	3.04 %	1.78 %
	<b>SD</b>	14.84 %	15.97 %	24.28 %	10.88 %	20.84 %	12.16 %	7.11 %
	<b>RMSE</b>	<b>4.03 %</b>			<b>Rate of recovery</b>	<b>115.16 %</b>		
<b>35 %</b>	<b>Ratio of intensity</b>	6.9814	2.1297	0.6496	0.7617	1.1292	8.6183	2.2195
	<b>Concentration</b>	36.07 %	36.96 %	36.84 %	35.19 %	37.53 %	37.28 %	36.46 %
	<b>Deviation</b>	1.07 %	1.96 %	1.84 %	0.19 %	2.53 %	2.28 %	1.46 %
	<b>SD</b>	3.06 %	5.60 %	5.27 %	0.53 %	7.23 %	6.51 %	4.16 %
	<b>RMSE</b>	<b>1.78 %</b>			<b>Rate of recovery</b>	<b>104.62 %</b>		
<b>50 %</b>	<b>Ratio of intensity</b>	10.1420	3.0884	0.9361	1.0684	1.5852	11.7605	3.1243
	<b>Concentration</b>	50.86 %	49.52 %	50.55 %	48.72 %	48.57 %	49.90 %	49.88 %
	<b>Deviation</b>	0.86 %	-0.48 %	0.55 %	-1.28 %	-1.43 %	-0.10 %	-0.12 %
	<b>SD</b>	1.73 %	-0.96 %	1.09 %	-2.55 %	-2.86 %	-0.20 %	-0.25 %
	<b>RMSE</b>	<b>0.84 %</b>			<b>Rate of recovery</b>	<b>99.43 %</b>		

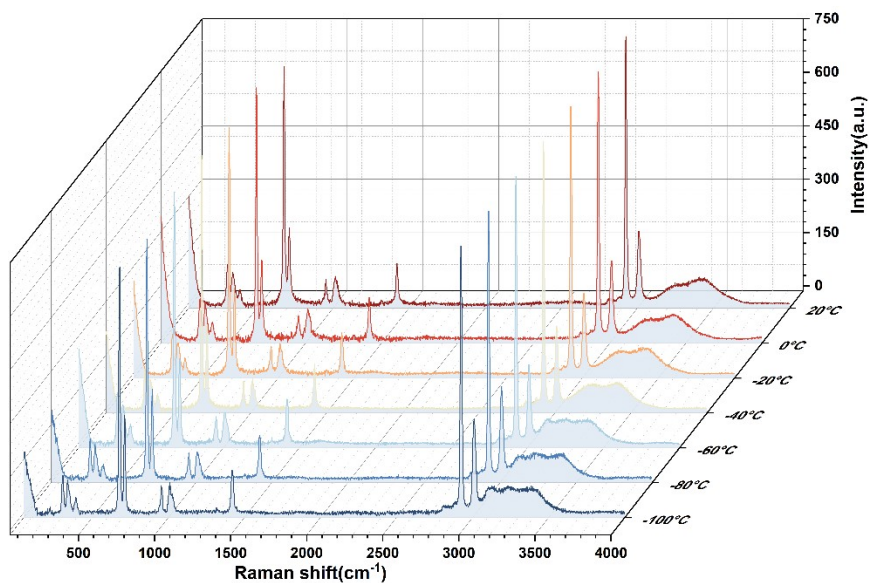


Fig.S2 Original spectra of 45% concentration solution at different temperatures

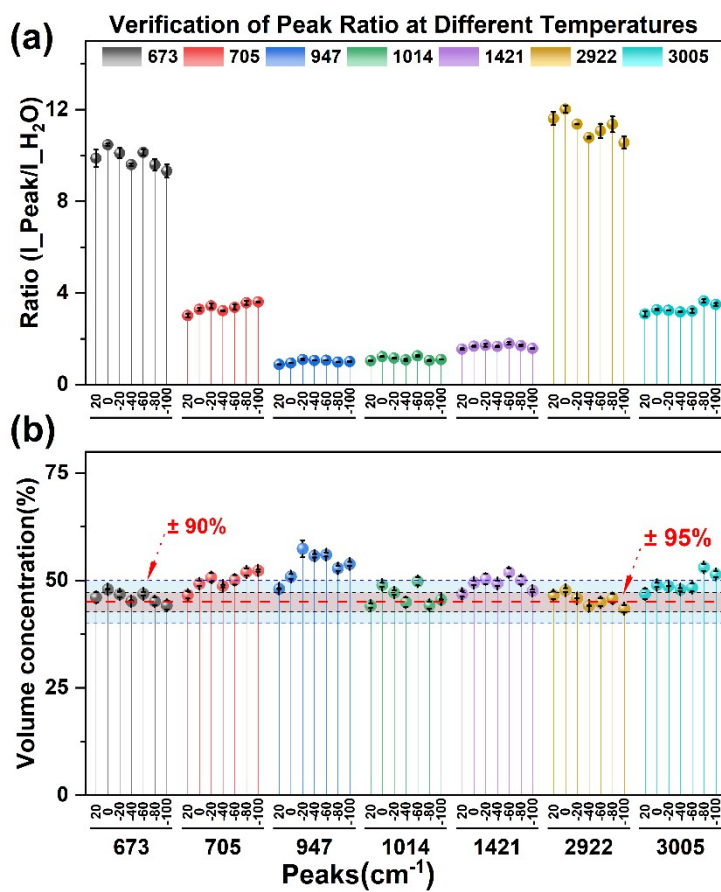


Fig.S3 Verification of invariance of peak ratios (a) and quantification concentration (b) at different temperatures.