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EFFECT OF CONSCIOUSNESS ENERGY HEALING TREATMENT ON PHYSICOCHEMICAL PROPERTIES OF L-TRYPTOPHAN: A NOVEL POLYMORPHIC FORM FOR IMPROVED NUTRACEUTICALS

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Abstract: L-tryptophan, an essential amino acid involved in protein synthesis and neurotransmitter formation, was subjected to Consciousness Energy Healing Treatment to investigate any changes in its physicochemical properties. A control group was established, while the other group received the Trivedi Effect®Consciousness Energy Healing Treatment remotely for three minutes under laboratory conditions. Modern analytical techniques were used to analyze the samples, and results revealed significant differences in the particle size, specific surface area, weight loss, and powder XRD peak intensities of the treated L-tryptophan as compared to the control sample. Additionally, the average crystallite size of the treated L-tryptophan was increased by 25.97% in comparison to the control sample, suggesting the possible creation of a novel polymorphic form of L-tryptophan. The DTG thermograms of both the samples showed that the Consciousness Energy Healing Treatment reduced the weight loss and improved the thermal stability of the L-tryptophan sample. These findings suggest that using Biofield Energy Treated L-tryptophan can be considered a favorable approach to produce superior-quality nutraceuticals.

Keywords: Consciousness Energy Healing Treatment, L-tryptophan, physicochemical properties, particle size, crystallite size, nutraceuticals.

Introduction

L-tryptophan is one of the essential amino acids used in the biosynthesis of proteins and certain brain-signaling chemicals. It is as a precursor for serotonin, which is a neurotransmitter that helps in controlling the mood and sleep, and synthesized it with the help of tryptophan hydroxylase [1]. L-tryptophan is metabolized further into melatonin and vitamin B_3 (nicotinic acid), in which the melatonin plays a vital role in maintaining the circadian rhythms of various biological functions [2]. L-tryptophan can be obtained naturally from animal and plant proteins. It plays a significant role in the development as well as the functioning of various organs of the body. The body absorbs L-tryptophan from food and converts it in the form of 5-HTP (5-hyrdoxytryptophan), followed by serotonin, melatonin, and vitamin B_6 (nicotinamide) [3,4]. Serotonin helps in transmitting the signals between the nerve cells and also causes the narrowing of blood vessels [5]. The reduced levels of tryptophan inside the body may cause depression, obsessive compulsive disorder, and bipolar disorder, etc. [6]. It is used for the treatment of some mental health disorders [7], for improving athletic performance [8]; quit smoking [9], treatment of emotional symptoms in premenstrual dysphoric disorder (PMDD) [10],

attention deficit-hyperactivity disorder (ADHD), mental functionality problems in the elderly [11], ulcer healing caused by H pylori [12], sleep apnea, seasonal affective disorder (SAD), and anxiety, etc. It is soluble in water (11.4g/L at 25 ^{o}C), hot alcohol, and alkali hydroxide; insoluble in chloroform.

The physicochemical properties of any nutraceutical have very much importance in its quality. Biofield Energy Treatment has grate role altering the physicochemical properties of nutraceutical compounds [14]. Biofield is a putative energy field, which has the basic concept that human beings possess this subtle form of energy [15]. Thus, an expert has the ability to harness energy from the universe and can communicate it to any object(s) around the globe. Such energy is considered as the Biofield Energy, and its healing techniques are known as the Biofield Energy Treatment, which was also accepted by the National Center for Complementary and Alternative Medicine (NCCAM) [16] under CAM. The other therapies involved under this category are deep breathing, yoga, Tai Chi, Qi Gong, meditation, chiropractic/osteopathic manipulation, massage, special diets, homeopathy, progressive relaxation, acupressure, guided imagery, acupuncture, relaxation techniques, hypnotherapy, movement therapy, healing touch, pilates, rolfing structural integration, traditional Chinese herbs and medicines, mindfulness, Ayurvedic medicine, naturopathy, essential oils, Reiki, aromatherapy, cranial-sacral therapy and applied prayer [17,18]. The Trivedi Effect®-Consciousness Energy Healing Treatment has also been considered worldwide due to its remarkable results in the living organisms as well as the non-living materials. Biofield Energy Healing Treatment has been reported for causing significant alterations in the physicochemical and thermal properties of various organic/pharmaceutical compounds [1922], alter the characteristics of crops [23,24], microorganisms [25,26], metals, ceramics, and polymers [27-29], nutraceuticals [14], and improved the bone and skin health [30-32], etc. Thus, the aim of this study was to analyse the effect of the Biofield Energy Healing Treatment on the physicochemical and thermal properties of L-tryptophan by using various analytical techniques.

Materials and Methods

Chemicals and Reagents

The test sample L-tryptophan was purchased from Alfa Aesar, India. Similarly, other chemicals used in the experiments also purchased in India.

Consciousness Energy Healing Treatment Strategies

The L-tryptophan sample considered for the experiment was divided into two equal parts. One part of Ltryptophan sample was considered as a control sample where no Biofield Energy Treatment was provided. However, the other part of L-tryptophan was received the Trivedi Effect®-Consciousness Energy Healing Treatment distantly under typical laboratory conditions (3 minutes) by the famous Biofield Energy Healer, Alice Branton, USA, known as the treated L-tryptophan sample. However, the control sample was treated under same laboratory conditions with a "sham" healer who is ignorant about the Biofield Energy Treatment. After that, both the samples were kept in sealed conditions and characterized using sophisticated analytical techniques. **Characterization**

The particle size distribution (PSD) analysis of L-tryptophan was performed using Malvern Mastersizer 2000 (UK) using the wet method [33,34]. The X-ray diffraction (PXRD) analysis of L-tryptophan powder sample was performed with the help of Rigaku

MiniFlex-II Desktop X-ray diffractometer (Japan) [35,36]. The crystallites size was calculated with the help of the Scherrer's formula (1)

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

Where G = crystallite size (nm), λ = radiation wavelength, k = equipment constant, β = full-width at half maximum, and θ = Bragg angle [37].

The thermal gravimetric analysis (TGA) thermograms of L-tryptophan were obtained with the help of TGA Q50 TA instruments. The differential scanning calorimetry (DSC) analysis of L-tryptophan was performed with the help of DSC Q200, TA instruments [38]. The % change in the above parameters the treated Ltryptophan was calculated compared to the control sample using the following equation 2:

[Treated −Control]
% change = ×100 (2) Control

Results and Discussion

Particle Size Analysis (PSA)

The analysis revealed the particle size distribution of the control and Biofield Energy Treated L-tryptophan samples in Table 1. It showed the particle size distribution of the control sample at d_{10} = 27.61 µm, d_{50} = 140.51 µm, d_{90} = 364.34 µm, and D(4, 3) = 172.08 µm. Besides, the particle size distribution of the Biofield Energy Treated sample showed significant alterations as it was observed at d_{10} = 28.03 µm, d_{50} = 142.25 µm, d_{90} = 380.13 µm, and D(4, 3) = 177.77 µm. Therefore, the analysis showed a significant increase in the particle size values 1.52% (d_{10}), 1.24% (d_{50}), 4.33% (d_{90}), and 3.31% {D(4,3)} of the Biofield Energy Treated Ltryptophan compared to the control sample.

Parameter	d_{10} (µm)	d_{50} (µm)	d_{90} (µm)	D(4,3)(µm)	SSA(m^2/g)
Control	27.61	140.51	364.34	172.08	0.095
Biofield Energy Treated	28.03	142.25	380.13	177.77	0.094
Percent change (%)	1.52	1.24	4.33	3.31	-1.05

d_{10}, d_{50}, and d_{90}: particle diameter corresponding to 10%, 50%, and 90% of the cumulative distribution, D(4,3): average mass-volume diameter, and SSA: specific surface area. **Table 1:** Particle size data of the control and treated L-tryptophan

On a similar note, the Biofield Energy Treated sample showed a decrease (1.05%) in the specific surface area as it was observed as 0.094 m^2/g, as compared with the SSA of the control sample that was found as 0.095 m^2/g. This significant alteration in the surface area of the Biofield Energy Treated L-tryptophan may arise because of the increase in particle size after the Biofield Energy Treatment. Later on, the particle size distribution of the drug is known as an important factor in the formulation design as it might impact the flowability, blend uniformity, and compactibility factors of the drug with excipients. Such properties are also considered important in defining the safety, efficacy, and the quality of the drug formulation. The literature reported that the flowability of the drug might be hindered in the presence of smaller particles as compared to the large and spherical particles [39,40]. Hence, it is presumed that the treated sample might show better flowability, uniformity, and compactibility during the formulation development as compared to the untreated sample

Powder X-ray Diffraction (PXRD) Analysis

The PXRD diffractograms of the control and treated L-tryptophan samples are shown in Figure 1. Moreover, the calculations corresponding to the peak intensities and crystallite sizes and further analysis for both the samples are presented in Table 2.

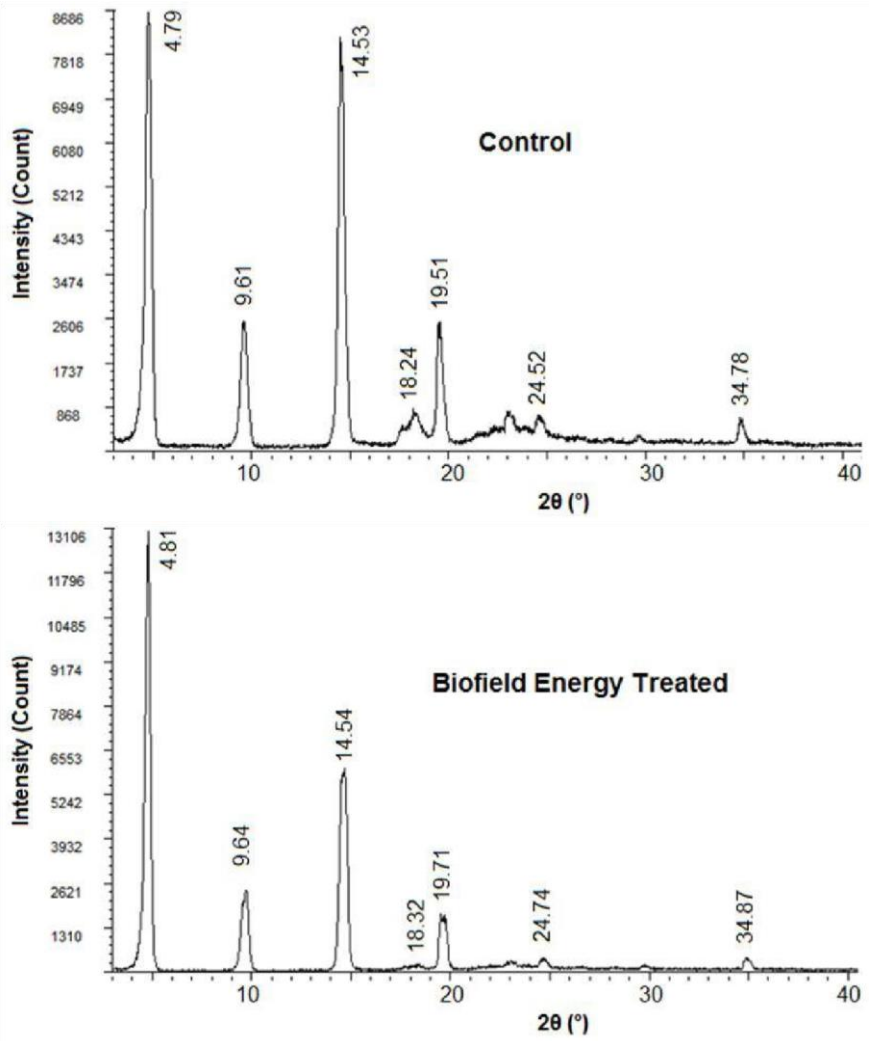

Figure 1: PXRD diffractograms of the control and treated L-tryptophan

Entry No.	Bragg angle (º2θ)		Intensity (cps)			Crystallite size (G, nm)		
	Control	Treated	Control	Treated	% change	Control	Treated	% change
1	4.79	4.81	2491	3011	20.88	227.0	267.0	17.62
2	9.61	9.64	769	549	-28.61	208.0	239.0	14.90
3	14.53	14.54	2273	1574	-30.75	222.0	226.0	1.80
4	18.24	18.32	375	57	-84.80	81.0	104.0	28.40
5	19.51	19.71	593	299	-49.58	233.0	299.0	28.33
6	24.52	24.74	615	78	-87.32	30.8	220.0	614.29
7	34.78	34.87	116	92	-20.69	262.0	237.0	-9.54

Table 2: PXRD data for the control and treated L-tryptophan

The diffractogram analysis revealed the alteration in the Bragg's angles of the characteristic peaks of the Biofield Energy Treated sample as compared to the control L-tryptophan sample. Besides, the peak intensities of the Biofield Energy Treated sample also showed significant changes ranging from -87.32% to 20.88% in comparison to the control sample. Similarly, the crystallite sizes of the Biofield Energy Treated sample were also observed to be changed, ranging from -9.54% to 614.29%, as compared to the control sample. Besides, the average crystallite size of the control sample was observed to as 180.54 nm; while the Biofield Energy

Treated sample showed an average crystallite size as 227.43 nm. Thus, the average crystallite size of the treated sample was significantly increased by 25.97% as compared to the control sample. The Biofield Energy Treatment was reported by several kind of literatures regarding its possible impact on the compound to alter the crystalline structure and crystal morphology by altering the peak intensities and crystallite sizes, and thereby might create a new polymorph of the compound [41]. Thus, the analysis indicated the formation of the new polymorph of the compound through significant alterations in the peak intensities, and crystallite size of the treated L-tryptophan, which could be used in improving its drug profile [42] as compared to the untreated sample.

Thermal Gravimetric Analysis (TGA)/ Differential Thermogravimetric Analysis (DTG)

The thermal analysis of both the L-tryptophan samples was done using the TGA/DTG technique. The literature reported the thermogravimetric records for L-tryptophan, according to which it shows a fast mass loss of 2024% starting at 526-538 K, followed by a continuous mass decrease. Also, it was reported that some small molecules of NH_3, CO_2, and H_2O were evolved during the degradation [43]. The TGA thermograms of both the samples (Figure 2) showed thermal degradation at ~250ºC, which was similar as reported in the literature. The further analysis revealed that the total weight loss of the control sample was 97.75%, while it was observed as 92.60% for the Biofield Energy Treated sample. Thus, the total weight loss of the treated L-tryptophan sample was reduced by 5.27% during the sample degradation as compared to the untreated sample. As a result, the residue amount of the treated sample was significantly increased by 228.88% (Table 3) as compared to the control sample. It indicated the reduction in thermal degradation and improved thermal stability of the Biofield Energy Treated L-tryptophan sample as compared to the untreated sample.

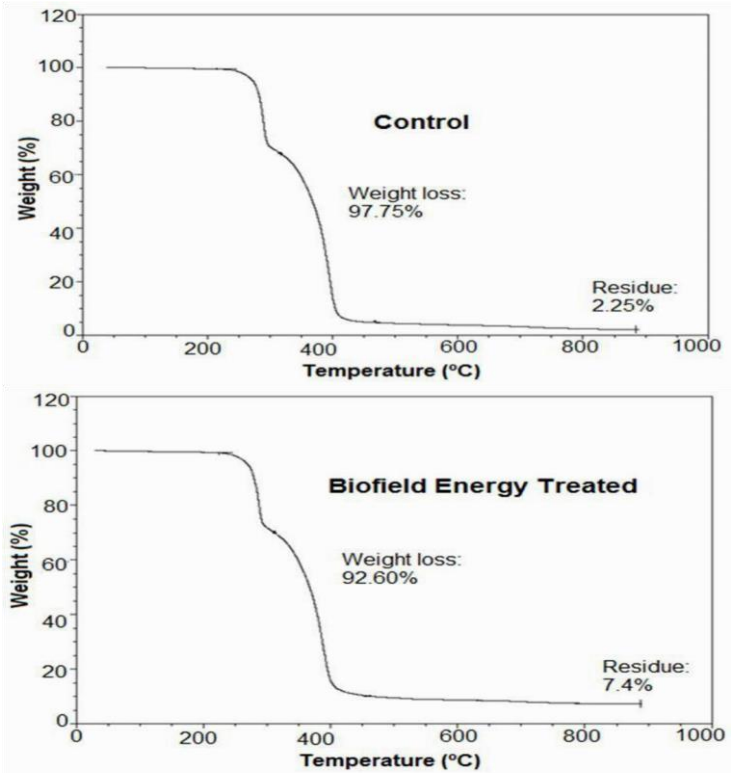

Figure 2: TGA thermograms of the control and treated L-tryptophan

Sample	TGA		DTG	
	Total weight	Residue %	Peak 1 T_{max} (°C)	Peak 2 T_{max} (°C)

	loss (%)			
Control	97.75	2.25	228.60	394.34

Sample	**TGA**		**DTG**	
	Total weight loss (%)	**Residue %**	**Peak 1 T_{max} (°C)**	**Peak 2 T_{max} (°C)**
Biofield Energy Treated	92.60	7.40	286.53	388.60
% Change	-5.27	228.88	25.34	-1.45

T_{max} = The temperature at which maximum weight loss takes place in TG or peak temperature in DTG. **Table 3:** TGA/DTG data of the control and treated L-tryptophan

Moreover, the DTG thermograms of the control and Biofield Energy Treated samples (Figure 3) showed two peaks. The analysis revealed that the maximum degradation temperature (T_{max}) corresponding to 1st peak of the treated sample was increased by 25.34%; while it was slightly decreased by 1.45% corresponding to 2nd peak as compared to the control sample. It indicated that the maximum thermal degradation temperature of the Biofield Energy Treated sample was significantly improved in comparison to the untreated sample. Overall, the TGA/DTG studies showed the improved thermal stability profile of the Biofield Energy Treated

L-tryptophan sample as compared with the control sample.

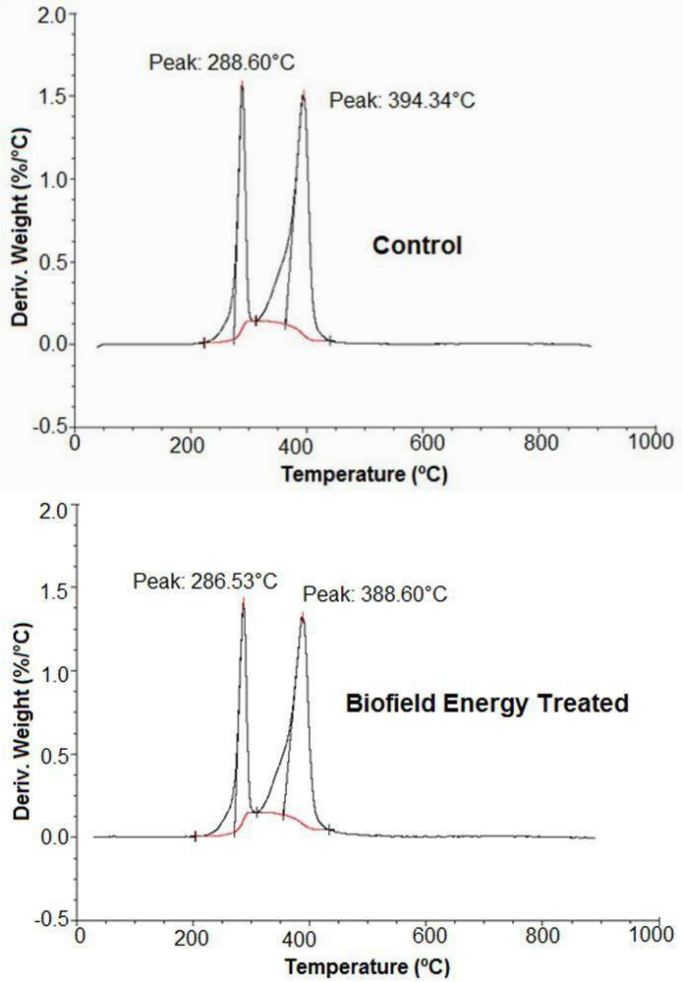

Figure 3: DTG thermograms of the control and treated L-tryptophan

Differential Scanning Calorimetry (DSC) Analysis

The DSC technique helps in studying the thermal behaviour of the compound such as melting and crystallization temperature etc. [44]. Previous literature reported the presence of a single endothermic peak in the thermogram of L-tryptophan, in the temperature range of 540-577 K [45].

The DSC thermograms of both the samples were observed to be similar as reported in the literature and they also showed a single endothermic peak (Figure 4), which is considered as the melting peak. The peak temperature was of the control sample was 283.40 ^{o}C, while it was observed at 291.02 ^{o}C in the treated sample. Thus, the analysis showed that the peak temperature of the Biofield Energy Treated sample was increased by 2.69%, as compared to the control sample (Table 4). Moreover, the latent heat of fusion (ΔH) of the treated sample was observed as 316.50J/g, which was significantly reduced by 16.36% compared with the ΔH of the control sample (378.40J/g).

The analysis indicated the improved thermal stability of the treated L-tryptophan sample after the Biofield Energy Treatment. Thus, it was assumed that the Biofield Energy Treatment cause some alterations in the molecular chains and crystallization structure [46] of the treated L-tryptophan, which might be responsible for such alterations in the melting temperature and latent heat of fusion as compared to the untreated sample.

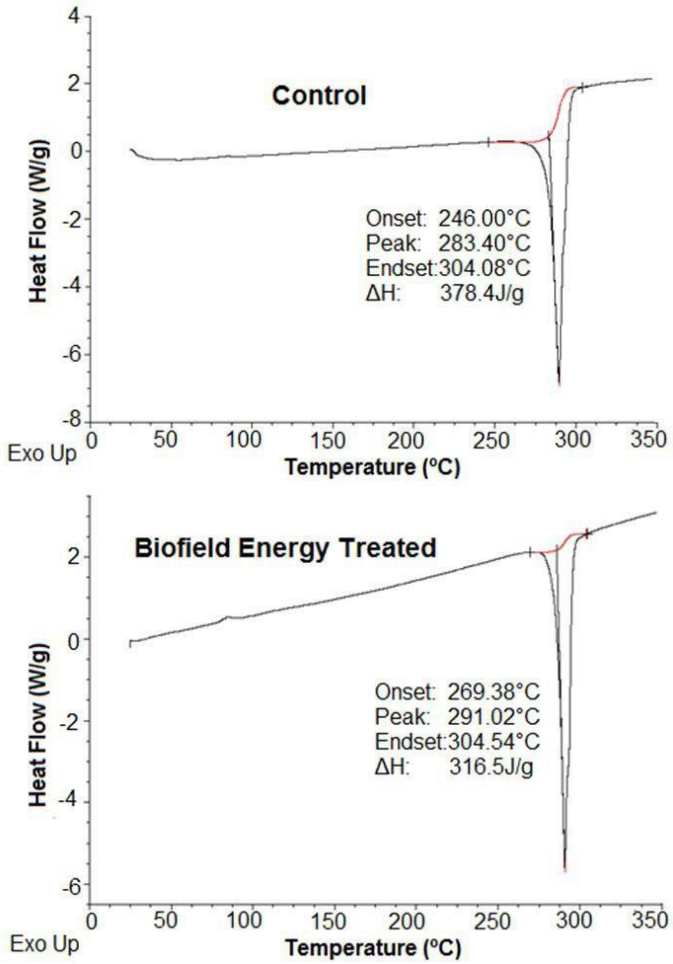

Figure 4: DSC thermograms of the control and treated L-tryptophan

Sample	Melting point (°C)	ΔH (J/g)
Control Sample	283.40	378.40
Biofield Energy Treated	291.02	316.50
% Change	2.69	-16.36

ΔH: Latent heat of fusion

Table 4: DSC data for the control and treated samples of L-tryptophan

Conclusion

The overall results of the control and Biofield Energy Treated L-tryptophan indicated that the Trivedi Effect®Consciousness Energy Healing Treatment imposes the significant impact on the physicochemical properties such as particle size, surface area, peak intensities, crystallite size, thermal degradation, melting point, and other thermal properties of the L-tryptophan sample. The particle size values of the Biofield Energy Treated sample was increased by 1.52% (d_{10}), 1.24% (d_{50}), 4.33% (d_{90}), and 3.31% {D(4,3)} compared with the control sample. Moreover, it also resulted in 1.05% decrease in the specific surface area of the Biofield Energy Treated sample, as compared to the untreated L-tryptophan sample. The peak intensities of the Biofield Energy Treated sample were observed to be altered ranging from -87.32% to 20.88%, while the crystallite sizes were altered ranging from -9.54% to 614.29%, compared to the untreated sample. Also, the average crystallite size the Biofield Energy Treated L-tryptophan sample was found to be increased by 25.97% as compared with the control sample. The total weight loss of the treated sample was reduced by 5.27%,

compared to the control sample. It resulted in a significant 228.88% increase in the residual amount of the treated L-tryptophan, as compared to the control sample. It revealed the improved thermal stability of the treated sample when compared with the untreated sample. Later on, the DTG data revealed two peaks in the thermograms of both the samples. The analysis showed that the T_{max} corresponding to 1st peak of the Biofield Energy Treated sample was significantly increased by 25.34%; whereas, the
T_{max} corresponding to 2nd peak was slightly decreased by 1.45% as compared to the control sample. The melting temperature of the treated sample was increased by 2.69%, while the ΔH_{fusion} was reduced by 16.36%, as compared to the control sample. It also indicated the improved thermal stability of the Biofield Energy Treated L-tryptophan as compared with the untreated sample. The overall analysis concluded that the Trivedi Effect®-Consciousness Energy Healing Treatment imposes a major impact on the physicochemical and thermal properties of the treated L-tryptophan sample that might improve the flowability, appearance, thermal stability, and storage properties of the sample, compared with the untreated sample. Hence, the Biofield Energy Treated L-tryptophan may be considered suitable for formulation of pharmaceuticals/nutraceuticals regarding the prevention and treatment of various diseases such as mental health disorders, improve athletic performance; treatment of emotional symptoms in premenstrual dysphoric disorder, quit smoking, attention deficit-hyperactivity disorder, ulcer healing caused by *H pylori*, mental functionality problems in the elderly, sleep apnea, seasonal affective disorder, and anxiety, etc.

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