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Full Length Research Paper

Physicochemical and Thermal Characterization of *Withania somnifera* (Ashwagandha) Root Extract: Impact of Biofield Energy Treatment

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Ashwagandha, also known as Indian Ginseng or Indian Winter cherry is a very important herb of Ayurveda system of medicine in India. The study involved the evaluation of the impact of the Trivedi Effect®-Consciousness Energy Healing Treatment on the various properties of ashwagandha root extract by using the analytical techniques. For this, the test sample was divided into two parts in which, the first part was considered as control where no treatment was given. While the second part was termed as the Biofield Energy Treated sample as it was provided the Trivedi Effect®-Consciousness Energy Healing Treatment remotely by a renowned Biofield Energy Healer, Gopal Nayak. The powder X-ray diffraction data of both the samples did not show any sharp diffraction peak in their diffractograms, thereby denoting their amorphous nature.The particle size values of the treated ashwagandha root extract were significantly decreased by 40.72% (d_{10}), 35.90% (d_{50}), 36.63% (d_{90}), and 35.37% {D(4,3)}; that causes 44.44% increase in the surface area as compared to the control sample. The weight loss of the treated sample was reduced by 9.86%; whereas, the residue weight was significantly increased by 95.82%compared to the control sample. The evaporating temperature of the treated sample was significantly reduced by 15.62%; while the latent heat of evaporation was increased by 34.42%, compared to the control sample. The Consciousness Energy Healing Treated ashwagandha extract showed the significant changes in its physicochemical and thermal properties that may help in improving the dissolution, solubility, and bioavailability along with its thermal stability compared with the untreated sample. Hence, the use of the Biofield Energy Treated ashwagandha extract in various nutraceutical formulations might be advantageous in terms of their stability, safety, and efficacy. Hence, The Biofield Energy Treated ashwagandha extract could be used for better prevention as well as treatment of tuberculosis, arthritis, tumors, leukoderma, asthma, bronchitis, menstrual problems, Parkinson's disease, chronic liver disease, bipolar disorder, anxiety, insomnia, *etc*.

Keywords: Ashwagandha extract, Consciousness Energy Healing Treatment, The Trivedi Effect®, PXRD, Particle size, TGA/DTG

1. INTRODUCTION

Ashwagandha (*Withania somnifera*, fam. Solanaceae) is commonly known as Indian Ginseng or Indian Winter cherry and is considered a very important herb of Ayurveda system of medicine in India. It is used widely as a Rasayanain Ayurvedafor possessing various health benefits [1]. Ashwagandha is known for its wide clinical uses that are attributed to its biologically active chemical constituents such as, the alkaloids (*e.g.,* isopelletierine, cuseohygrine, anaferine, anahygrine, *etc.*), steroidal lactones (withaferins, withanolides) and saponins [2]. The roots of ashwagandha are known for their pharmacological effects due to the presence of withanolides, *i.e.,* a group of steroidal lactones. The use of ashwagandha has been evident in the treatment of tuberculosis, arthritis, tumors, leukoderma, asthma, bronchitis, backache, menstrual problems, fibromyalgia, Parkinson's disease, and chronic liver disease, *etc*. [3-6].

Several chemical constituents of ashwagandha have been reported for their role in the immunomodulatory actions along with the treatment of the bipolar disorder, obsessive-compulsive disorder (OCD), anxiety, attention deficit hyperactivity disorder (ADHD), and insomnia [7]. Besides, it is also beneficial in reducing the side effects of medications used in the treatment of schizophrenia and cancer. Ashwagandha is used for reducing the fat and sugar levels in the blood and it is also used as a general tonic and an adaptogen that helps the body to cope with daily stress [8-10]. Some studies also reported the use of ashwagandha for improving the thinking ability, increasing sexual desire, improving fertility problems in men and women, decreasing the inflammation and thereby the pain and swelling, and preventing the aging effects [11-14]. In rural parts of India, the plant extract is applied externally to snakebite victims as an antidote. The scientific studies also reported its use in snake bite as the antitoxin-PLA2 glycoprotein isolated from ashwagandha had been found to neutralize the PLA2 activity of the Najanaja venom. Thus the use of ashwagandha plant extract as PLA2 toxin inhibitors are currently used in the development of novel therapeutic reagents in the treatment of snake bite [15].

The efficacy of any pharmaceutical/nutraceutical is highly affected by its physiochemical and thermal properties [16]. Hence, the researchers put their focus on inventing the various approaches regarding the attainment of maximum biological activity and improvement of efficacy through the alteration of the physiochemical and thermal properties of compounds. The Biofield Energy Healing Treatment is one among such approaches that are used nowadays for altering such properties of compounds. Biofield Energy is based on the concept that human beings are infused with a subtle form of energy [17]. Moreover, a human has the ability to harness energy from the universe and it could be transmitted to any living organism(s) or nonliving object(s) around the globe. There are various Energy therapies similar to it called the Complementary and Alternative Medicine (CAM) and are endorsed by the National Center for Complementary and Alternative Medicine (NCCAM). Such CAM therapies are deep breathing, yoga, Tai Chi, Qi Gong, meditation, massage, chiropractic/osteopathic manipulation, special diets, homeopathy, progressive relaxation, acupuncture, guided imagery, acupressure, hypnotherapy, relaxation techniques, movement therapy, healing touch, naturopathy, traditional Chinese herbs and medicines, *etc*. [18, 19]. Biofield Energy Healing has also been reported for its use in the treatment against various diseases and therefore considered as Energy therapy by NCCAM [20]. The Trivedi Effect®-Consciousness Energy Healing Treatment has been known worldwide as a CAM therapy that plays a significant effect on the living organisms and nonliving materials. The impact of Biofield Energy Treatment has been evident in the field of microbiology [21, 22], pharmaceutical, organic, and nutraceutical compounds [23-26], significant impact on the bone and skin health [27, 28] and

in the field of biotechnology [29], metals, ceramics, and polymers [30-32], and agriculture science [33, 34]. Thus, in this study, the effect of Biofield Energy Treatment was studied on the physicochemical and thermal properties of ashwagandha extract by using various analytical techniques.

2. MATERIALS AND METHODS

2.1. Chemicals and Reagents

The test sample *Withania somnifera* (Ashwagandha) hydroalcoholic root extract was purchased from Sanat Product Ltd., India and other chemicals used in the experiment also purchased from India.

2.2. Consciousness Energy Healing Treatment Strategies

The ashwagandha extract used in the experiment was equally divided into two parts. The first part of the sample was not given the Biofield Energy Treatment and considered as a control sample. The second part of the sample was received the Trivedi Effect®-Consciousness Energy Healing Treatment remotely in the proper laboratory conditions for 3 minutes and known as the Biofield Energy Treated sample. This Biofield Energy Treatment was provided by the renowned Biofield Energy Healer, Gopal Nayak, India, through the unique energy transmission process to the test sample. Further, regarding the comparison, the control sample was treated with a "sham" healer who did not have any knowledge about the Biofield Energy Treatment. Thereafter, both the samples were kept in sealed conditions and characterized using sophisticated analytical techniques.

2.3. Characterization

The powder X-ray diffraction (PXRD) analysis of ashwagandha extract was performed with the help of Rigaku Mini Flex-II Desktop X-ray diffractometer (Japan) [35, 36]. The average size of crystallites was calculated from PXRD data using the Scherrer's formula (1)

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

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

The particle size analysis (PSA) was performed with the help of Malvern Mastersizer 2000, from the UK using the wet method [38, 39]. Similarly, the thermal gravimetric analysis (TGA)/ differential thermogravimetric analysis (DTG) thermograms of ashwagandha extract were obtained with the help of TGA Q50 TA instruments. The differential scanning calorimetry (DSC) analysis of ashwagandha extract was performed with the help of DSC Q200, TA instruments [40].

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

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

3. RESULTS AND DISCUSSION

3.1. Powder X-ray Diffraction (PXRD) Analysis

The PXRD study was performed to analyse the peak intensity and crystallite size of the ashwagandha root extract and to determine any alteration in the crystallite patterns of the ashwagandha root extract after the Biofield Energy Treatment. The PXRD analysis of the control and treated samples (Figure 1) did not show any sharp diffraction peak in their respective diffractograms, which revealed the amorphous nature of both the samples. Thus, it was anticipated that the Biofield Energy Treatment did not have any effect on the crystalline properties of the ashwagandha sample.

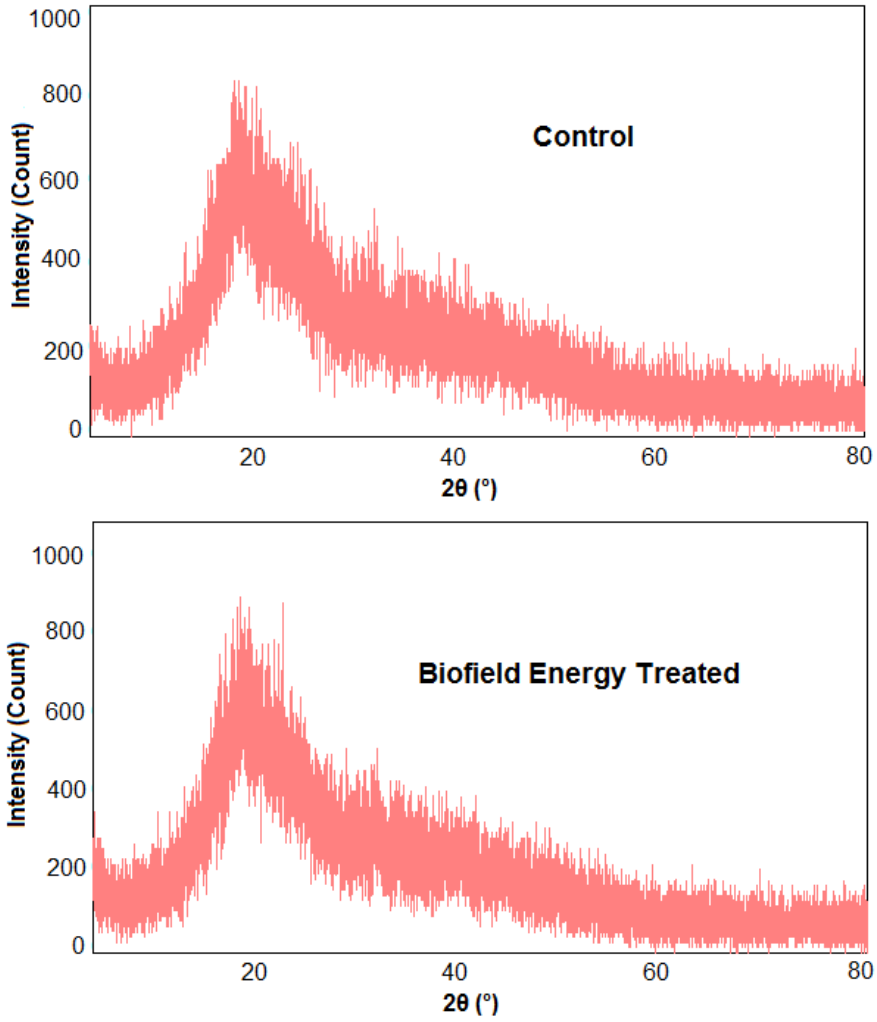

Figure 1: *PXRD diffractograms of the control and treated ashwagandha root extract.*

3.2. Particle Size Analysis (PSA)

The particle size analysis was done to determine the impact of the Biofield Energy Treatment on the particle size distribution of the ashwagandha extract. The data showed that the

particle size distributions of the treated sample were significantly decreased by 40.72%, 35.90%, 36.63%, and 35.37% at d_{10}, d_{50}, d_{90}, and D(4, 3), respectively, compared to the control sample (Table 2).

Table 2:*The particle size distribution of the control and treated ashwagandha root extract.*

Parameter	d_{10} (µm)	d_{50} (µm)	d_{90} (µm)	D(4,3)(µm)	SSA(m^2/g)
Control	29.69	85.56	187.29	98.36	0.18
Biofield Energy Treated	17.60	54.84	118.68	63.57	0.26
Percent change (%)	-40.72	-35.90	-36.63	-35.37	44.44

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 reduction in the particle sizes significantly affected the specific surface area of the treated sample (0.26 m^2/g), and it was observed to be increased by 44.44% as compared to the SSA of the control sample (0.18 m^2/g). The solubility, dissolution, and absorption of a drug plays a vital role in the bioavailability as well as the efficacy of drug and such properties could be affected by the particle size distribution of the drug [41, 42]. The research studies showed that decreasing the particle size of the compound further increases the effective surface area for salvation, and hence used to enhance the solubility and bioavailability of drug [43, 44]. Thus, the Biofield Energy Treatment of ashwagandha extract might improve the bioavailability and efficacy due to its decreased particle sizes, compared to the control sample.

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

The TGA/DTG technique helps in analysing the difference between the thermal degradation pattern and stability profile of the control and treated ashwagandha extract. The results showed that the total weight loss of the control sample was 90.67% during the thermal heating; however, the treated sample showed 81.73% weight loss, which was significantly decreased by 9.86%in the treated sample compared to the control sample. The resultant residue remaining after the degradation of the treated sample was significantly increased by 95.82% in comparison to the control sample (Table 3). Therefore, the TGA data indicated the increased thermal stability of the treated sample after the Biofield Energy Treatment in comparison to the control ashwagandha extract sample.

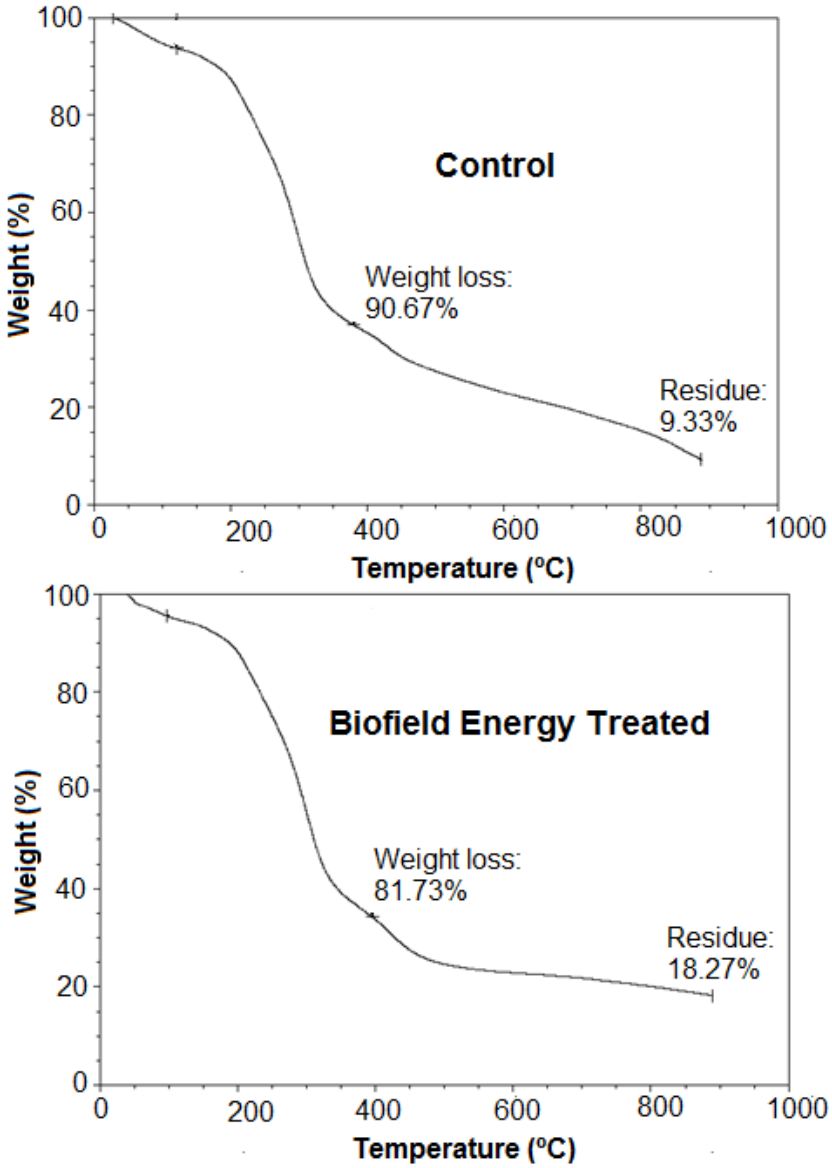

Figure 2: *TGA thermograms of the control and treatedashwagandha root extract.*

Table 3: *TGA/DTG data of the control and treated samples of ashwagandha root extract.*

Sample	TGA		DTG;T_{max} (°C)	
	Total weight loss (%)	Residue %	Peak 1	Peak 2
Control	90.67	9.33	296.75	432.01
Biofield Energy Treated	81.73	18.27	299.31	432.94
% Change	-9.86	95.82	0.86	0.22

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

The DTG data showed the presence of two peaks in the thermograms of both the samples (Figure 3). The maximum thermal degradation temperature (T_{max}) corresponding to the 1st and 2nd peak of the treated sample was slightly increased by 0.86% and 0.22%, respectively, as compared to the control sample. The DTG results also indicated the improved thermal stability of the ashwagandha extract after the Biofield Energy Treatment than the control sample. Thus, the overall TGA/DTG results showed that the thermal stability of the treated sample was increased and thermal degradation was reduced in comparison to the untreated sample.

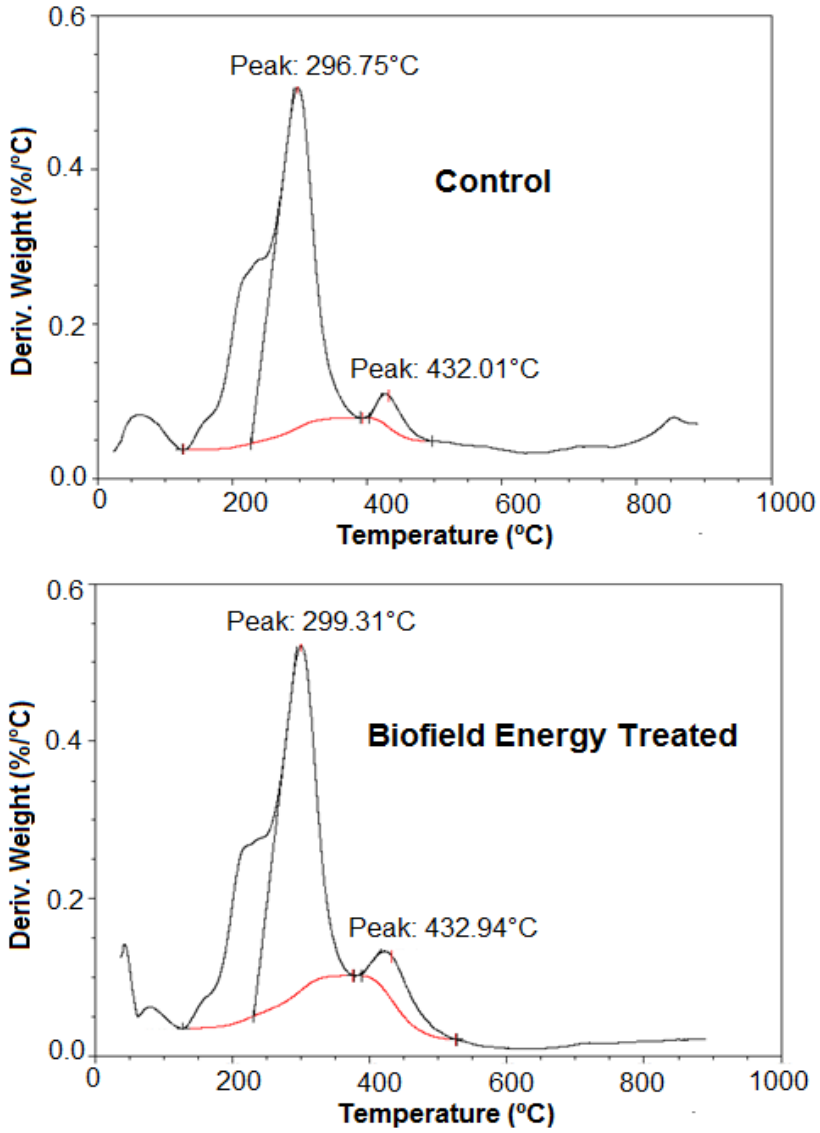

Figure 3: *DTG thermograms of the control and ashwagandha root extract.*

3.4. Differential Scanning Calorimetry (DSC) Analysis

The DSC analysis of the control and treated sample was done and the thermograms (Figure 4) were used to analyse the difference in the melting and other thermal behaviours [45] of the treated sample during heating as compared to the control sample. The results of the DSC

thermogram of the control sample showed the presence of an endothermic peak at 114.10ºC, which was reduced to 96.28ºC for the treated sample (Table 4). Thus, the evaporation temperature of the treated sample was significantly reduced by 15.62% as compared to the control sample. Besides, the $\Delta H_{evaporation}$of the treated sample was significantly increased by 34.42%, compared to the control ashwagandha extract sample(Table 4).

Table 4: *Comparison of DSC data between the control and treated ashwagandha root extract.*

Description	Melting Point (°C)	$\Delta H_{evaporation}$(J/g)
Control sample	114.10	64.79
Biofield Energy Treated	96.28	87.09
% Change	-15.62	34.42

ΔH: Latent heat of evaporation.

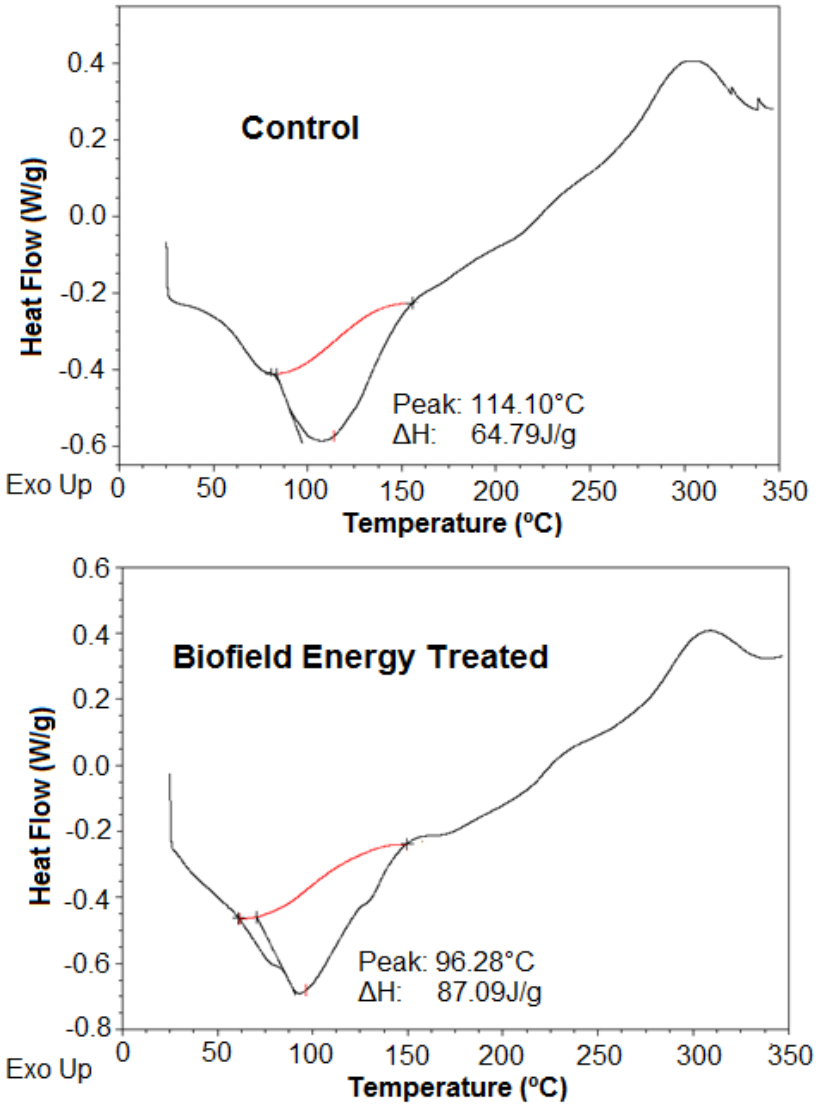

Figure 4: *DSC thermograms of the control and treated ashwagandha root extract.*

Thus, the DSC results showed significant changes in the melting temperature as well as $\Delta H_{evaporation}$ of the treated sample. Such alterations might result due to some changes in the intermolecular forces [45] of the particles of ashwagandha extract after the Biofield Energy Treatment, compared to the control sample.

4. CONCLUSIONS

This study was done to analyze the impact of the Trivedi Effect®-Consciousness Energy Healing Treatment on the properties of ashwagandha root extract such as the physicochemical and thermal properties. The powder X-ray diffraction data of both the samples did not show any sharp diffraction peak in their diffractograms, thereby denoting their amorphous nature. The particle size values of the Biofield Energy Treated sample was significantly decreased by 40.72% (d_{10}), 35.90% (d_{50}), 36.63% (d_{90}), and 35.37% {D (4,3)}; that causes 44.44% increase in the surface area as compared to the control sample. Thus, the Biofield Energy Treatment might help in increasing the dissolution, solubility, and absorption parameters of the treated sample than the control ashwagandha extract. The weight loss of the Biofield Energy Treated sample was reduced by 9.86%; whereas, the residue weight was significantly increased by 95.82% compared to the control sample. Thus, the TGA/DTG analysis indicated a significant increase in the thermal stability of the treated ashwagandha extract after the Biofield Energy Treatment in comparison to the control sample. The evaporating temperature of the Biofield Energy Treated sample was significantly reduced by 15.62%; while the latent heat of evaporation was increased by 34.42%, compared to the control sample. Thus, it could be concluded that the Trivedi Effect®-Consciousness Energy Healing Treatment significant affect the physicochemical as well as the thermal properties of ashwagandha extract that might help in improving its dissolution, solubility, and bioavailability profile along with the thermal stability than the untreated sample. Hence, The Biofield Energy Treated ashwagandha extract could be used in the formulation for better prevention as well as treatment of various diseases such as tuberculosis, arthritis, tumors, leukoderma, asthma, bronchitis, backache, menstrual problems, fibromyalgia, Parkinson's disease, chronic liver disease, bipolar disorder, obsessive-compulsive disorder (OCD), anxiety, attention deficit hyperactivity disorder (ADHD), insomnia, *etc*.

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