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Evaluation of the Impact of Energy of Consciousness Healing Treatment on the Physicochemical, Spectral and Thermal Properties of Ascorbic Acid (Vitamin C)

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ABSTRACT

Ascorbic acid (Vitamin C) acts as a cofactor for the enzymatic reactions and performs numerous physiological functions in the human body. This study was done with the objective to analyse the impact of the Trivedi Effect®-Consciousness Energy Healing Treatment on the physicochemical, spectral and thermal properties of ascorbic acid using various analytical techniques. In this regard, the sample of ascorbic acid was divided into two parts and only one part was received the Trivedi Effect®-Biofield Energy Healing Treatment remotely by a renowned Biofield Energy Healer, Mr. Mahendra Kumar Trivedi and termed as Biofield Energy Treated ascorbic acid. The PXRD relative peak intensities and crystallite sizes of the treated ascorbic acid were significantly altered ranging from -42.39% to 202.77% and -60.00% to 199.99%, respectively compared with the control sample. However, the average crystallite size of the treated ascorbic acid was significantly increased by 13.56% compared with the control sample. The particle size of the treated ascorbic acid values were significantly decreased by 26.46% (d_{10}), 22.76% (d_{50}), 30.47% (d_{90}) and 27.12% {D(4,3)}, respectively; however, the surface area was significantly increased by 35.58% compared with the control sample. The melting point and latent heat of fusion (ΔH) were increased by 0.12% and 1.86%, respectively in the treated ascorbic acid compared to the control sample. The total weight loss was decreased, and maximum thermal degradation temperature was increased in the treated ascorbic acid compared with the control sample. The thermal analysis showed that the thermal stability of the treated ascorbic acid was increased compared to the control sample. The Energy of Consciousness Healing Treatment might have produced a new polymorphic form of ascorbic acid, which would be more soluble, bioavailable, and thermally stable compared with the untreated ascorbic acid. Thus, the Consciousness Energy Healing Treated ascorbic acid would be very useful to design better nutraceutical/pharmaceutical formulations which might offer better therapeutic response against scurvy, cancer, obesity, cardiovascular diseases, neurodegenerative and autoimmune diseases.

Keywords: Ascorbic acid, The Trivedi Effect®, Biofield energy, Consciousness energy healing treatment, PXRD, Particle size, DSC, TGA/DTG

INTRODUCTION

Vitamins are essential for our health and are present in almost all the foods we consume. Currently, many vitamin supplements such as multivitamin formulations are available for the prevention and control of vitamin deficiency but also for the treatment of some other diseases [1]. Ascorbic acid (L-ascorbic acid) also known as vitamin C **(Figure 1)**. Foods that contain vitamin C include all the citrus fruit, tomatoes, red peppers, potatoes, oysters, liver, milk, etc. [2,3]. It is required in a range for the essential metabolic reactions in all plants and animals. Ascorbic acid and ascorbate are both naturally present in the body and interconvert according to pH when either of these is introduced into cells [4]. Ascorbic acid can be found only at lower pH, but in neutral pH or above pH 5 is predominantly found in the ionized form, ascorbate **(Figure 1)**. Vitamin C plays as a cofactor in the enzymatic reactions (i.e., hydroxylation and amidation) and few non-enzymatic reactions. It performs numerous

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physiological functions include the synthesis of collagen, carnitine, neurotransmitters; metabolism of microsome and synthesis and catabolism of tyrosine in the human body [3]. Several collagen synthesis where vitamin C acts as a cofactor for prolyl hydroxylase and lysyl hydroxylase, which is very important in wound-healing and preventing bleeding from capillaries. Vitamin C is an electron donor acts as a potent water-soluble highly effective antioxidant, protecting against oxidative stress [4,5]. In the body, the 1 and 2 electrons oxidized forms of vitamin C, semidehydroascorbic acid and dehydroascorbic acid respectively can be reduced by means of glutathione and NADPH-dependent enzymatic mechanisms [4,6]. The role of vitamin C in the body is related to the maintenance of the internal microenvironment determined by the redox balance, proven to be effective in the prevention and treatment of diseases such as scurvy, cancer, obesity, cardiovascular diseases (myocardial infarction, stroke, etc.) hypertension, neurodegenerative diseases (Alzheimer's disease), autoimmune diseases (rheumatoid arthritis), etc. [4,7-12].

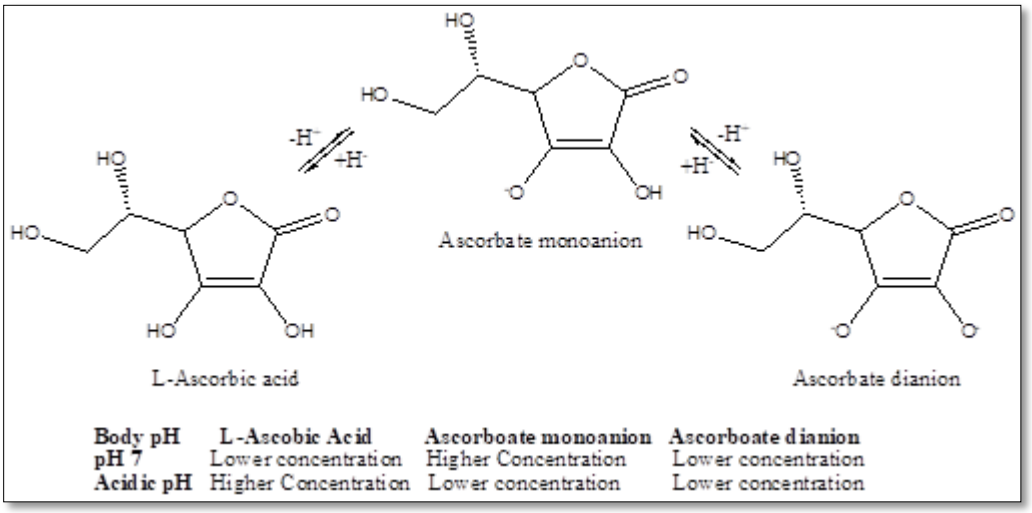

Figure 1. pH dependent forms of vitamin C and concentration in the human body.

Vitamin C deficiency leads to the various complications in the body, such as "scurvy" leads to the bleeding gums, weakness, fatigue, brown spots on the skin (thighs and legs), bruising, spongy gums and bleeding from all mucous membranes. Others symptoms associated with less noticeable signs of vitamin C deficiency are still very serious such as weak immune system, gingivitis, slow wound healing, dry and splitting hair, nose bleeding, leaky gut, autoimmune disease, swollen and painful joints, etc. Long term problems due to the low levels of vitamin C include the cancers, high blood pressure, stroke, gallbladder disease, atherosclerosis, etc. [8-10].

Tolerable upper intake level (UL) of vitamin C is 2,000 mg/day as per the Food and Nutrition Board of the National Academy of Sciences. Relatively large doses of ascorbic acid may cause indigestion, diarrhea, headache, flushing of the face, skin rashes, fatigue, disturbed sleep, hemochromatosis, suppress the production of progesterone from the corpus luteum in healthy subjects [3,13]. Low plasma concentrations are testified in patients with diabetes and infections and in smokers, but the contribution of diet and stress to these situations is uncertain [14,15].

Some of the limitations associated with vitamin C are its degradation during the packaging, storage, and cooking of blended foods (maize, soya, etc.). Analytical study on ascorbic acid (Lab grade), grape juice and vitamin C tablet (a pharmaceutical product) confirmed that exposure to air and storage temperature condition significantly affect the stability of the vitamin C so need to store under refrigeration condition (4-5°C) [16]. Similarly, other scientific study described that the loss of ascorbic acid following the first order kinetic model and with 30.30% loss of vitamin C while processing at 70°C for 90 min in fruit juice [17]. The stability is the major issue for vitamin C during processing, storage, and cooking [15-17]. Physicochemical and thermal properties of the pharmaceuticals play an important role of its absorption, bioavailability as well as the stability [18] and to improve such parameters of the pharmaceuticals is constant approach by the researcher. In this scenario, it was observed that Biofield Energy Healing Treatment (the Trivedi Effect®) is an economical approach and has considerable impact on the physicochemical and thermal properties of pharmaceuticals and nutraceuticals, through the possible mediation of neutrinos [19-22]. Every human body can discharge the electromagnetic energy in the form of bio-photons, generated by the continuous flow of the electrically charged particles inside the body, collectively known as "Biofield Energy". The Biofield Energy Healing practitioners have the capability to harness the energy from the "Universal Energy Field" and can transmit into any living or non-living object(s), this process is called Biofield Energy Healing Treatment [23-25]. The Biofield based Energy Therapies have been reported to with significant

outcomes against various disease [26]. The National Center of Complementary and Integrative Health has recognized and accepted Biofield Energy Healing as a Complementary and Alternative Medicine health care approach in addition to other therapies, medicines and practices such as yoga, Qi Gong, Tai Chi, hypnotherapy, healing touch, Reiki, etc. [27]. These therapies have been accepted by most of the U.S.A. population with several advantages [28]. The Trivedi Effect®-Biofield Energy Healing Treatment had been widely reported scientifically with significant outcome in different fields of pharmaceuticals and nutraceuticals [19-21,29,30], organic chemistry [31,32], materials science [33-35], agricultural science [36,37], microbiology [38,39], cancer research [40,41], etc. Biofield Energy Healing Treatment (the Trivedi Effect®) significantly improved the thermal stability of some pharmaceuticals and nutraceuticals [17,19,28]. Thus, the Trivedi Effect®-Biofield Energy Healing Treatment can be an economical approach and solution to the practical issue like the thermal stability of vitamin C and to improve other physicochemical parameters for designing better pharmaceuticals and nutraceutical formulations. Therefore, this study has been designed to evaluate the impact of the Trivedi Effect® - Energy of Consciousness Healing Treatment on the physicochemical, thermal and structural properties of ascorbic acid using modern analytical techniques.

MATERIALS AND METHODS

Chemicals and reagents

The test sample ascorbic acid (Alfa Aesar) and other chemicals used during the experiments were of analytical grade purchased in India.

Consciousness energy healing treatment strategies

The sample of ascorbic acid was divided into two parts. One part of ascorbic acid was considered as a control sample, where no Biofield Energy Treatment was provided. The second part of ascorbic acid was treated with the Trivedi Effect® - Consciousness Energy Healing Treatment remotely under standard laboratory conditions for 3 min by a renowned Biofield Energy Healer, Mr. Mahendra Kumar Trivedi (USA) known as the Biofield Energy Treated ascorbic acid. The control group was treated with a "sham" healer who did not have any knowledge about the Biofield Energy Treatment. After that, the treatment, both the samples of ascorbic acid were kept in sealed conditions and characterized using modern analytical techniques.

Characterization

The powder X-ray diffraction (PXRD) analysis of ascorbic acid powder sample was performed with the help of PANalytical X'Pert3 Pro [19-21,42]. The average size of crystallites was calculated from PXRD data using the Scherrer's formula (1):

$$G = k\lambda/\beta\cos\theta \quad (1)$$

Where G is the crystallite size in nm, k is the equipment constant (0.5), λ is the radiation wavelength (0.154 nm for Kα1 emission), β is the full-width at half maximum and θ is the Bragg angle [42,43].

The particle size distribution (PSD) analysis was performed with the help of Malvern Mastersizer 3000, UK instrument and Mastersizer V3.50 software using the wet method [19-21,42]. Fourier transform infrared (FT-IR) spectroscopy of ascorbic acid was performed on Spectrum ES (Perkin Elmer, USA) Fourier transform infrared spectrometer. Ultra violet-visible spectroscopy (UV-Vis) analysis was carried out using Shimadzu UV-2400PC series, Japan. Similarly, the differential scanning calorimetry (DSC) analysis of ascorbic acid was performed with the help of DSC Q200, TA instruments. The thermal gravimetric analysis (TGA) thermograms of ascorbic acid were obtained with the help of TGA Q50 TA instruments [19-21,42].

The % change in crystallite size, peak intensity, particle size, surface area, melting point, latent heat, weight loss and the maximum thermal degradation temperature of the Biofield Energy Treated ascorbic acid was calculated compared with the control sample using the following equation 2:

$$\% \text{ Change} = \frac{[\text{Treated} - \text{Control}]}{\text{Control)}} \times 100 \quad (2)$$

RESULTS AND DISCUSSION

Powder X-ray diffraction (PXRD) analysis

The sharp and intense peaks in PXRD diffractograms of the control and Biofield Energy Treated ascorbic acid **(Figure 2)** indicating that both the samples were crystalline in nature. PXRD data such as Bragg angle, relative intensity, and crystallite size of the control and Biofield Energy Treated ascorbic acid are presented in **Table 1**.

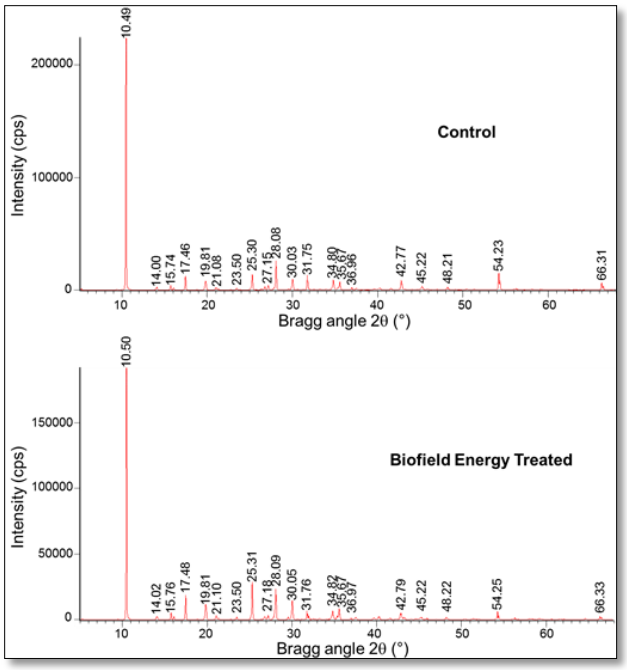

Figure 2. PXRD diffractograms of the control and treated ascorbic acid.

Table 1. PXRD data for the control and treated ascorbic acid.

Entry No.	Bragg angle (°2θ)	Relative Intensity (%)			Crystallite size (G, nm)		
		Control	Treated	% Change	Control	Treated	% Change
1	10.5	100	100	0.00	69.22	57.69	-16.67
2	14.0	0.47	0.93	97.87	57.88	69.45	20.00
3	14.2	0.76	0.91	19.74	57.89	57.89	0.01
4	15.8	1.22	2.17	77.87	38.70	38.70	-0.01
5	16.1	0.54	0.95	75.93	34.84	49.78	42.91
6	17.5	3.65	7.75	112.33	43.63	43.64	0.01
7	19.8	2.35	4.71	100.43	35.89	35.89	0.00
8	19.9	1.64	3.81	132.32	57.43	57.43	-0.01
9	21.1	0.64	1.27	98.44	23.97	31.97	33.35
10	23.5	0.43	0.78	81.40	36.11	32.10	-11.11
11	25.3	3.97	12.02	202.77	41.41	72.46	75.00
12	26.8	0.9	1.10	22.22	58.14	58.14	0.00
13	27.2	1.09	1.30	19.27	48.49	48.49	0.00
14	28.1	7.56	9.67	27.91	48.59	72.88	50.00
15	30.1	2.78	6.09	119.06	48.80	36.60	-25.00
16	31.8	3.77	2.74	-27.32	58.80	73.51	25.01
17	34.8	2.67	2.71	1.50	59.28	59.28	0.01

18	35.3	0.5	1.15	130.00	32.98	59.36	80.00
19	35.6	2.06	3.60	74.76	99.00	74.25	-25.00
20	35.7	0.85	1.72	102.35	99.03	99.03	0.00
21	36.9	0.63	0.48	-23.81	59.64	74.55	25.00
22	37.6	0.39	0.68	74.36	74.68	29.87	-60.00
23	40.2	0.41	0.84	104.88	60.22	60.23	0.01
24	40.3	0.43	0.98	127.91	37.66	75.31	99.98
25	41.6	0.36	0.41	13.89	25.21	75.63	199.99
26	42.8	2.49	1.94	-22.09	60.75	75.93	25.00
27	42.9	1.51	2.00	32.45	75.96	75.97	0.01
28	45.2	0.97	0.72	-25.77	61.27	51.06	-16.68
29	45.3	0.52	0.73	40.38	76.62	76.62	-0.01
30	48.2	0.65	0.78	20.00	61.97	61.97	0.00
31	48.4	0.34	0.45	32.35	77.50	77.50	0.00
32	54.2	4.26	2.69	-36.85	45.39	79.45	75.05
33	54.4	2.34	1.40	-40.17	63.59	79.49	25.01
34	56.3	0.35	0.58	65.71	64.14	80.19	25.01
35	66.3	1.84	1.06	-42.39	42.22	84.47	100.05
36	66.5	1.03	0.67	-34.95	48.31	67.64	40.02

The PXRD diffractogram of both the samples of ascorbic acid showed highest peak intensity (100%) at Bragg's angle (2θ) equal to 10.5° **(Table 1, entry 1)**. The overall relative peak intensities of the Biofield Energy Treated ascorbic acid were significantly altered ranging from -42.39% to 202.77% compared to the control sample.

Similarly, the crystallite size of the treated ascorbic acid was significantly altered ranging from -60.00% to 199.99% compared to the control sample. Overall, the average crystallite size of the Biofield Energy Treated ascorbic acid was significantly increased by 13.56% compared to the control sample.

The relative peak intensity of each diffraction face on the crystalline compound changes according to the crystal morphology [44] and alterations in the XRD pattern provide the proof of polymorphic transitions [45,46]. Changes in the crystallite size and relative peak intensities of PXRD peaks revealed that the crystal morphology of the Biofield Energy Treated ascorbic acid was altered compared to the control sample. Thus, it can be anticipated that the decreased in the crystallite size and relative peak intensities of the ascorbic acid were due to the energy transferred through the Trivedi Effect®-Biofield Energy Healing Treatment and this probably introduced a new polymorphic form of ascorbic acid. Polymorphic forms of pharmaceuticals have the significant effects on the drug performance, such as bioavailability, therapeutic efficacy and toxicity, because of their thermodynamic and physicochemical properties like melting point, energy, stability and especially solubility, are different (probably improvement) from the original form [47,48]. Thus, it can be anticipated that Mr. Trivedi's Biofield Energy Treatment (the Trivedi Effect®) could be a very useful technique for the production of novel crystal polymorph of ascorbic acid that would improve the bioavailability and its therapeutic performance.

Particle size distribution (PSD) analysis

Particle size values of the control and Biofield Energy Treated ascorbic acid were investigated and the results are presented in **Table 2**. The particle size values in the Biofield Energy Treated ascorbic acid at d_{10}, d_{50}, d_{90} and D(4,3) was significantly decreased by 26.46%, 22.76%, 30.47% and 27.12%, respectively compared to the control sample. Consequently, the surface area of the control and Biofield Energy Treated ascorbic acid were 66.39 m^2/g and 90.01 m^2/g, respectively. The surface area of the Biofield Energy Treated ascorbic acid was significantly increased by 35.58% compared with the control sample.

Table 2. Particle size values {d_{10}, d_{50}, d_{90} and D(4,3)} and surface area of the control and treated ascorbic acid.

Parameter	d_{10} (µm)	d_{50} (µm)	d_{90} (µm)	D(4,3) (µm)	Surface area (m^2/g)
Control	44.60	145.00	361.00	177.00	66.39
Biofield Treated	32.80	112.00	251.00	129.00	90.01
Percent change* (%)	-26.46	-22.76	-30.47	-27.12	35.58

**denotes the percentage change in the particle size values {d_{10}, d_{50}, d_{90} and D(4,3)} and surface area of treated ascorbic acid with respect to the control sample*

The particle size and surface area of the pharmaceuticals play a vital role in the solubility, absorption, dissolution and bioavailability [49-51]. Smaller the particle size and higher surface area enhance the solubility of the solid particles as well as increase the dissolution rate and bioavailability [51,52]. Thus, it is anticipated that the Trivedi Effect® - Energy of Consciousness Healing Treated ascorbic acid might be absorbed in faster rate from the gut and thus, may offer better bioavailability compared to the control sample.

Fourier transform infrared (FT-IR) spectroscopy

The FT-IR spectra of the control and Biofield Energy Treated ascorbic acid showed the clear stretching and bending peak in the functional group and fingerprint region **(Figure 3)**. The strong peaks in the functional group region of both control and Biofield Energy Treated spectra were observed near 3528-3032 cm^{-1} may be due to O-H stretching frequency due to the primary and secondary alcohol present in the structure of ascorbic acid. The broad FT-IR band near 2917 cm^{-1} was definitely C-H stretching bands of both the samples. Very intensive peaks near 1755 cm^{-1} in the spectra of the control and Biofield Energy Treated samples were the results of stretching vibration bands of C=O of the carbonyl group. The spectra showed aliphatic C=C stretching at 1673 cm^{-1} for the samples. It showed the C-O and C-C stretching frequency at 1121 and 1027 cm^{-1}, respectively for both the samples of Ascorbic Acid. The FT-IR spectra did not display any changes in the vibrational frequencies. The experimental FT-IR data of the control and Biofield Energy Treated samples were matched with the reported values of ascorbic acid [53]. The fingerprint and functional group region of the Biofield Energy treated ascorbic acid was remained the same compared to the control sample. Overall FT-IR results suggested that there was no significant alteration in the structural properties of the Biofield Energy Treated ascorbic acid compared to the control sample.

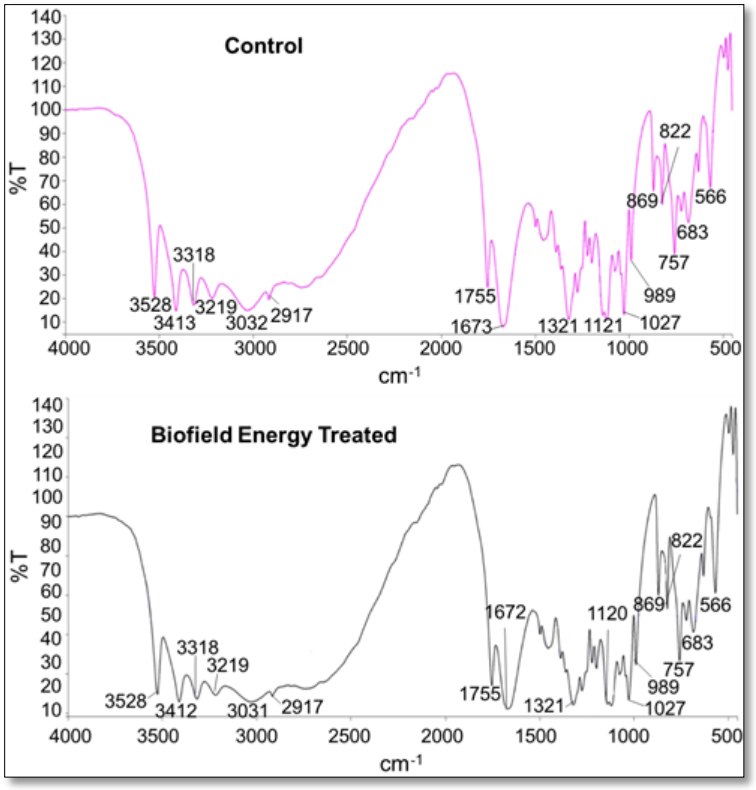

Figure 3. FT-IR spectra of the control and treated ascorbic acid.

Ultraviolet-visible spectroscopy (UV-Vis) analysis

The UV-visible spectra of the control and Biofield Energy Treated ascorbic acid are shown in **Figure 4**. The UV spectrum of control and Biofield Energy Treated ascorbic acid showed the maximum absorbance at 266 nm (λ_{max}). UV absorption of ascorbic acid in water solution is 266 nm according to the literature Selimovic et al. [54], which was well correlated with the experimental results. The peak at 266 nm was showed a minor shift of absorbance maxima from 1.0335 in control to 1.0948 in the Biofield Energy treated ascorbic acid. Thus, no significant difference was found in the absorbance maxima between the control and Biofield Energy treated samples.

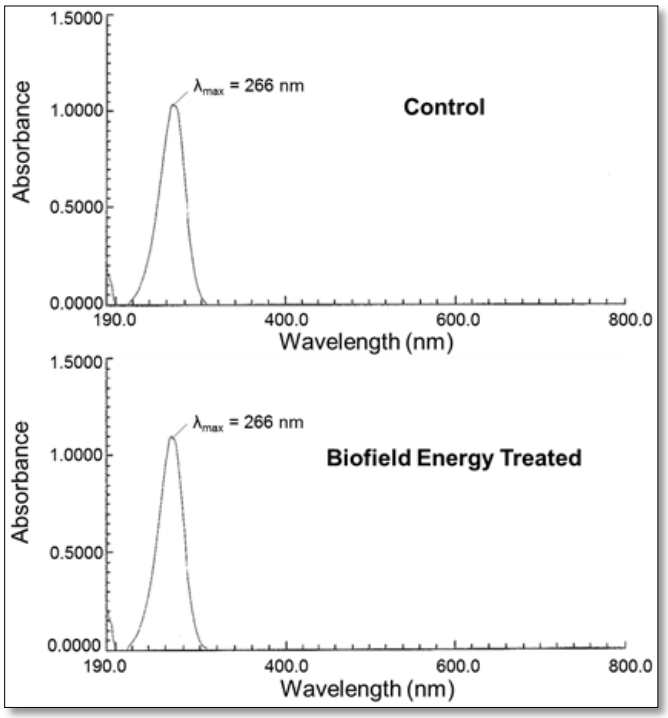

Figure 4. UV-Vis spectra of the control and treated ascorbic acid.

Differential scanning calorimetry (DSC) analysis

The DSC thermograms of the control and Biofield Energy treated samples of ascorbic acid exhibited a sharp endothermic peak at 193.32 and 193.56°C, respectively, which was due to the melting temperature of ascorbic acid **(Figure 5)**. The experimental data are well correlated with the published literature data [55]. The results suggested that the melting temperature of the Biofield Energy treated ascorbic acid was increased by 0.12% compared to the control sample **(Table 3)**. Similarly, the latent heat of fusion (ΔH) in the Biofield Energy treated (262.80 J/g) ascorbic acid was increased by 1.86% compared to the control (258.00 J/g) sample **(Table 3)**. The DSC data concluded that the thermal stability of the ascorbic acid was increased after the Biofield Energy treatment.

Table 3. DSC data for the control and treated ascorbic acid.

Description	Melting temperature (°C)	ΔH_{fusion} (J/g)
Control sample	193.32	258.00
Biofield Energy Treated sample	193.56	262.80
% Change*	0.12	1.86

ΔH: Latent Heat of Fusion

**denotes the percentage change of the treated ascorbic acid with respect to the control sample*

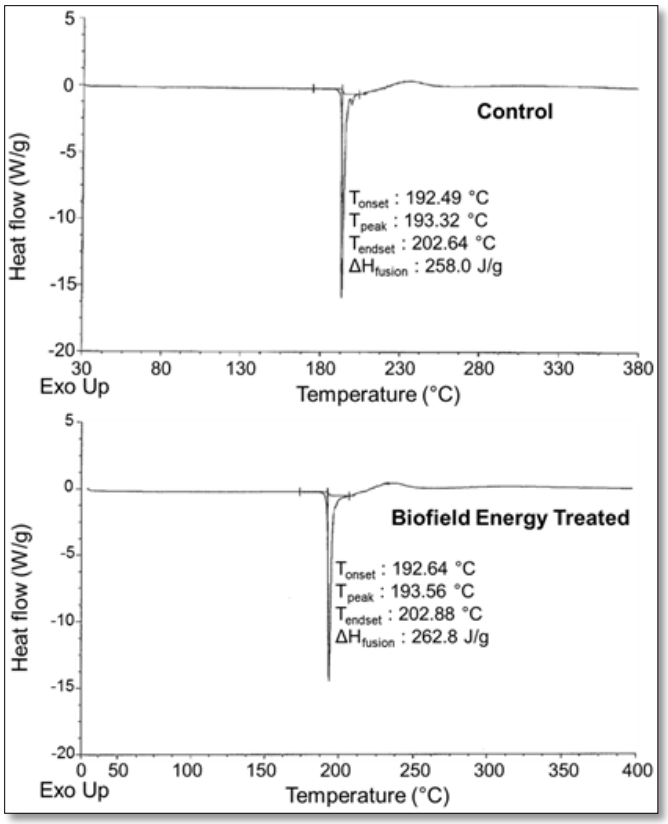

Figure 5. DSC thermograms of the control and treated ascorbic acid.

Thermal gravimetric analysis (TGA)

The TGA thermograms of the control and Biofield Energy Treated ascorbic acid exhibited three steps of thermal degradation **(Figure 6)**. The experimental data are well correlated with the published literature data [55]. The weight loss of each step was calculated for both the samples and tabulated in **Table 4**. The percentage weight loss in the 1st and 3rd steps of degradation of the Biofield Energy Treated ascorbic acid was significantly decreased by 12.80% and 1.36%, while in the 2nd step of degradation was slightly increased by 0.45% compared with the control sample **(Table 4)**. The total weight loss in the Biofield Energy Treated ascorbic acid was decreased by 0.50% compared with the control sample.

Table 4. Thermal degradation steps of the control and treated ascorbic acid.

Step	TGA (% Weight loss)			DTG (T_{max})		
	Control	Treated	% Change	Control	Treated	% Change
1st step of degradation	2.43	2.16	-12.80	218.89	220.55	0.76
2nd step of degradation	42.26	42.45	0.45			
3rd step of degradation	16.37	16.15	-1.36			
Total weight loss	61.06	60.76	-0.50			

T_{max}: Maximum Thermal Degradation Temperature

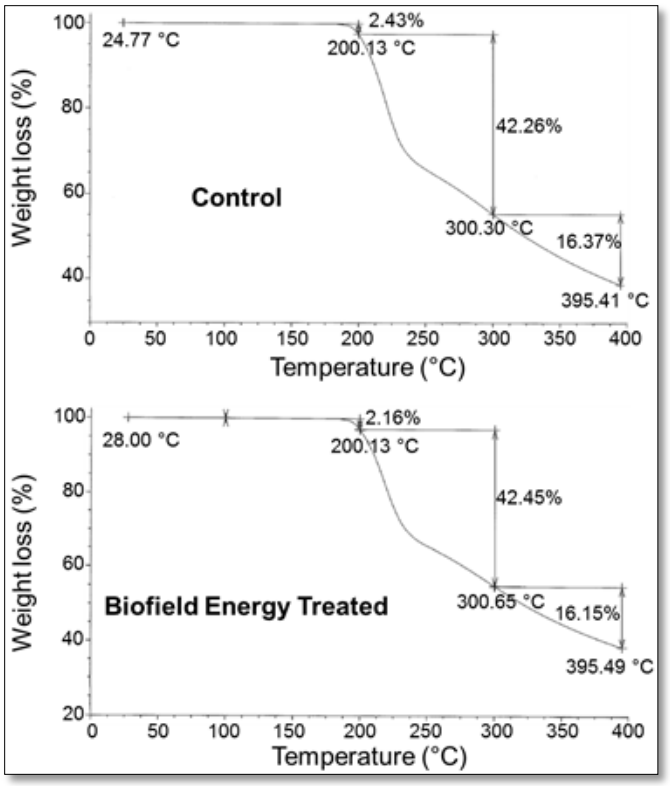

Figure 6. TGA thermograms of the control and treated ascorbic acid.

The DTG thermograms of the control and Biofield Energy Treated ascorbic acid **(Figure 7)** revealed maximum thermal degradation temperature (T_{max}) at 218.89°C and 220.55°C, respectively. The DTG analysis indicated that the maximum thermal decomposition temperature of the Biofield Energy Treated ascorbic acid was increased by 0.76% compared with the control sample **(Table 4)**. Overall, thermal analysis (DSC, TGA/DTG) revealed that the thermal stability of the Biofield Energy Treated ascorbic acid was increased compared to the control sample.

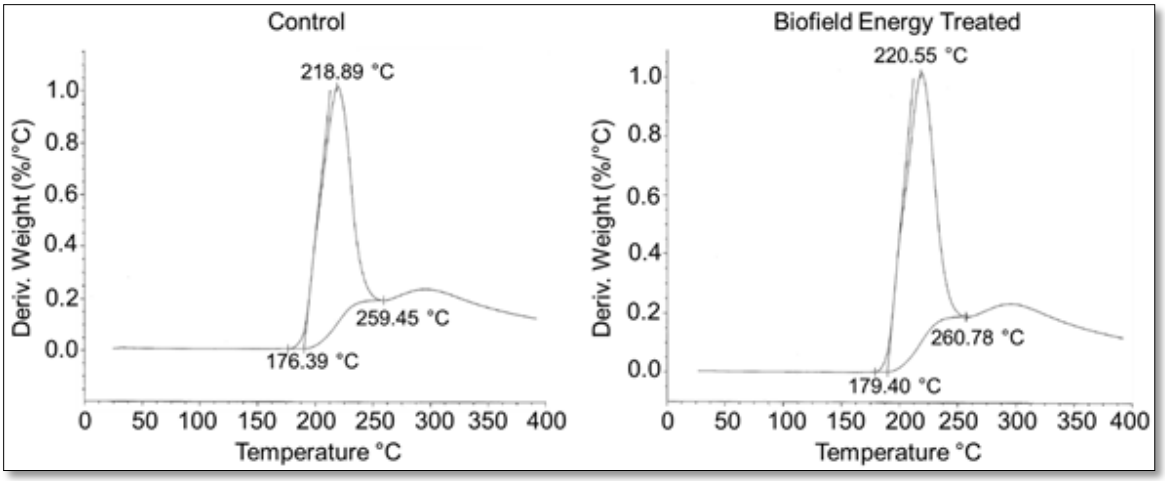

Figure 7. DTG thermograms of the control and treated ascorbic acid.

CONCLUSION

Overall experimental results revealed that the Trivedi Effect® - Consciousness Energy Healing Treatment has a significant impact on the physicochemical and thermal properties of ascorbic acid. The relative peak intensities and crystallite sizes of the Biofield Energy Treated ascorbic acid were significantly altered ranging from -42.39% to 202.77% and -60.00% to 199.99%, respectively compared to the control sample. However, the average crystallite size of the treated ascorbic acid was significantly increased by 13.56%

compared with the control sample. The particle size of the treated ascorbic acid were significantly decreased by 26.46% (d_{10}), 22.76% (d_{50}), 30.47% (d_{90}) and 27.12% {D(4,3)}, respectively compared with the control sample. Thus, the surface area of the treated ascorbic acid was significantly increased by 35.58% compared with the control sample. The melting point and ΔH_{fusion} were increased in the treated ascorbic acid compared to the control sample. The total weight loss was decreased and the maximum thermal degradation temperature was increased in the treated ascorbic acid compared with the control sample. Overall, the thermal analysis indicated that the thermal stability of the Biofield Energy Treated ascorbic acid was increased compared to the control sample. The Energy of Consciousness Healing Treatment might have produced a new polymorphic form of ascorbic acid, which would be more soluble, bioavailable, and thermally stable compared with the untreated ascorbic acid. The Biofiel Energy treated ascorbic acid would be very useful to design better nutraceutical/pharmaceutical formulations which might offer better therapeutic response against scurvy, cancer, obesity, cardiovascular diseases (myocardial infarction, stroke, etc.), hypertension, neurodegenerative diseases (Alzheimer's disease), autoimmune diseases (rheumatoid arthritis), etc.

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