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Consciousness Energy Healing Treatment: Impact on the Physicochemical and Thermal Properties of Pyridoxine HCl

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Abstract

Pyridoxine HCl plays an important role in the human body as a coenzyme in the synthesis process of amino acids and neurotransmitters such as serotonin, norepinephrine, aminolevulinic acid, sphingolipids, *etc.* The objective of this study was to determine the effect of the Trivedi Effect®-Consciousness Energy Healing Treatment on the various physicochemical and thermal properties of pyridoxine HCl using various analytical techniques such. The study plan involved dividing the pyridoxine HCl sample into two parts, in which, the first part was not given any treatment (control sample), while the second part was provided the Consciousness Energy Healing Treatment by a renowned Biofield Energy Healer, Gopal Nayak and named as the Biofield Energy Treated pyridoxine. The particle size values of the treated pyridoxine was altered by -19.51% (d_{10}), -11.92% (d_{50}), 2.46% (d_{90}), and -2.44% {D(4,3)}; whereas, the surface area was significantly increased by 18.92%, compared to the control sample. The powder X-ray diffraction data showed the remarkable increase in the peak intensities and crystallite sizes of the treated pyridoxine in the range from 8.81% to 21.57% and 9.64% to 17.85%, respectively compared to the control sample. Moreover, the treated pyridoxine also showed an increase in the average crystallite size by 13.69%, compared to the control sample. The total weight loss of the treated pyridoxine was significantly reduced by 13.35% during the thermal degradation; however, the residue weight was increased by 29.48% after degradation, in comparison to the control sample. The maximum thermal degradation temperature of the treated pyridoxine corresponding to 1st and 2nd peak was altered by 4.37% and 2.24%, respectively than the control sample. The latent heat of fusion of the treated pyridoxine was significantly increased by 5.89% compared to the control sample. Hence, it was assumed that the Trivedi Effect®-Consciousness Energy Healing Treatment might form a new polymorph of pyridoxine HCl that might be helpful in designing more efficacious pharmaceutical/nutraceutical product due to its better solubility, absorption, bioavailability, and thermal stability than the untreated sample.

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Introduction

Vitamin B_6 occurs in the nature in the form of pyridoxine, which after absorption in the gastrointestinal tract, converted to a form of coenzyme, pyridoxal phosphate [1]. Such conversion takes place in the liver, and further, it is involved in various metabolic processes. The converted form of pyridoxine *i.e.,* pyridoxal 5-phosphate plays an important role of coenzyme in the synthesis process of amino acids, neurotransmitters such as serotonin, and norepinephrine, aminolevulinic acid, and sphingolipids, *etc.* [2]. The other biochemical reactions that use pyridoxal 5'-phosphate includes amino acids and glycogen metabolism, and the synthesis of nucleic acids, sphingomyelin, haemoglobin, dopamine, and gamma-aminobutyric acid (GABA) [3]. Pyridoxine naturally occurred in fish, poultry, grains, pork, and legumes. It is also available in supplement form that is used in the prevention and treatment of vitamin B_6 deficiency in those people who couldn't get enough quantity from their diets [4]. Besides, there are certain conditions that may cause its deficiency within the body such as liver disease, alcoholism, heart failure, overactive thyroid, *etc*. Also, the low levels of vitamin B_6 may occur due to the use of some medications such as cycloserine, isoniazid, penicillamine, hydralazine, *etc.* [5]. Pyridoxine also plays a very important role in maintaining the health of skin, nerves, and red blood cells. There was evidence that denoted the role of pyridoxine in the prevention and treatment of peripheral neuropathy (a nerve disorder) that might occur due to the use of isoniazid [6]. Its use has been also evident in the treatment of certain hereditary disorders such as hyperoxaluria, xanthurenic aciduria, homocystinuria, *etc* [7]. The other health conditions that involved the use of pyridoxine with varying results are carpal tunnel syndrome; premenstrual syndrome (PMS); childhood autism; schizophrenia; attention deficit hyperactivity disorder (ADHD), *etc*. Several human studies reported the impact of pyridoxine deficiency on the cellular and humoral responses of the immune system, as the deficiency may cause altered lymphocyte differentiation and maturation, impaired antibody production, reduced delayed-type hypersensitivity (DTH) responses, decreased interleukin (IL)-2 production and lymphocyte proliferation and other similar immunologic activities [8, 9]. The pyridoxine deficiency may also cause microcytic anemia, electroencephalographic abnormalities, Crohn's disease, celiac disease, ulcerative colitis, depression, impaired renal function, dermatitis with cheilosis, and glossitis (swollen tongue), *etc* [10]. Therefore, for combating against the deficiency, vitamin B_6 was given in the form of pyridoxine supplements to the patients; however, the bioavailability and efficacy of the drug/nutraceutical depends upon its physicochemical properties [11]. Hence, the recent research studies mainly focus on improving the physicochemical and analytical properties of the drug that may affect its bioavailability to achieve the maximum biological activities [12]. The approach of Consciousness Energy Healing Treatment has been used nowadays by researchers to modify such physicochemical and thermal properties of the drug [13, 14]. Biofield Energy Treatment is a type of Energy Healing technique that may help in the treatment of various diseases and therefore, accepted by the National Center for Complementary and Alternative Medicine (NCCAM) under the CAM therapies [15, 16]. The Trivedi Effect®- Consciousness Energy Healing Treatment has also been used by various scientists to improve the physicochemical and thermal properties of various drugs. Its impact has been reported in the field of biotechnology [17, 18], agricultural productivity [19, 20], pharmaceuticals/nutraceuticals [21-23], metals, ceramics, and chemicals [24-26], antimicrobial activity [27-29], bone health [30], skin health [31, 32], and cancer research [33], *etc*. The current study has been structured with the aim to analyze the impact of the Biofield Energy Treatment on the physicochemical and thermal characteristics of pyridoxine HCl by using various analytical techniques.

Materials and Methods

Chemicals and Reagents

The test sample pyridoxine HCl was purchased from Tokyo Chemical Industry Co. Ltd., Japan but the other chemicals used in the experiment were purchased in India.

Consciousness Energy Healing Treatment Strategies

The test sample, i.e., pyridoxine HCl was divided into two equal parts. One part of pyridoxine was considered as a control sample where no Biofield Energy Treatment was provided. However, the second part of

pyridoxine was received the Consciousness Energy Healing Treatment (the Trivedi Effect®) remotely under standard laboratory conditions for 3 minutes by the renowned Biofield Energy Healer, Gopal Nayak, India, and known as the Biofield Energy Treated pyridoxine. The control sample was treated by a "sham" healer who did not have any awareness about the Biofield Energy Treatment. After the treatment, both the samples were kept in sealed conditions and characterized using sophisticated analytical techniques.

Characterization

The particle size analysis (PSA) of pyridoxine HCl was performed with the help of Malvern Mastersizer 2000, from the UK using the wet method [34, 35]. The powder X-ray diffraction (PXRD) analysis was performed with the help of Rigaku MiniFlex-II Desktop X-ray diffractometer (Japan) [36, 37]. The average crystallites size of was calculated using the Scherrer's formula (1)

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

Where G is the crystallite size in nm, λ is the radiation wavelength, k is the equipment constant, β is the full-width at half maximum, and θ is the Bragg angle [38].

Similarly, the thermal gravimetric analysis (TGA)/ differential thermogravimetric analysis (DTG) thermograms of pyridoxine were obtained with the help of TGA Q50 TA instruments. The differential scanning calorimetry (DSC) analysis was performed with the help of DSC Q200, TA instruments [39].

The % change in particle size, surface area, peak intensity, crystallite size, weight loss, degradation temperature, melting point, and latent heat of the treated pyridoxine was calculated compared with the control sample using the following equation 2:

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

Results and Discussion

Particle Size Analysis (PSA)

The particle size analysis was done and the observed data were presented in Table 1. The data indicated the alterations in the particle size distribution of the treated pyridoxine at d_{10}, d_{50}, d_{90}, and D(4, 3) by -19.51%, -11.92%, 2.46%, and -2.44%, respectively, in comparison to the control sample. It was observed that the consciousness energy healing treatment affected more on the small sized particle i.e., d_{10} and d_{50} μm sized particles as compared to d_{90}, and D(4, 3) of the pyridoxine HCl sample.

Besides, the analysis of the specific surface area of the treated pyridoxine showed that the surface area (0.43 m^2/g) was increased by 18.92% after the Biofield Energy Treatment, as compared with the control sample (0.37 m^2/g). In recent days the emphasis was done on improving the absorption and bioavailability of the drug by modifying the physicochemical properties of the crystalline compound and thereby increasing the surface area [40]. The enhanced surface area ultimately increases the surface area to volume ratio of the drug, which therefore increases the surface area available for the process of salvation [41]. Hence, it is presumed that the treated pyridoxine HCl showed improved surface area after the Biofield Energy Treatment that might help in increasing the solubility, absorption, and bioavailability of the drug as compared to the untreated sample.

Powder X-Ray Diffraction (PXRD) Analysis

Table 1. The particle size distribution of the control and treated pyridoxine HCl.

Parameter	d_{10} (μm)	d_{50} (μm)	d_{90} (μm)	D(4,3)(μm)	SSA(m^2/g)
Control	9.89	41.54	129.37	58.26	0.37
Biofield Energy Treated	7.30	36.88	133.41	57.31	0.44
Percent change (%)	-19.51	-11.92	2.46	-2.44	18.92

d_{10}, d_{50}, and d_{90}: particle diameter corresponding to 10%, 50%, and 90% of the cumulative distribution, D(4,3): the average mass-volume diameter, and SSA: the specific surface area.

The PXRD analysis was done for the control and treated samples of pyridoxine HCl and the corresponding diffractograms were recorded from diffraction analysis as given in Figure 1. The data corresponding to the characteristic peaks of the samples such as Bragg's angles, relative intensities, and crystallite sizes are presented in Table 2 for both the samples.

It was observed that the treated pyridoxine showed some alterations in the Bragg's angles of the characteristic peaks of the PXRD diffractograms as compared to the control sample. Also, the treated pyridoxine showed a significant increase in the peak intensities as well as the crystallite sizes in the range from 8.81% to 21.57% and 9.64% to 17.85%, respectively as compared to the control sample. The significant change was also observed in the average crystallite size of the treated pyridoxine (395.40nm) after the Biofield Energy Treatment that was increased by 13.69% in comparison to the control sample (347.80nm). The changes in Bragg's angles of the characteristic peaks along with the respective peak intensities and crystallite sizes compared to the untreated sample might be due to the changes in the crystalline pattern of the pyridoxine HCl after the Biofield Energy Treatment and there might be a new polymorph generated after the treatment [42]. Hence, the Biofield Energy Treatment might help in improving the solubility and drug profile by generating a new polymorph of the drug [43] as compared to the control sample.

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

The TGA/DTG technique was used to determine the changes in the thermal degradation pattern of the treated pyridoxine in comparison to the control sample. The previous scientific studies on the thermogravimetric analysis of pyridoxine HCl reported its thermal stability below 150°C [44]. The control and the treated samples also showed similar TGA thermograms (Figure 2) as reported in the literature. Further analysis indicated a significant reduction in the weight loss of the treated pyridoxine by 13.35% in comparison to the control sample (Table 3). The significant reduction in weight loss ultimately increases the residue amount remaining after the degradation of the treated sample and it was observed to be increased by 29.48% (Table 3) after the thermal degradation process as compared to the control sample. Therefore, the TGA analysis indicated the reduced thermal degradation of the treated pyridoxine HCl sample after the Biofield Energy Treatment in comparison to the untreated sample.

The DTG analysis showed the presence of two peaks in the thermograms of both the samples (Figure 3). The analysis of the peak temperatures of the DTG thermograms showed that the maximum degradation temperature (T_{max}) for the 1st and 2nd peak of the treated pyridoxine was decreased slightly by 4.37% and 2.24%, respectively, compared to the T_{max} of the control sample. The overall analysis indicated the alterations in the thermal degradation pattern of the treated pyridoxine along with the improved thermal stability after the Biofield Energy Treatment as compared to the control sample.

Differential Scanning Calorimetry (DSC) Analysis

The DSC data indicate the changes in the enthalpy as well as any endothermic and exothermic events that might happen in the process of heating of the treated pyridoxine in comparison to the untreated sample [45]. The DSC thermograms of the control and treated samples showed a single endothermic peak *i.e.,* the melting temperature peak, in their respective thermograms (Figure 4). The data indicated similar in the melting temperature of the treated pyridoxine (Table 4) in comparison to the control sample. However, the latent heat of fusion (ΔH_{fusion}) of the treated pyridoxine was increased by 5.89% compared to the ΔH_{fusion} of the control sample.

The significant change in the enthalpy of fusion of the treated pyridoxine might indicate some considerable changes in the molecular chain pattern and crystalline structure [46] as compared to the control pyridoxine HCl sample.

Conclusion

The study was done on pyridoxine HCl to determine the impact of the Trivedi Effect®-Consciousness Energy Healing Treatment on its physicochemical and thermal properties as compared to the untreated pyridoxine. The Biofield Energy Treated pyridoxine showed altered particle size values of the treated pyridoxine by -19.51% (d_{10}), -11.92% (d_{50}),

Table 2. PXRD data for the control and treated pyridoxine HCl.

Entry No.	Bragg angle (°2θ)		Intensity (cps)			Crystallite size (G, nm)		
	Control	Treated	Control	Treated	% change [a]	Control	Treated	% change [b]
1	10.12	10.25	128	155	21.09	297	350	17.85
2	16.73	16.86	51	62	21.57	334	381	14.07
3	20.52	20.68	840	914	8.81	350	403	15.14
4	24.81	24.95	1172	1398	19.28	374	422	12.83
5	27.59	27.73	985	1145	16.24	384	421	9.64

[a]denotes the percentage change in the relative intensity of the treated pyridoxine with respect to the control sample; [b]denotes the percentage change in the crystallite size of the treated pyridoxine with respect to the control sample.

Table 3. TGA/DTG data of the control and treated samples of pyridoxine HCl.

Sample	TGA		DTG	
	Total weight loss (%)	Residue %	Peak 1 T_{max} (°C)	Peak 2 T_{max} (°C)
Control	68.83	31.17	217.80	387.69
Biofield Energy Treated	59.64	40.36	208.28	379.01
% Change	-13.35	29.48	-4.37	-2.24

T_{max} = the temperature at which maximum weight loss takes place in TG or peak temperature in DTG.

Table 4. DSC data for the control and treated samples of pyridoxine HCl.

Sample	Peak Temperature (°C)	ΔH (J/g)
Control	215.42	304.09
Biofield Energy Treated	215.42	322.00
% Change	0.0	5.89

ΔH: Latent heat of fusion.

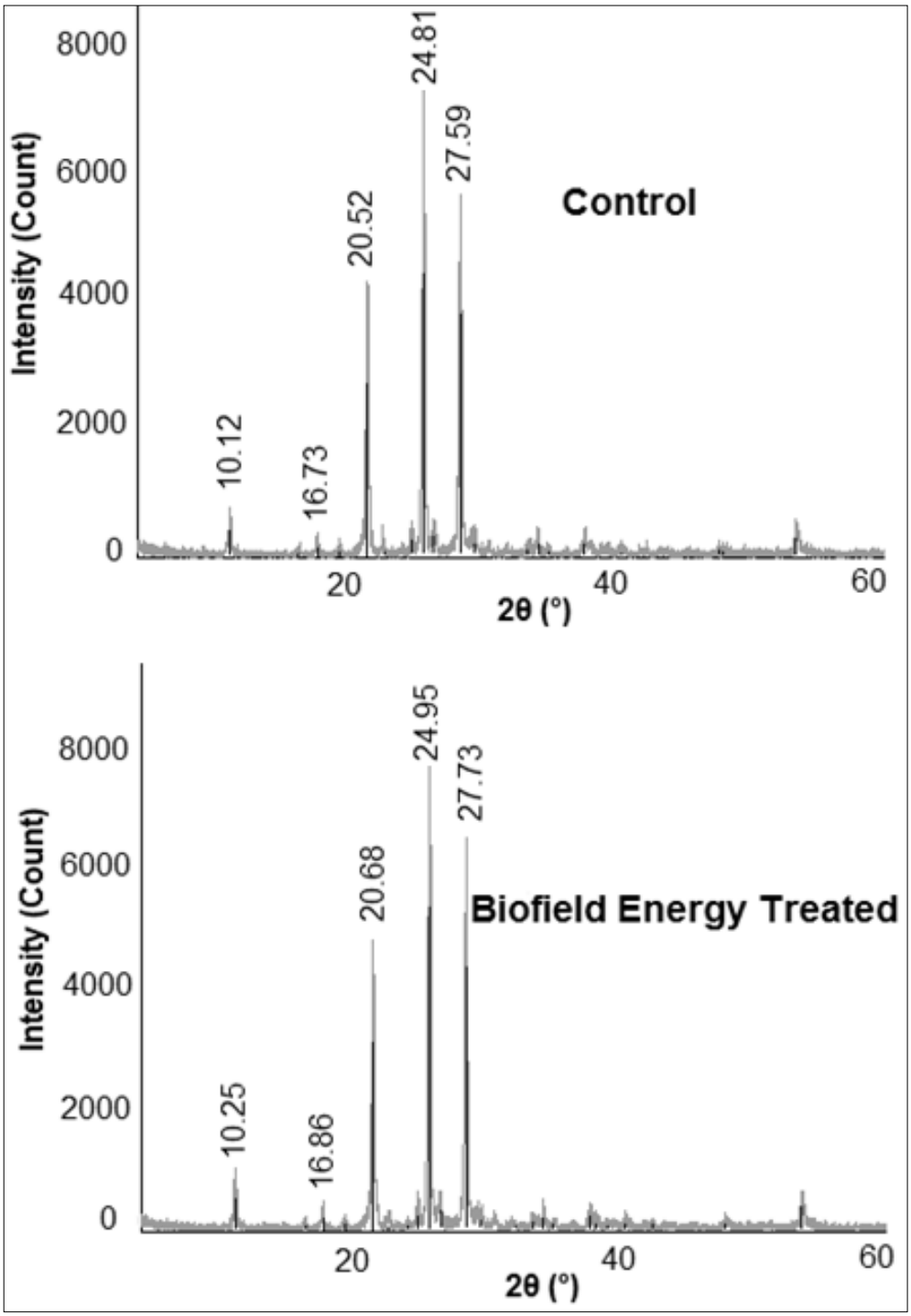

Figure 1. PXRD diffractograms of the control and treated pyridoxine HCl.

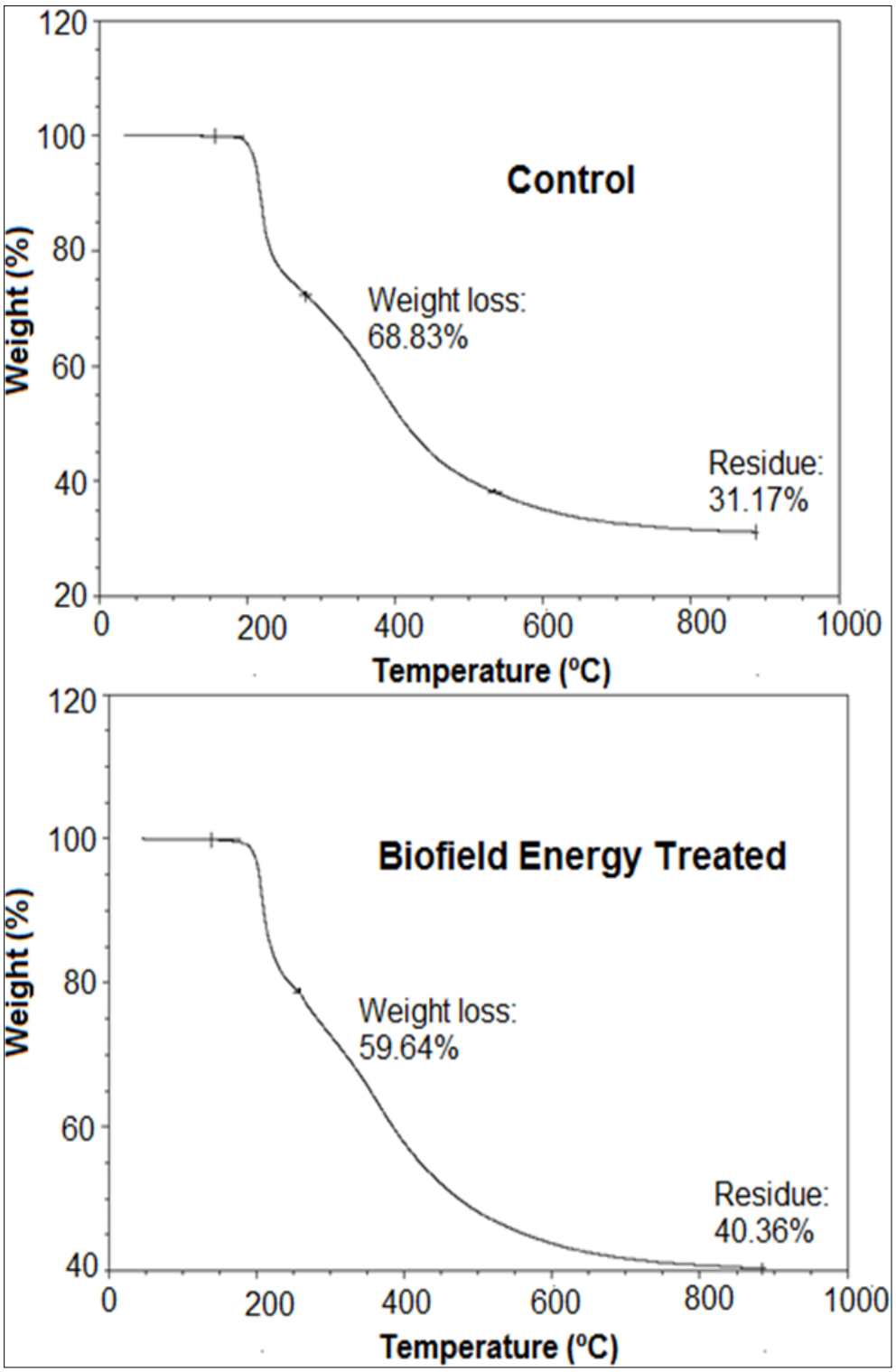

Figure 2. TGA thermograms of the control and treated pyridoxine HCl.

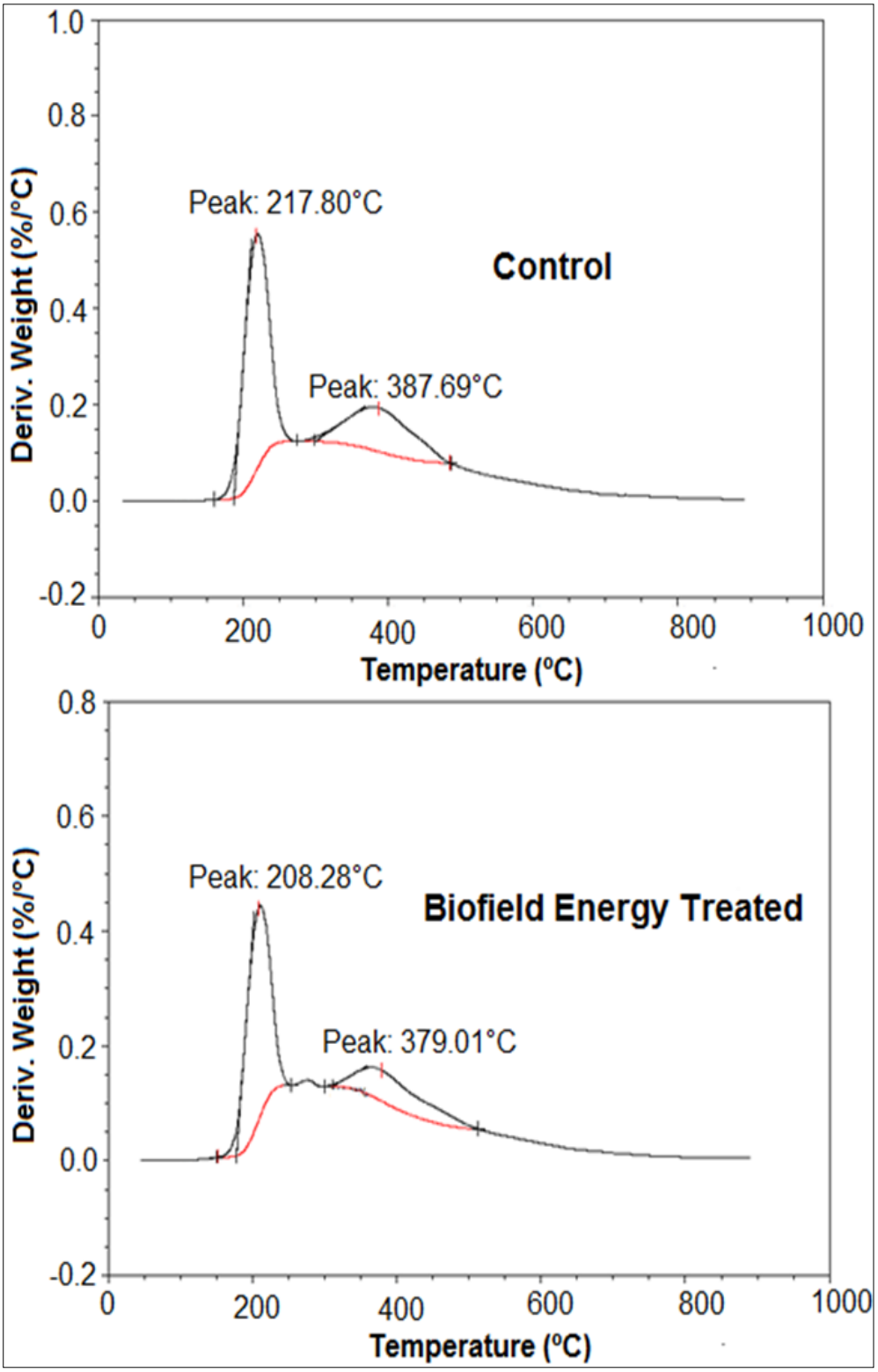

Figure 3. DTG thermograms of the control and treated pyridoxine HCl.

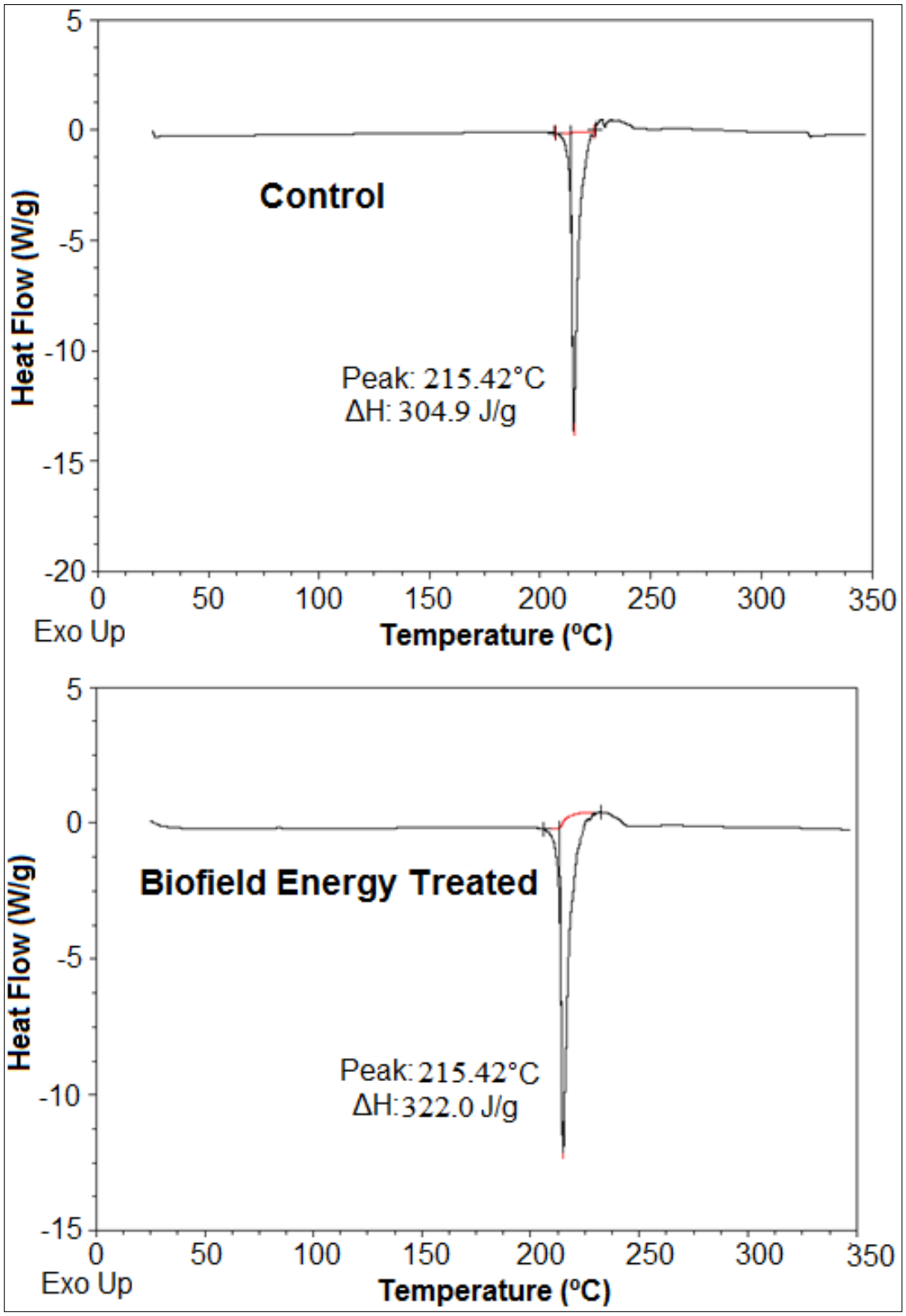

Figure 4. DSC thermograms of the control and treated pyridoxine HCl.

2.46% (d_{90}), and -2.44% {D(4,3)}; whereas, the surface area was significantly increased by 18.92%, compared to the control sample. This results concluded the potential increase in the dissolution and solubility of the treated pyridoxine that might improve the bioavailability as compared to the control sample. The PXRD data showed the remarkable increase in the peak intensities and crystallite sizes of the Biofield Energy Treated pyridoxine in the range from 8.81% to 21.57% and 9.64% to 17.85%, respectively compared to the control sample. Moreover, the treated pyridoxine also showed an increase in the average crystallite size by 13.69%, compared to the control sample. Hence, the PXRD data suggested the possible changes in the crystalline structure as well as the crystalline properties of the treated pyridoxine that might occur due to the possible formation of a new polymorph of pyridoxine HCl. The total weight loss of the Biofield Energy Treated sample was significantly reduced by 13.35% during the thermal degradation; however, the residue weight was increased by 29.48% after degradation, in comparison to the control sample. The ΔH_{fusion} of the Biofield Energy Treated pyridoxine was significantly reduced by 12.28% as compared to the control pyridoxine HCl sample. Thus, the thermal analysis concluded the reduced thermal degradation and improved ΔH_{fusion} of the Biofield Energy Treated pyridoxine increased thermal stability as compared to the untreated sample. Hence, the complete study concluded that the Trivedi Effect®-Consciousness Energy Healing Treatment might improve the solubility, absorption, thermal stability, and bioavailability of the pyridoxine HCl sample by altering its physicochemical and thermal properties. Hence, the treated pyridoxine HCl may be considered beneficial in formulation development due to better prevention and treatment against various diseases such as microcytic anemia, electroencephalographic abnormalities, Crohn's disease, celiac disease, ulcerative colitis, depression, impaired renal function, dermatitis with cheilosis, glossitis, carpal tunnel syndrome, premenstrual syndrome, childhood autism, sleep apnoea, schizophrenia, bipolar disorder, attention deficit hyperactivity disorder, *etc*.

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