

Electronic Supplementary Information (ESI)

Kinetic spectrophotometric assay for the determination of vitamin C in cosmetics following ultrasound-assisted emulsification

Isela Lavilla*, Vanesa Romero*, Paula Costas, Carlos Bendicho

Centro de Investigación Mariña, Universidade de Vigo, Departamento de Química Analítica y Alimentaria, QA2 group, 36310 Vigo, Spain

isela@uvigo.es ; vromero@uvigo.es

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Table S1. Declared ingredients of the analyzed cosmetic samples.

SAMPLE	INGREDIENTS
<p>Armonia® natural cosmetics facial serum</p>	<p>water, denatured alcohol, propylenglycol, glycerin, lactic acid, glycolic acid, filtered snail slime, aloe barbadensis leaf extract, glicirrizia glabra root extract (licorice), calendula officinalis flower extract, hydrolyzed collagen, allantoin, retinyl palmitate, ascorbyl palmitate, tocopheryl acetate, panthenol, citric acid, malic acid, tartaric acid, inositol, biotine, riboflavin, niacinamide, chondroitin sodium sulphate, disodium EDTA, sodium hydroxide, PEG-40 hydrogenated castor oil, ceratonia siliqua gum (carob gum), tropolone, sodium benzoate, potassium sorbate, imidazolidinyl urea, caprylylglycol, hydroxyethylcellulose, cellulose, sodium acetate, isopropyl alcohol, 1,2-hexanediol, parfum (fragrance).</p>
<p>Babaria® moisturizing oil free facial cream</p>	<p>water, steareth-21, steareth-2, aloe barbadensis leaf extract, alcohol denat., cetyl alcohol, stearyl alcohol, butylene glycol, PEG-60 almond glycerides, caprylyl glycol, glycerin, carbomer, nordihydroguaiaretic acid, oleanolic acid, urea, parfum, triclosan, sodium hydroxide, acrylates/C10-30 alkyl acrylates crosspolymer, phenoxyethanol, methylparaben, ethylparaben, propylparaben, buthylparaben, CI 42090 (FD & C blue 1) benzyl salicylate, citral, citronellol, geraniol, hexyl cinnamal, limonene, linalool, alpha-isomethyl ionone.</p>
<p>Clarins® Hydraquench facial cream</p>	<p>water, caprylic/capric triglyceride, glycerin, silica, cetearyl alcohol, pentylene glycol, dipentaerythrityl tetrahydroxystearate/tetraisoostearate, glyceril stearate, PEG-100 stearate, trehalose, cetearyl glucoside, stearyl alcohol, dimethicone, parfum/fragrance, polyacrylamide C13-14 isoparaffin, ethylhexylglycerin, tocopheryl acetate, disodium EDTA, sodium hyaluronate, sodium PCA, butylene glycol, dimethiconol, glyceryl acrylate/acrylic acid copolymer, tocopherol, phenoxyethanol, laureth-7 alcohol, biosaccharide gum-4, rubus chamaemorus seed oil, methylisothiazolinone, thermus thermophilus ferment, helianthus annuus (sunflower) seed oil, cedrelopsis grevei bark extract, lapsana communis flower/leaf/stem extract, pyrus sorbus bud extract, camellia sinensis leaf extract, potassium sorbate, rhodolia rosea root extract, sodium lauryl sulfate.</p>
<p>Elizabeth Arden® ceramide capsules daily youth restoring serum</p>	<p>water, butyrospermum parkii (shea) butter, butylene glycol, tridecyl stearate, isodecyl salicylate, PEG-30 dipolyhydroxystearate, tridecyl trimellitate, persea gratissima (avocado) oil, isocetyl stearyl stearate, propylene glycol, dipentaerythrityl hexacaprylate/hexacaprate, sorbitan sesquioleate, magnesium sulfate, phenoxyethanol, hydrogenated castor oil, sodium PCA, ozokerite, methylparaben, tocopheryl acetate, isopropyl palmitate, disodium EDTA, copper pca, butylparaben, ethylparaben, propylparaben, helianthus annuus (sunflower) seed oil, CI 75130/beta-carotene, tocopherol, citric acid.</p>

Table S1 (continued)

<p>Elizabeth Arden® advanced ceramide lift and firm night cream</p>	<p>water, dimethicone, butylene glycol, butyrospermum parkii (shea butter), glycerin, cetearyl alcohol, isostearyl alcohol, caprylic/capric triglyceride, theobroma cacao (cocoa) seed butter, ceteth-20 phosphate, butylene glycol cocoate, isodecyl salicylate, ceramide 1, ceramide 3, ceramide 6 ii, calluna vulgaris extract, chondrus crispus (carrageenan), dioscorea villosa (wild yam) root extract, glycine soja (soybean) sterols, hibiscus abelmoschus seed extract, trifolium pratense (clover) flower extract, sodium hyaluronate, linoleic acid, linolenic acid, ascorbyl palmitate, retinyl palmitate, tetrahexyldecyl ascorbate, tocopherol, tocopheryl acetate, erythritol, glycine soja (soybean) oil, caprylyl glycol, isohexadecane, macadamia ternifolia seed oil, PEG-40 hydrogenated castor oil, acetyl octapeptide-3, sodium PCA, trehalose, urea, homarine hcl, hydrogenated lecithin, hydrolyzed potato protein, hydrolyzed soy protein, hydrolyzed yeast protein, lauryl PEG-9 polydimethylsiloxylethyl dimethicone, lecithin, phospholipids, phytosphingosine, ammonium acryloyldimethyltaurate/behent-25 methacrylate crosspolymer, ammonium acryloyldimethyltaurate/VP copolymer, ceteth-20, cholesterol, oleic acid, oleyl alcohol, PEG-100 stearate, sodium lauroyl lactylate, dicetyl phosphate, hydroxyethyl acrylate/sodium acryloyldimethyl taurate copolymer, polysorbate 60, polysorbate 80, polyquaternium-51, ethylcellulose, beta-glucan, hexylene glycol, xanthan gum, sodium hydroxide, thioctic acid, ubiquinone, disodium EDTA, cyclohexasiloxane, cyclopentasiloxane, parfum/fragrance, benzyl salicylate, butylphenyl methylpropional, hexyl cinnamal, hydroxycitronellal, hydroxyisohexyl 3-cyclohexene carboxaldehyde, limonene, linalool, isopropylbenzyl salicylate, benzoic acid, methylparaben, phenoxyethanol, potassium sorbate, sodium benzoate, sorbic acid, triacetin, chlorphenesin</p>
<p>Estée Lauder® Future Perfect anti- wrinkle radiance eye cream</p>	<p>water, butyrospermum parkii (shea butter), polyethylene, hydrogenated polyisobutene, dicaprylyl carbonate, cetearyl alcohol, polybutene, sucrose, isostearyl neopentanoate, isopentyl diol, cetyl sters, rosmarinus officinalis, boswellai serrata extract, chamomilla recutita, polygonum cuspidatum, piscis, magnolia officinalis, coffea robusta seed extract, sigesbeckia orientalis extract, cucumis melo, avocado oil, sesquistearate de methyl glucose, cetearyl glucoside, laurdimonium hydroxypropyl hydrolyzed soy protein, glycerin, acetyl glucosamine saccharomyces lysate, caffeine, creatine, phytantriol, sodium hyaluronate, aminopropyl ascorbyl phosphate, Decarboxy carnosine HCL, ascorbyl tocopheryl maleate, ethyl bisiminomethyl guaiacol manganese chloride, astrocryum murumuru butter, linoleic acid, caprylic/capric triglyceride, acetyl hexapeptide-3, aminoguanidine bicarbonate, dimethicone, potassium sulfate, lecithin, propylene glycol dicaprylate, ácido nordihydroguaiaretic acid, glycosaminoglycans, NADH sodium salt, arginine ferulate, phytosphingosine, hydroxyethylcellulose, acrylates/C10-30 alkyl acrylates crosspolymer, sodium chondroitin sulfate, aminomethyl propanol, cholesterol, ethylhexyl stearate, ethylhexyl palmitate, propylenglycol dicaprate, xanthan gum, hexylene glycol, carbomer, caprylyl glycol , disodium EDTA, sodium dehydroacetate, phenoxyethanol, mica, titanium dioxide.</p>

Table S1 (continued)

<p>Farmacia gel facial moisturizing cream</p>	<p>water, alcohol, glycerin, propylenglycol, phenoxyethanol, PEG-40 hydrogenated castor oil, acrylates/C10-30 alkyl acrylates crosspolymer, hydrolyzed yeast extract, parfum (fragrance), trehalose, urea, caprylyl glycol, 1,2-hexanediol, xanthan gum, diethylhexyl syringilidenmalonate, sodium hydroxide, disodium EDTA, serine, pentylene glycol, PEG-30 dipolyhydroxystearate, trideceth-6, caprylic/capric triglyceride, glyceryl polyacrylate, algina, polyglucuronic acid, pullulan, sodium hyaluronate, pottasium sorbate, sodium benzoate, disodium fosfate, sodium fosfate, CI 42090 (blue 1)</p>
<p>L'oréal Paris® revitalift filler facial serum</p>	<p>water, glycerin, hydroxyethylpiperazine ethane sulfonic acid, sodium hyaluronate, dipeptide diaminobutyroyl benzylamide diacetate, disodium EDTA, secale cereale seed extract/rye seed extract, ascorbyl glucoside, PEG-60 hydrogenated castor oil, pentylene glycol, benzyl alcohol, benzyl benzoate, benzyl salicylate citronellol, linalool, chlorphenesin, phenoxyethanol, parfum/fragrance.</p>
<p>NeoStrata® glycolic renewal facial serum</p>	<p>water, hydrolyzed vegetable protein, glycolic acid, glycereth-7 trimethyl ether, sodium hydroxide, glycerin, lactobionic acid, arginine, xanthan gum, hibiscus sabdariffa flower extract, epigallocatechin gallate, sodium bisulfite, caprylyl glycol, phenoxyethanol, chlorphenesin, parfum (fragrance), benzyl benzoate, linalool, hexyl cinnamal, geraniol.</p>
<p>Noviderm Sérénactiv® moisturizing facial emulsion</p>	<p>water, hydrogenated polydecene, glycerin, dicaprylyl carbonate, lauryl glucoside, polyglyceryl-2 dipolyhydroxystearate, acrylates/C10-30 alkyl acrylates crosspolymer, sodium hydroxymethylglycinate, hydrolyzed lupine protein, xanthan gum, heptadecadienyl furan, undecyl dimethyl oxazoline, sodium hydroxide, citric acid, phenoxyethanol, sorbic acid</p>
<p>Yves Rocher ADN Végétal® moisturizing facial cream</p>	<p>water, butylene glycol, glycerin, denat. alcohol, urea, dimethicone, caprylic/capric triglyceride, cetearyl acid, cyclopentasyloxane, hydrogenated polyisobutene, cyclohexasyloxane, stearyl dimethicone, stearic acid, macadamia ternifolia seed oil, simmondsia chinensis (jojoba) sed oil, ceteareth-33, ethyl linoleate, parfum (fragrance), methylparaben, rosa moschata oil , triticum vulgare (wheat) germ oil extract, oleth-20, xanthan gum, tocopheryl acetate, retinyl palmitate, hydrolyzed wheat protein, allantoin, acrylates/C10-30 alkyl acrylates crosspolymer, dimethiconol, ethylparaben, propylparaben, butylparaben, tetrasodium EDTA, sodium hydroxide</p>
<p>Yves Rocher Sèrum Végétal® anti-ageing night cream</p>	<p>water, glycerin, methylpropanediol, glycine soja oil, ethylhexyl cocoate, dimethicone, steareth-2, myristyl myristate, glyceryl stearate, butylene glycol, behenyl alcohol, PEG-40 stearate, hydrogenated coconut oil, butyrospermum parkii butter, acacia senegal gum, centaurea cyanus flower water, phenoxyethanol, ammonium acryloyldimethyltaurate/VP copolymer, ethyl linoleate, parfum, lecithin, pyrus malus fruit extract, xanthan gum, sorbic acid, tocopheryl acetate, tetrasodium edta, retinyl palmitate, BHT, sodium hydroxide, methylsilanol mannuronate, mesembryanthemum crystallinum extract, sodium benzoate, potassium sorbate, citric acid, tocopherol, propyl gallate</p>

Table S1 (continued)

ISDIN flavo-C Forte® serum ascorbic acid 15%	water, ascorbic acid, propanediol, pentylene glycol, hexylene glycol, dimethicone, sodium citrate, dicaprylyl carbonate, 1,2-hexanediol, tocopherol, citric acid, caesalpinia spinosa fruit extract, parfum (fragrance), xanthan gum, kappaphycus alvarezii extract, disodium EDTA, hydrolyzed hyaluronic acid, sodium hyaluronate
La Roche-Posay Pure VitaminC10® serum ascorbic acid 10%	water, ascorbic acid, cyclohexasiloxane, glycerin, alcohol denat, potassium hydroxide, polymethylsilsesquioxane, polysilicone-11, dimethicone, propylene glycol, pentaerythrityl tetraethylhexanoate, c13-14 isoparaffin, tocopherol, sodium hyaluronate, hydrolyzed hyaluronic acid, adenosine, acetyl dipeptide-1 cetyl ester, PEG-20 methyl glucose sesquistearate, poloxamer 338, salicylic acid, polyacrylamide, toluene sulfonic acid, ammonium polyacryloyldimethyl taurate, xanthan gum, caprylyl glycol, disodium EDTA, BHT, laureth-7, parfum/fragrance
Nacomi Light it up® serum ascorbic acid 10%	water, ascorbic acid, glycerin, coco-caprylate/caprates, prunus amygdalus dulcis oil, sodium ascorbyl phosphate, triethanolamine, ascorbyl glucoside, rosa canina fruit oil, lauryl glucoside, polyglyceryl-2 dipolyhydroxystearate, xanthan gum, cellulose, hectorite, citric acid, dehydroacetic acid, benzyl alcohol

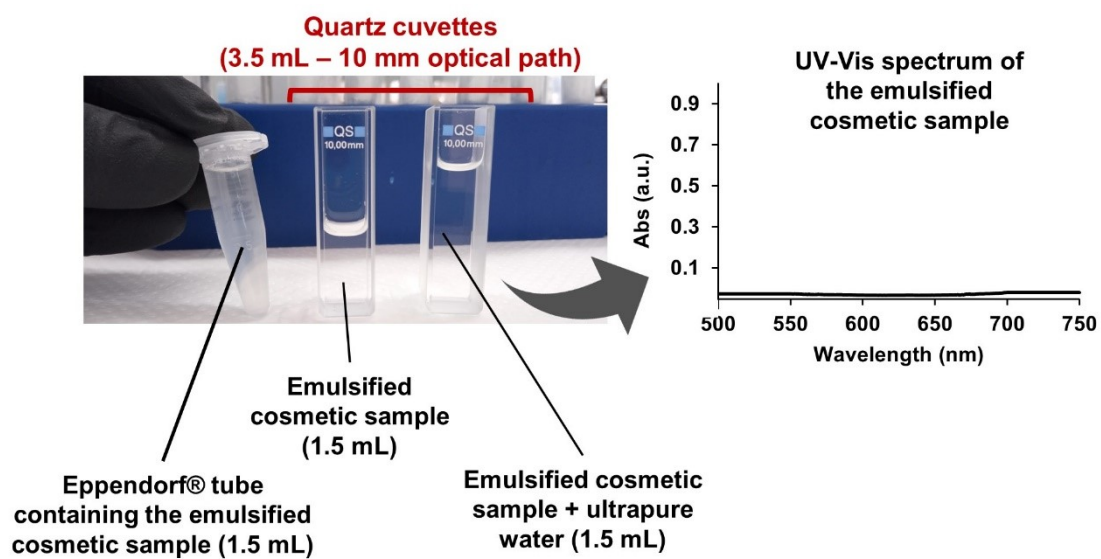


Figure S1. Image of the obtained emulsified cosmetic sample and UV-Vis spectrum of the emulsion

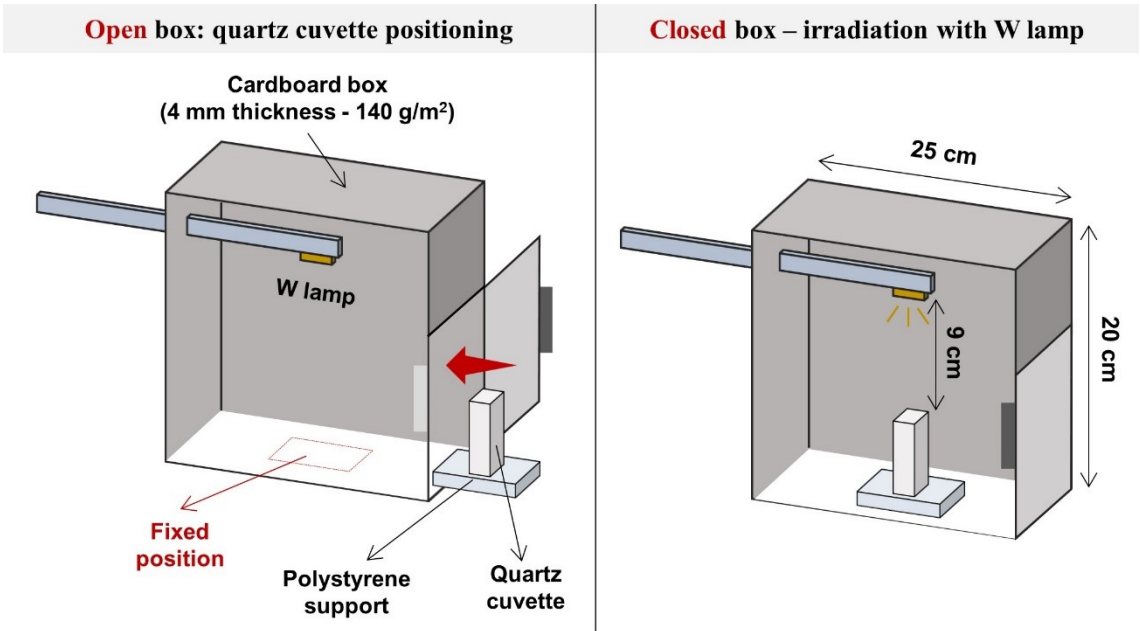


Figure S2. Scheme of the system used for irradiation under a tungsten lamp.

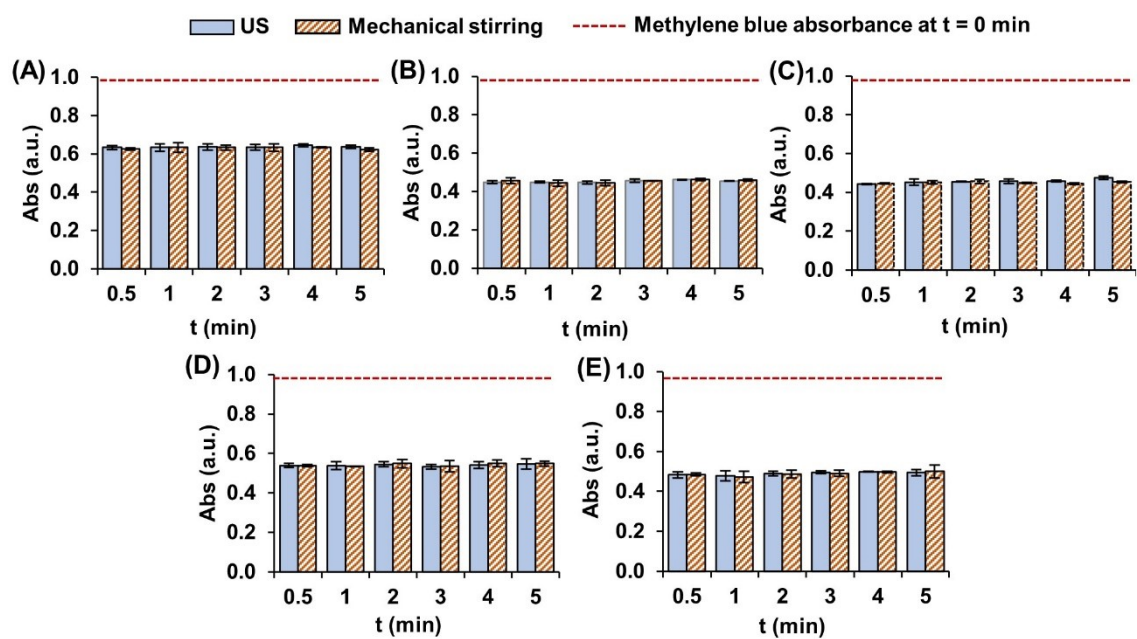


Figure S3. Influence of ultrasounds in AA stability (US amplitude 50 %, variable sonication time, $2 \mu\text{g mL}^{-1}$ in 1 % v/v acetic acid) with different surfactants or stabilizers: **(A)** SDS; **(B)** PVP; **(C)** PEG; **(D)** Triton X-100; **(E)** Tween 80 (surfactant/stabilizer concentration: 0.5 % m/v, MB concentration: 0,02 mM, reaction time: 5 min).

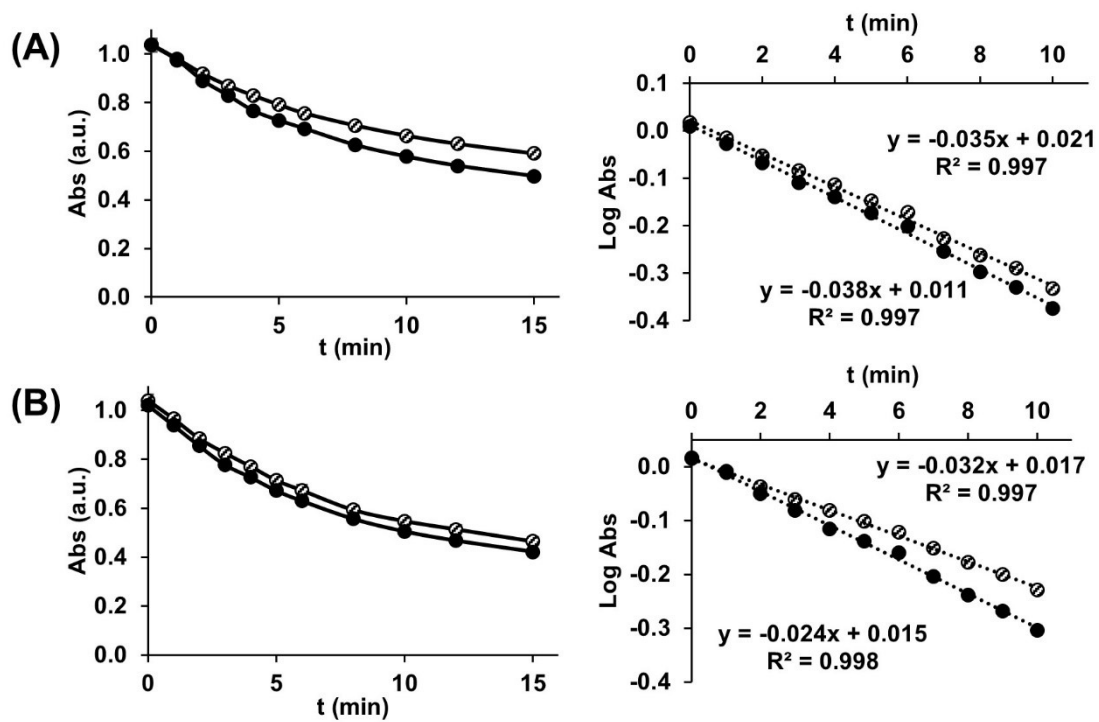


Figure S4. Kinetic curves and graphical representation of Log(Abs) vs t (min) with (A) hydrochloric acid (B) nitric acid.

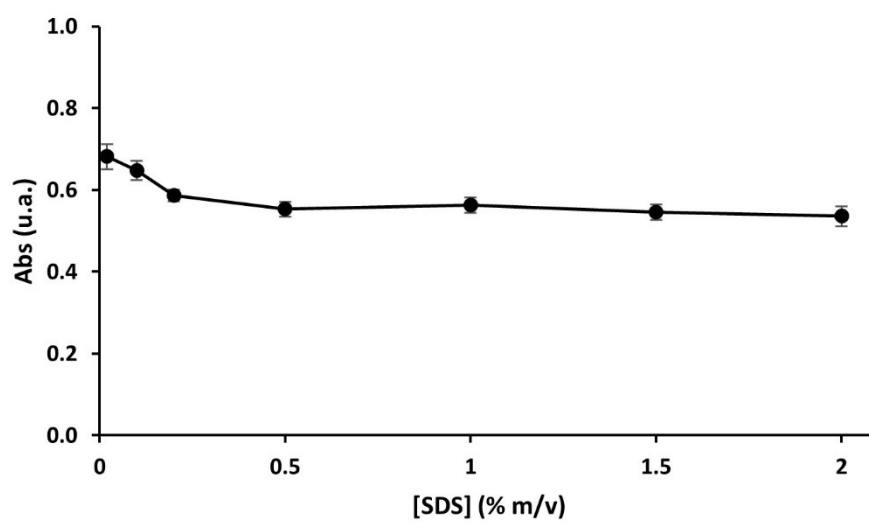


Figure S5. Optimization of SDS concentration.

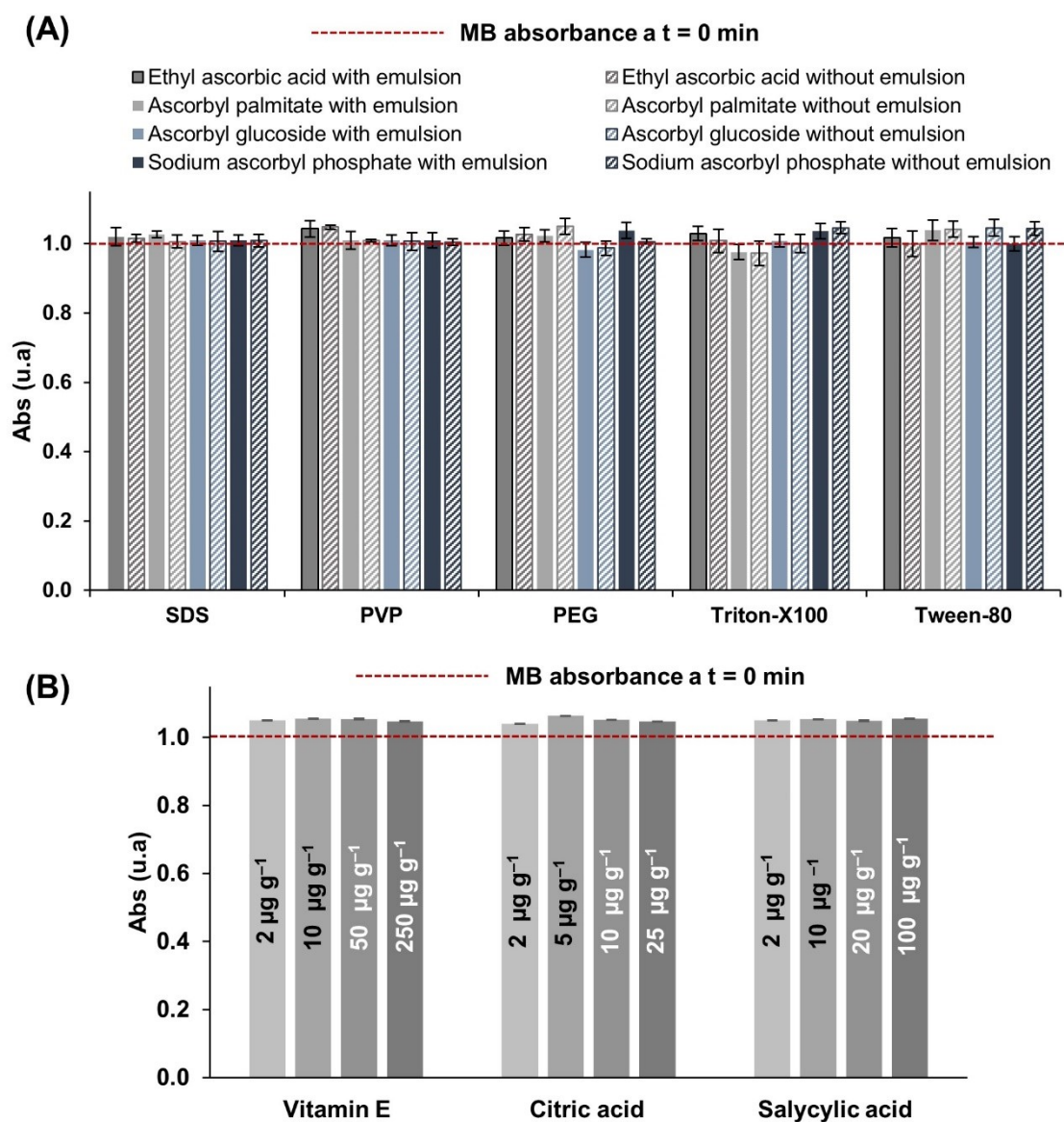


Figure S6. (A) Analytical response of AA derivatives ($2 \mu\text{g g}^{-1}$) with and without emulsion using different surfactants **(B)** Analytical response of other antioxidants at different concentrations (indicated as $\mu\text{g g}^{-1}$ in the graphic bars) (0.04 mM MB; 0.5 % m/v of SDS; 1 % v/v acetic acid; irradiation time under W lamp: 5 min).

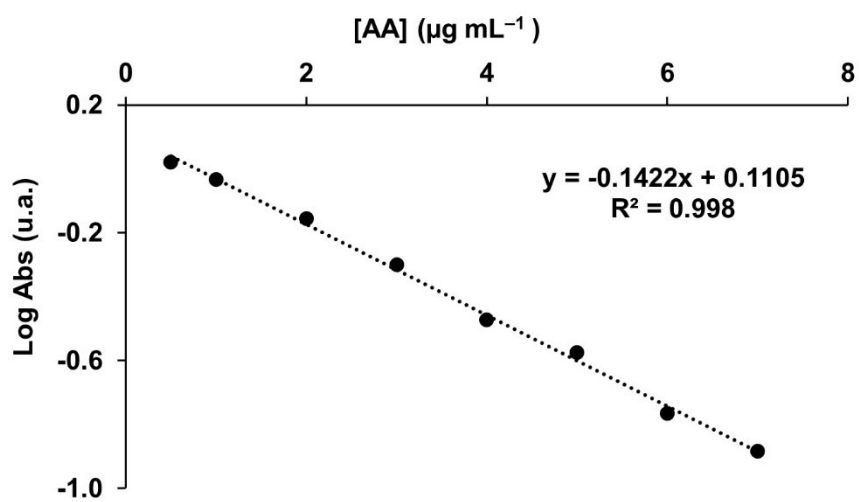


Figure S7. Calibration curve with aqueous standards obtained under optimal conditions (0.04 mM MB; 0.5 % m/v of SDS; 1 % v/v acetic acid; irradiation time under W lamp: 5 min).