

(Supporting information)

Development of a new paper-based voltage step electrocoagulation technique and application for wine classification

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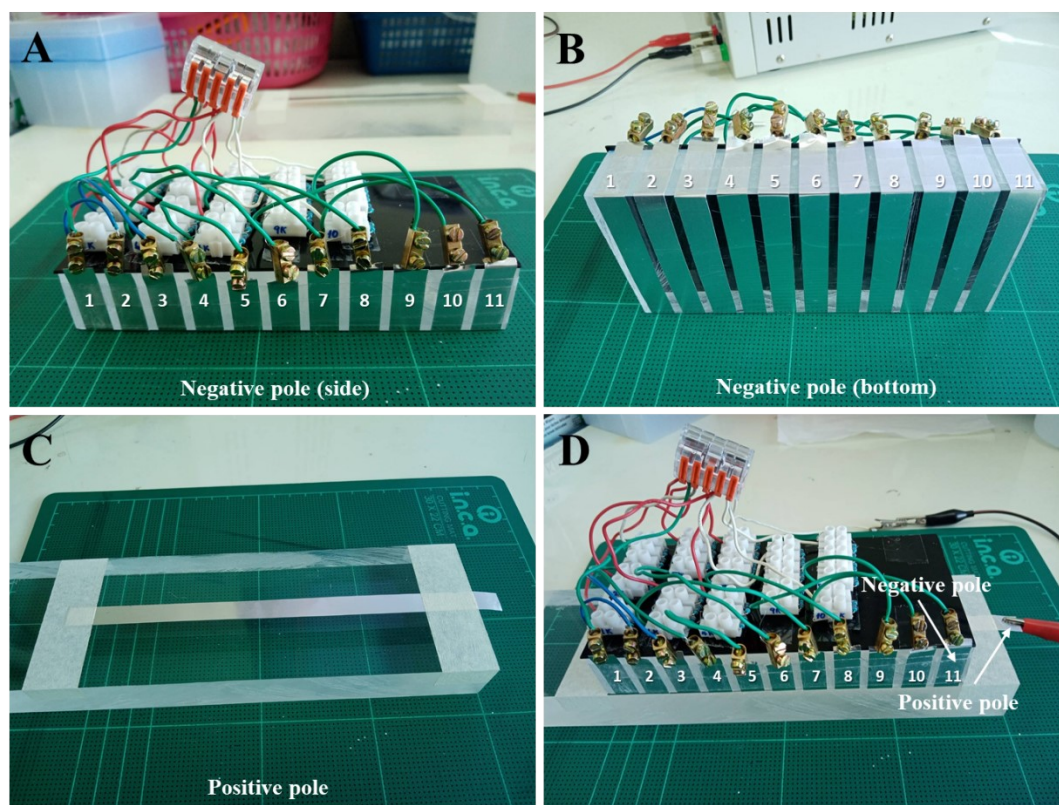


Fig. S1 pictures of proposed device including (A) negative pole (side), (B) negative pole (bottom), (C) positive pole, and (D) usage picture of proposed device.

Table S1 The information of 15 wine samples obtained from the local department stores in Thailand

VSEC group	Name code		Origin	% Alcohol (v/v)	Production year	Raw materials	Types
	Wine sample	Brand					
(i)	<i>4</i>	C3	McLaren Vale, Australia	14.9	2015	Shiraz grape	Red wine
	<i>7</i>	S1	Pattaya, Thailand	14.5	2014	Shiraz grape	Red wine
	<i>5</i>	G1	Khao Yai, Thailand	13	2014	Syrah grape	Red wine
(ii)	<i>2</i>	S1	Pattaya, Thailand	13	2012	Shiraz grape	Red wine
(iii)	<i>3</i>	C1	Loei, Thailand	12.5	2014	Shiraz grape	Red wine
	<i>1</i>	P1	Khao Yai, Thailand	14.5	2012	Shiraz grape	Red wine
	<i>9</i>	F1	Languedoc-Roussillon, France	13	2016	Syrah grape	Red wine
	<i>12</i>	C2	Sydney, Australia	10	2020	Shiraz/Syrah grape	Red wine
(iv)	<i>6</i>	K1	Thailand	12	2013	Black opal grape	Red wine
	<i>13</i>	G1	Khao Yai, Thailand	14	2011	Syrah grape	Red wine
(v)	<i>10</i>	C1	Loei, Thailand	12.5	2013	Shiraz grape	Red wine
	<i>11</i>	S1	Pattaya, Thailand	12.5	2015	Chenin Blanc grape	White wine
	<i>14</i>	K1	Thailand	12	2014	Mangosteen	Fruit wine
	<i>15</i>	K1	Thailand	12	2015	Lychee	Fruit wine
(vi)	<i>8</i>	M1	Thailand	12	2017	Mangosteen	Fruit wine

Table S2 The potential differences of each plate of the CAS. These results were calculated from the linear regression line as shown in **Fig. S2**

Plate No.	Voltages
1	0.915
2	0.929
3	0.901
4	0.902
5	0.894
6	0.874
7	0.843
8	0.852
9	0.818
10	0.816
11	0.800

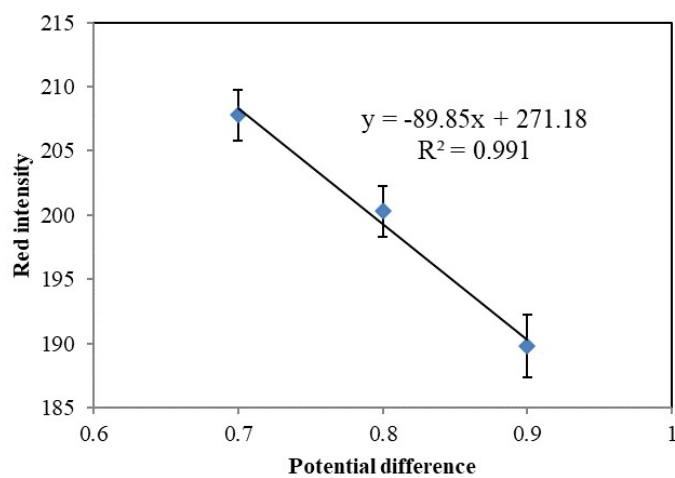


Fig. S2 the linear regression line obtained from the single plate electrode

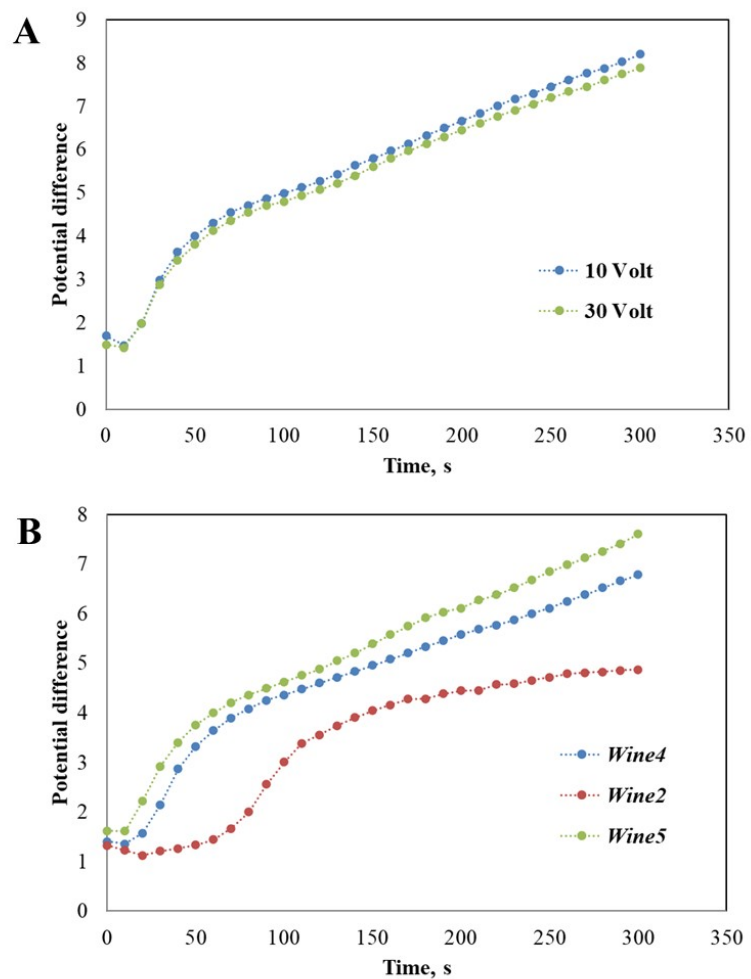


Fig. S3 (A) the VSEC voltage profiles as function of times of the proposed electrode applying the maximum voltages of 10 and 30 V to maintain constant current of 0.005 A, and (B) the corresponding profiles at constant 0.005 A (10 V of maximum current) of three wine samples.

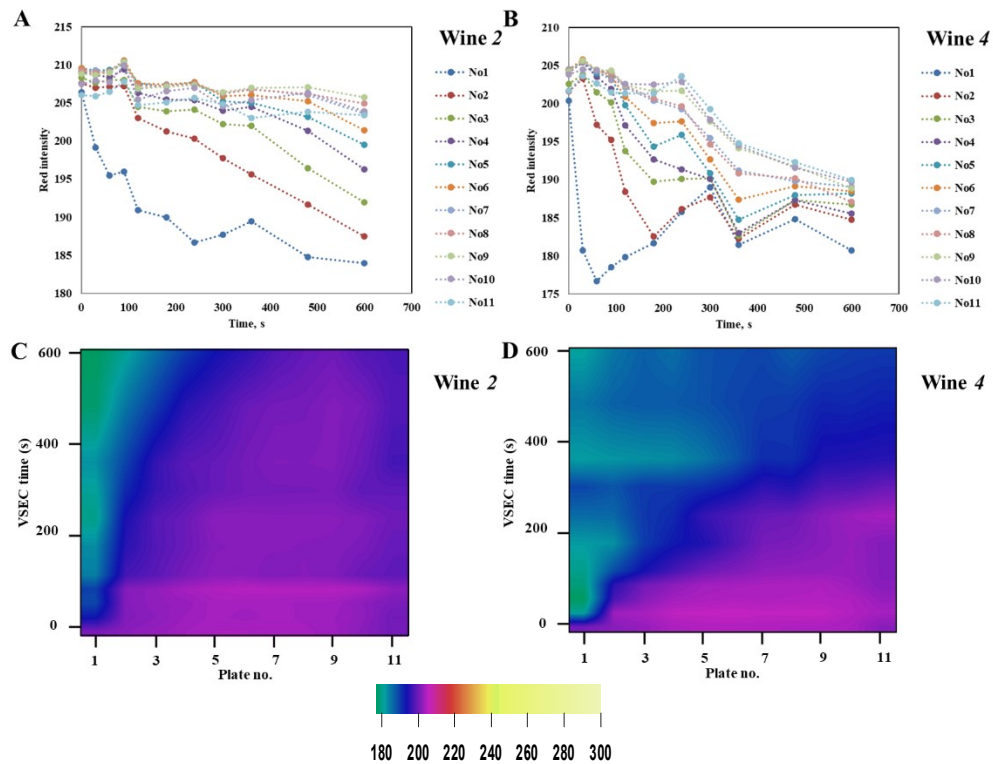


Fig. S4 effect of VSEC times on the red color intensity of filter paper on each plate of CAS (no.1-11, experiencing higher to lower voltages, respectively) after applying constant current of 0.005 A (with 10 V maximum voltage) to treat wines (A) 2 and (B) 4. The corresponding contour plots were shown in (C) and (D), respectively, with the color scale provided below.

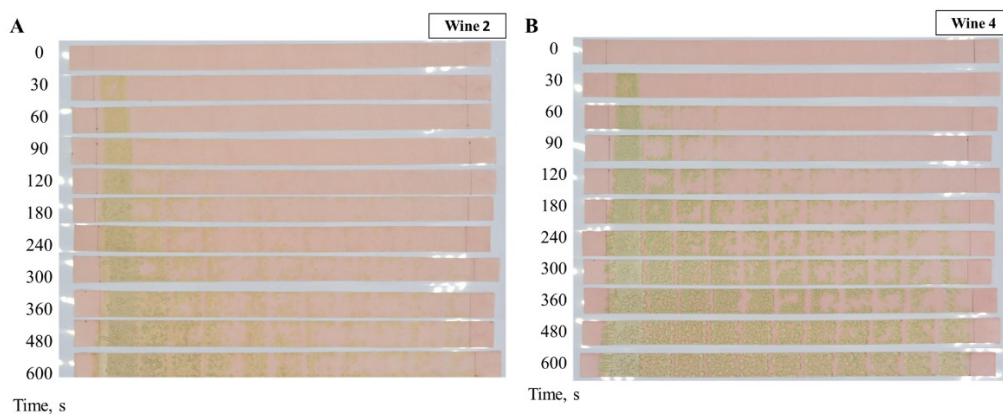


Fig. S5 the pictures of wine-soaked filter paper after VSEC applying constant current of 0.005 A (10 V of maximum voltage) with different times for (A) wine 2 and (B) wine 4.

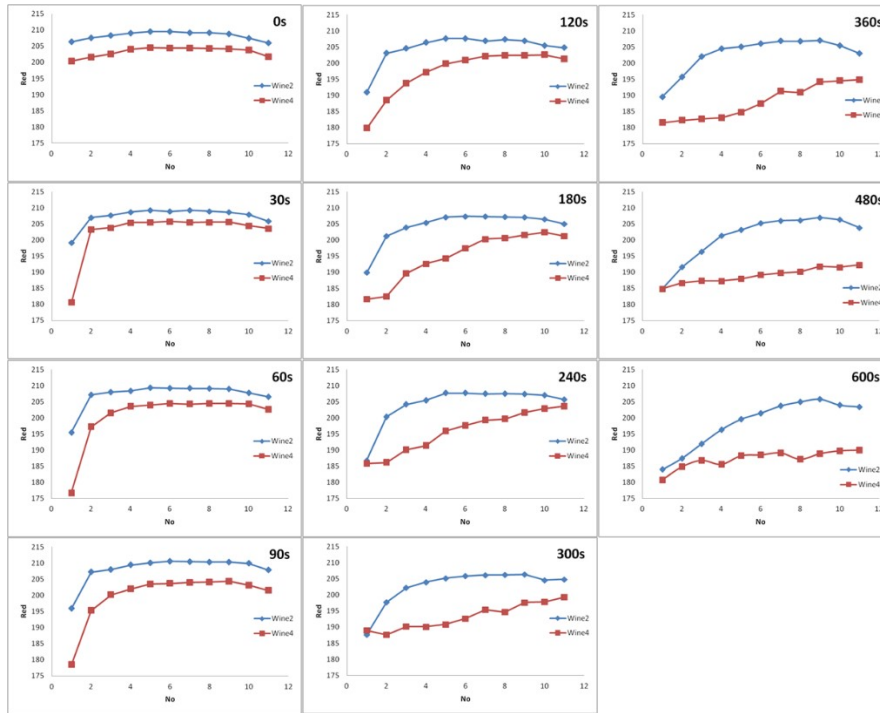


Fig. S6 the overlaid plots of plot profiles from wine 2 and 4 samples at different VSEC time.

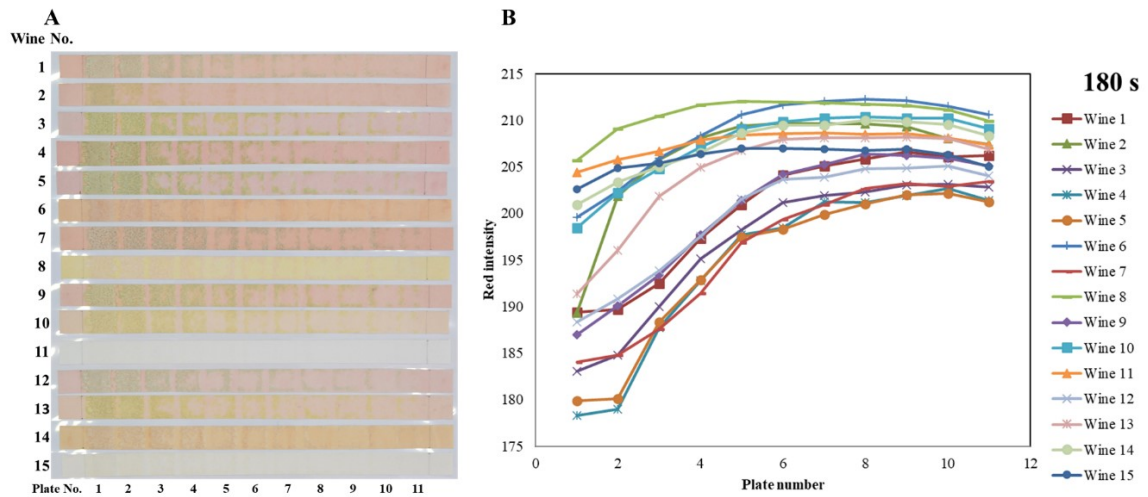


Fig. S7 the pictures (A) and plot profiles (B) of soaked filter papers of 15 wines sample after VSEC applying constant current of 0.005 A (10 V of maximum voltage) for 3 min.

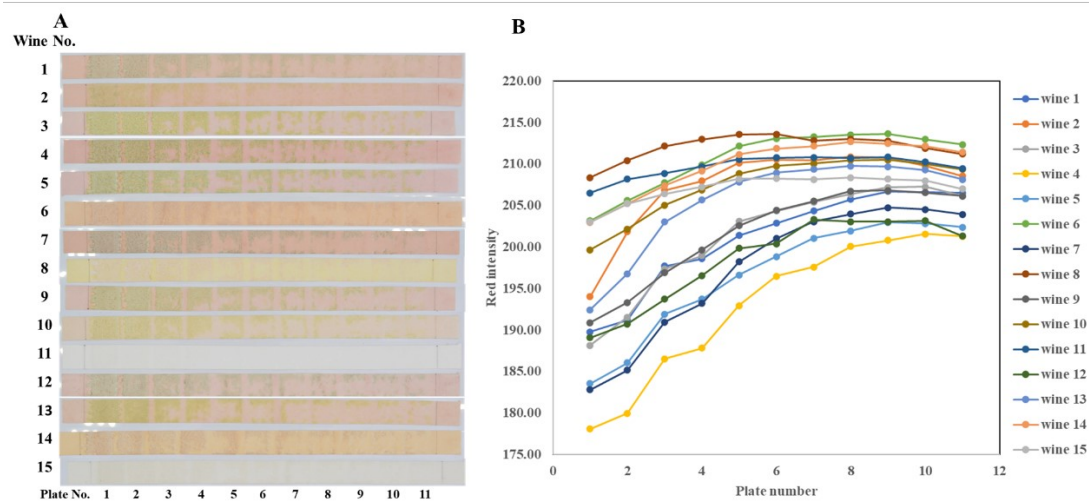


Fig. S8 the pictures (A) and plot profiles (B) of soaked filter papers of 15 wines sample after VSEC applying constant voltage of 10 V (0.020 A of maximum current) for 2 min.

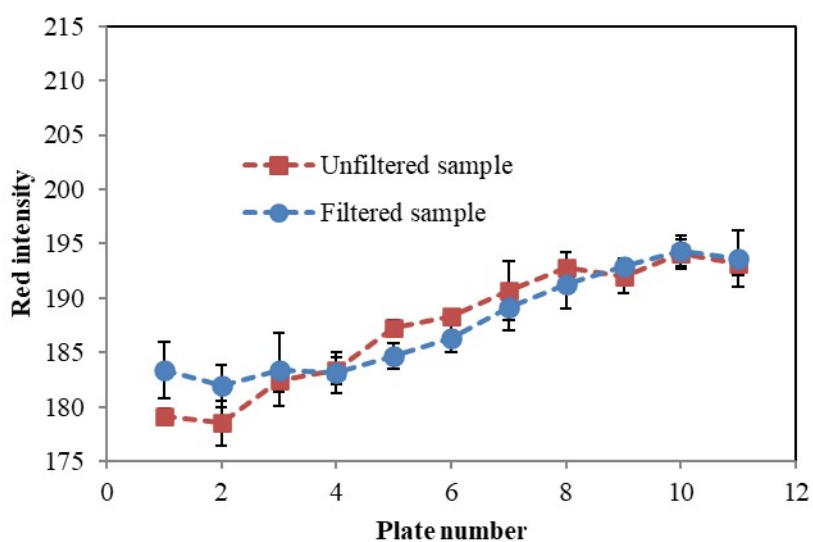


Fig. S9. the plot profiles from filtered and unfiltered wine samples. The wine-soaked filter papers were treated with VSEC applying constant current of 0.005 A (10 V of maximum voltage) for 5 min.

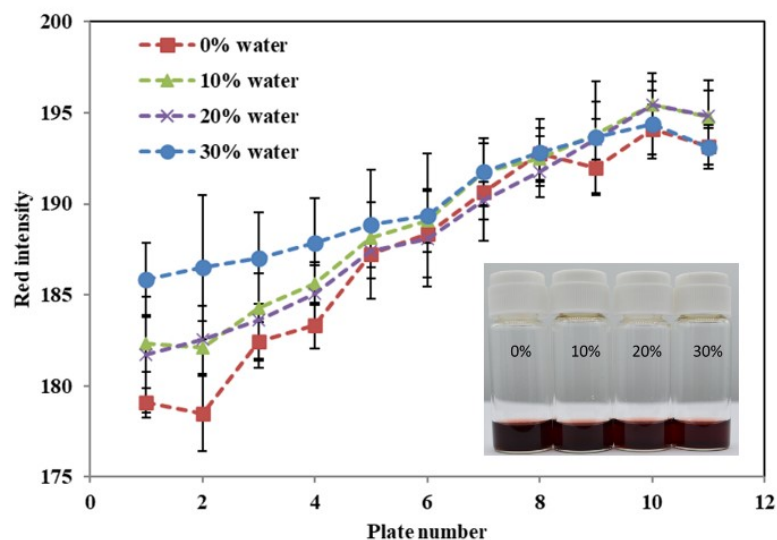


Fig. S10 the VSEC results (plate no. vs intensity profiles) of the wine samples without and with different dilutions. The wine-soaked filter papers were treated at constant 0.005 A (10 V of maximum voltage) for 5 min. The error bars were obtained with $n = 3$.

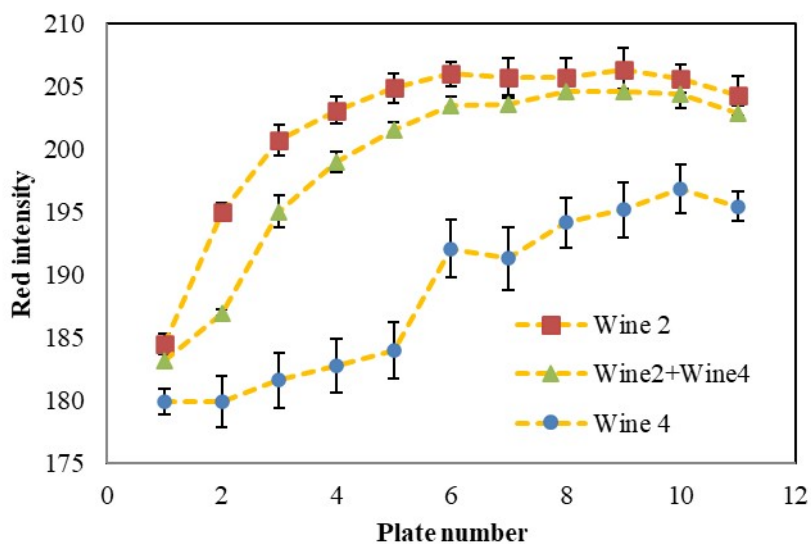


Fig. S11 the VSEC results (plate no. vs intensity profiles) of wine 2, wine 4 and the mixed wine (1:1 v:v, wine 2 + wine 4). The wine-soaked filter papers were treated at constant 0.005 A (10 V of maximum voltage) for 5 min. The error bars were obtained with $n = 3$.

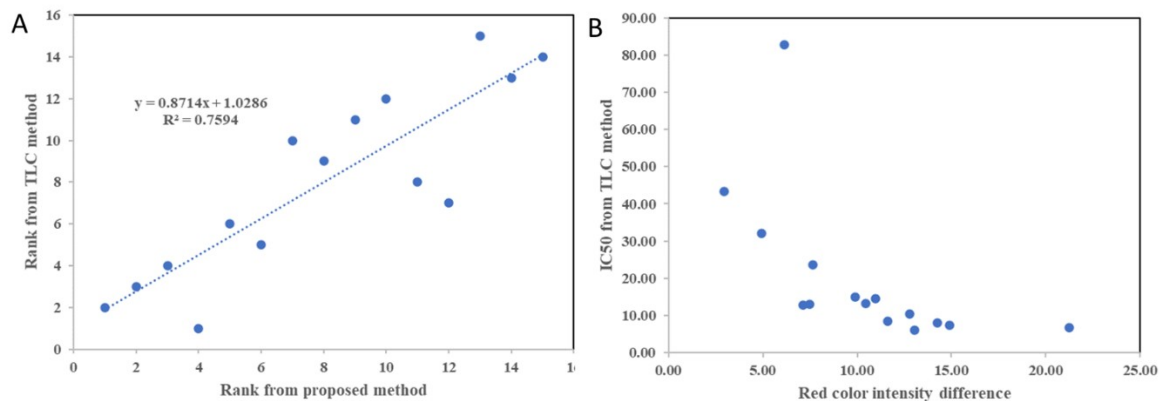


Fig. S12 (A) the correlation plot between the ranking of VSEC red color intensity differences and the IC₅₀ ranking from the TLC based antioxidant test method and (B) the corresponding plot of IC₅₀ against the red color intensity differences.

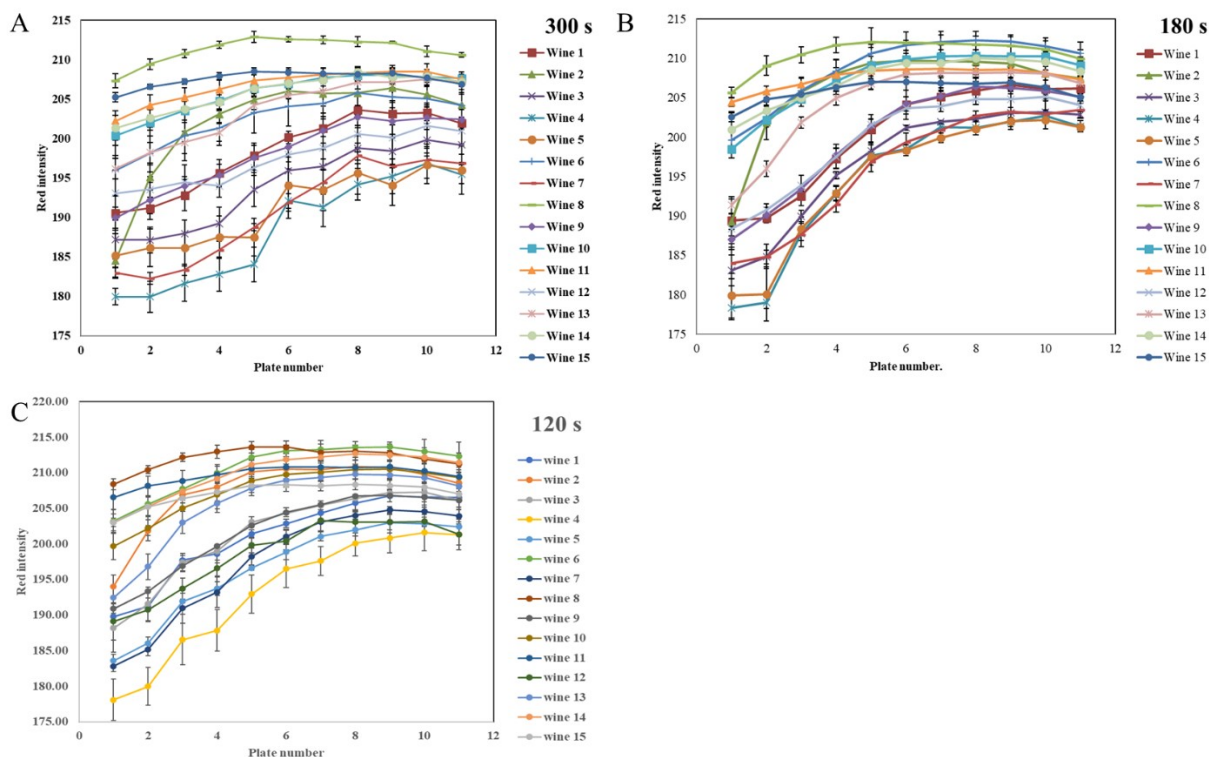


Fig. S13 the plot profiles in different VSEC conditions with error bar (n=3) corresponding to Fig. 5B, Fig. S7B, and Fig. S8B were shown in (A), (B), and (B) respectively.