

## Consciousness Energy Healing Treatment: Impact on Physicochemical and Thermal Properties of Silver Sulfadiazine

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### Abstract

Silver sulfadiazine is a topical medicine that belongs to sulfa antibiotics class of drugs and used in treating wound infections in burn patients. The aim of this study was to determine the effect of Consciousness Energy Healing Treatment (the Trivedi Effect<sup>®</sup>) on the various properties of silver sulfadiazine with the help of modern analytical techniques. The sample was divided into two parts; the first part was not given any treatment and considered as a control sample, while the second part was provided the Consciousness Energy Healing Treatment by the Biofield Energy Healer, Gopal Nayak remotely, named as the treated sample. The powder XRD data showed significant alterations in the peak intensities of the treated sample ranging from -30.71% to 47.54% compared to the control sample. The crystallite size was altered ranging from -78.12% to 1.47%; and the average crystallite size was significantly reduced by 31.62% in the treated sample compared to the control sample. The particle sizes were decreased in the treated sample by 12.75%(d<sub>10</sub>), 4.98%(d<sub>50</sub>), 0.89%(d<sub>90</sub>), and 2.92%{D(4,3)}; thus, the specific surface area was significantly increased by 17.31% compared with the control sample. The latent heat of fusion and latent heat of decomposition were profoundly increased by 24.62% and 156.28%, respectively in the treated sample compared to the control sample. The total weight loss was increased by 3.08% and the residue amount was reduced by 4.44% in the treated sample compared to the control sample. Thus, the Trivedi Effect<sup>®</sup>-Consciousness Energy Healing Treated sample might form a new polymorph of silver sulfadiazine that possesses reduced particle size and improved thermal properties compared to the untreated sample. Therefore, the Biofield Energy treated sample can be used in nutraceutical/pharmaceutical formulation, which would show a better bioavailability and therapeutic response against various infections in comparison to the control sample.

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## Introduction

Silver sulfadiazine is a topical medicine that belongs to sulfa- antibiotics class of drugs. It is used as an adjuvant in treating and preventing wound infections in burn patients. Silver sulfadiazine works on the bacteria by stopping their growth on the open wound; thereby decrease the risk of their spreading to the surrounding skin or to the blood where they may cause sepsis [1]. Silver ions are considered as a biocide that has the ability to binds to a broad range of targets. Such targets include the nucleophilic amino acids, amino, sulfhydryl, phosphate, imidazole, and carboxyl groups present in the proteins. Moreover, the binding to such sites of proteins causes enzyme inhibition by the process of protein denaturation [2]. Also, silver binds to the proteins present on the surface membranes and thus causes proton leaks in the membrane, which ultimately leads to the death of the cell. Besides, sulfadiazine works as a competitive inhibitor of bacterial para-aminobenzoic acid (PABA), which inhibited the reaction that is vital in the folic acid synthesis [3,4]. Although silver sulfadiazine is used topically; however, it is poorly soluble and has limited penetration through intact skin [5]. In recent days, the studies have been done on the physicochemical properties of the drug that mainly impart their effect on the absorption and bioavailability parameters of the formulation [6]. Thus, this study was also done with emphasizing the techniques that may improve these parameters of silver sulfadiazine.

The Biofield Energy Healing Treatment (the Trivedi Effect<sup>®</sup>) has been considered these days as a novel approach due to its considerable impact on the physicochemical and thermal behaviour of various compounds [7-9]. The Trivedi Effect<sup>®</sup> is considered as a scientifically proven phenomenon which involves the principle that a person can harness the inherently intelligent energy from its surroundings and transmit it in an object(s) (living/non-living) through the possible mediation of neutrinos [10]. This kind of energy is known as Biofield Energy that is possessed by every living organism surrounding the body, and it is infinite and para-dimensional electromagnetic field. The Biofield Energy (Putative Energy Fields) based Healing Therapies have been reported by various studies due to their significant outcomes against various medical conditions [11]. Therefore, the National Institutes of

Health (NIH) and the National Center for Complementary and Alternative Medicine (NCCAM) included such Energy therapies under the category of Complementary and Alternative Medicine (CAM) and is accepted by the most of the U.S. population [12,13].

The Trivedi Effect<sup>®</sup>-Consciousness Energy Healing Treatment has also been known for its ability to alter the characteristic properties of the organic compounds [14-16], metals and ceramic [17,18], nutraceuticals/pharmaceuticals [19,20], and in the field of microbiology [21-23], skin health [24,25], biotechnology [26,27], bone health [28-30], cancer science research [31,32], and crops [33,34]. Hence, the current study was designed with the aim to analyze the effect of the Trivedi Effect<sup>®</sup>-Consciousness Energy Healing Treatment on the physicochemical and thermal properties of silver sulfadiazine using modern analytical techniques.

## Materials and Methods

### *Chemicals and Reagents*

Silver sulfadiazine was purchased from Tokyo Chemical Industry Co., Ltd., Japan. All other chemicals used during the experiments were of analytical grade available in India.

### *Consciousness Energy Healing Treatment Strategies*

The study involved dividing the silver sulfadiazine test sample into two parts. The first part was considered as a control sample and no Biofield Energy Treatment was given to it. Besides, the second part of the sample was treated with the Trivedi Effect<sup>®</sup>-Energy of Consciousness Healing Treatment by the renowned Biofield Energy Healer, Gopal Nayak, India, remotely under standard laboratory conditions for 3 minutes and known as the Biofield Energy Treated sample. Later, the control sample was treated with a "sham" healer (did not have any knowledge about the Biofield Energy Treatment) for comparison purpose. Consequently, the control and Biofield Energy Treated samples were kept in sealed conditions and characterized using modern analytical techniques.

### *Characterization*

The powder X-ray diffraction (PXRD), particle size analysis (PSA), thermogravimetric analysis (TGA)/differential thermogravimetric analysis (DTG), and

differential scanning calorimetry (DSC) analysis of silver sulfadiazine were performed. The powder XRD analysis of silver sulfadiazine powder sample was performed with the help of Rigaku MiniFlex-II Desktop X-ray diffractometer (Japan) [35, 36]. The average size of crystallites was calculated from powder XRD 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 (0.94),  $\lambda$  is the radiation wavelength (0.154056 nm for K $\alpha$ 1 emission),  $\beta$  is the full-width at half maximum, and  $\theta$  is the Bragg angle [37].

The PSA was performed using Malvern Mastersizer 2000, from the UK with a detection range between 0.01  $\mu$ m to 3000  $\mu$ m using the wet method. Similarly, the DSC analysis of silver sulfadiazine was performed with the help of DSC Q200, TA Instruments. The TGA/DTG thermograms of silver sulfadiazine were obtained with the help of TGA Q50 TA instruments [38,39].

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

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

## Results and Discussion

### Powder X-ray Diffraction (PXRD) Analysis

The Biofield Energy Treated sample showed sharp and intense peaks in its diffractogram that are similar to the diffractogram of the control sample, representing the crystalline nature of both the samples. However, the Bragg's angles ( $2\theta$ ) of these peaks of the treated sample were observed to differ from the Bragg's angles of the peaks of the control sample (Figure 1) in the PXRD diffractogram. The highest peak intensity in the diffractograms of the control and the treated sample was present at  $2\theta$  equal to  $10.08^\circ$  and  $10.37^\circ$ , respectively (Table 1, entry 2). Besides, the intensities of the peaks of the Biofield Energy Treated sample were found to be significantly altered ranging from -30.71% to 47.54% in comparison to the control sample. Also,

the crystallite sizes of the treated silver sulfadiazine sample were observed to be altered significantly compared to the control sample. The significant decrease in crystallite size was observed for most of the peaks ranging from 2.34% to 78.12%; however the crystallite size at position  $2\theta$  equals to  $20.69^\circ$  was slightly increased by 1.47% (Table 1, entry 7), as compared to the control sample. The average crystallite size of the treated silver sulfadiazine sample (307.36 nm) was also decreased by 31.62% in comparison to the control sample (449.50 nm).

It is studied in various researches that the peak intensity of each diffraction face varied based on the alteration in the crystal morphology of the crystalline compound [40]. Such changes in the intensities of the peak and the corresponding alterations in the crystallite sizes of the treated sample indicate that the crystal morphology might be affected due to the Biofield Energy Treatment, compared to the untreated sample. Also, the changes in the PXRD pattern denote polymorphic transitions taken place in the compound [41,42]. Various scientific studies confirm the impact of different polymorphic forms of any drug on its therapeutic efficacy, bioavailability, and toxicity [43, 44]. Thus, the Trivedi Effect<sup>®</sup> Treated sample might be considered to form a new polymorphic form of silver sulfadiazine that may offer better performance when used in the pharmaceutical formulations in comparison to the untreated sample.

### Particle Size Analysis (PSA)

The control and Biofield Energy Treated sample were analysed for their particle size distribution and the results were presented in Table 2. The control silver sulfadiazine showed particle size distribution at  $d_{10}$ ,  $d_{50}$ ,  $d_{90}$ , and D(4,3) as 7.92  $\mu$ m, 30.09  $\mu$ m, 93.61  $\mu$ m, and 43.51  $\mu$ m, respectively. On the other hand, the particle size values of the treated sample were observed as 6.91  $\mu$ m, 30.49  $\mu$ m, 92.78  $\mu$ m, and 42.24  $\mu$ m at  $d_{10}$ ,  $d_{50}$ ,  $d_{90}$ , and D(4,3), respectively. Hence, the Biofield Energy Treated sample showed a decrease in particle size values by 12.75%, 4.98%, 0.89%, and 2.92% at  $d_{10}$ ,  $d_{50}$ ,  $d_{90}$ , and D(4,3), respectively compared to the control silver sulfadiazine sample. The reduction in particle sizes resulted in a significant increase in the specific surface area of the treated sample (0.61m<sup>2</sup>/g)

Table 1. PXRD data for the control and Biofield Energy Treated silver sulfadiazine.

Entry No.	Bragg angle ( $^{\circ}2\theta$ )		Peak Intensity (%)			Crystallite size (G, nm)		
	Control	Treated	Control	Treated	% change <sup>a</sup>	Control	Treated	% change <sup>b</sup>
1	8.67	8.91	241	167	-30.71	564	272	-51.77
2	10.08	10.37	1059	968	-8.59	536	304	-43.28
3	12.83	13.16	57	51	-10.53	522	350	-32.95
4	15.97	16.23	63	61	-3.17	474	345	-27.22
5	18.34	18.61	150	171	14.00	621	399	-35.75
6	19.73	19.94	76	75	-1.32	348	310	-10.92
7	20.53	20.69	64	65	1.56	272	276	1.47
8	21.38	21.68	55	49	-10.91	478	353	-26.15
9	22.95	23.20	83	89	7.23	463	362	-21.81
10	24.16	24.39	113	118	4.42	368	327	-11.14
11	27.77	27.99	138	132	-4.35	175	167	-4.57
12	33.05	33.27	97	87	-10.31	385	376	-2.34
13	37.25	37.52	61	90	47.54	681	149	-78.12

<sup>a</sup>denotes the percentage change in the intensity of Biofield Energy Treated sample with respect to the control sample;

<sup>b</sup>denotes the percentage change in the crystallite size of Biofield Energy Treated sample with respect to the control sample.

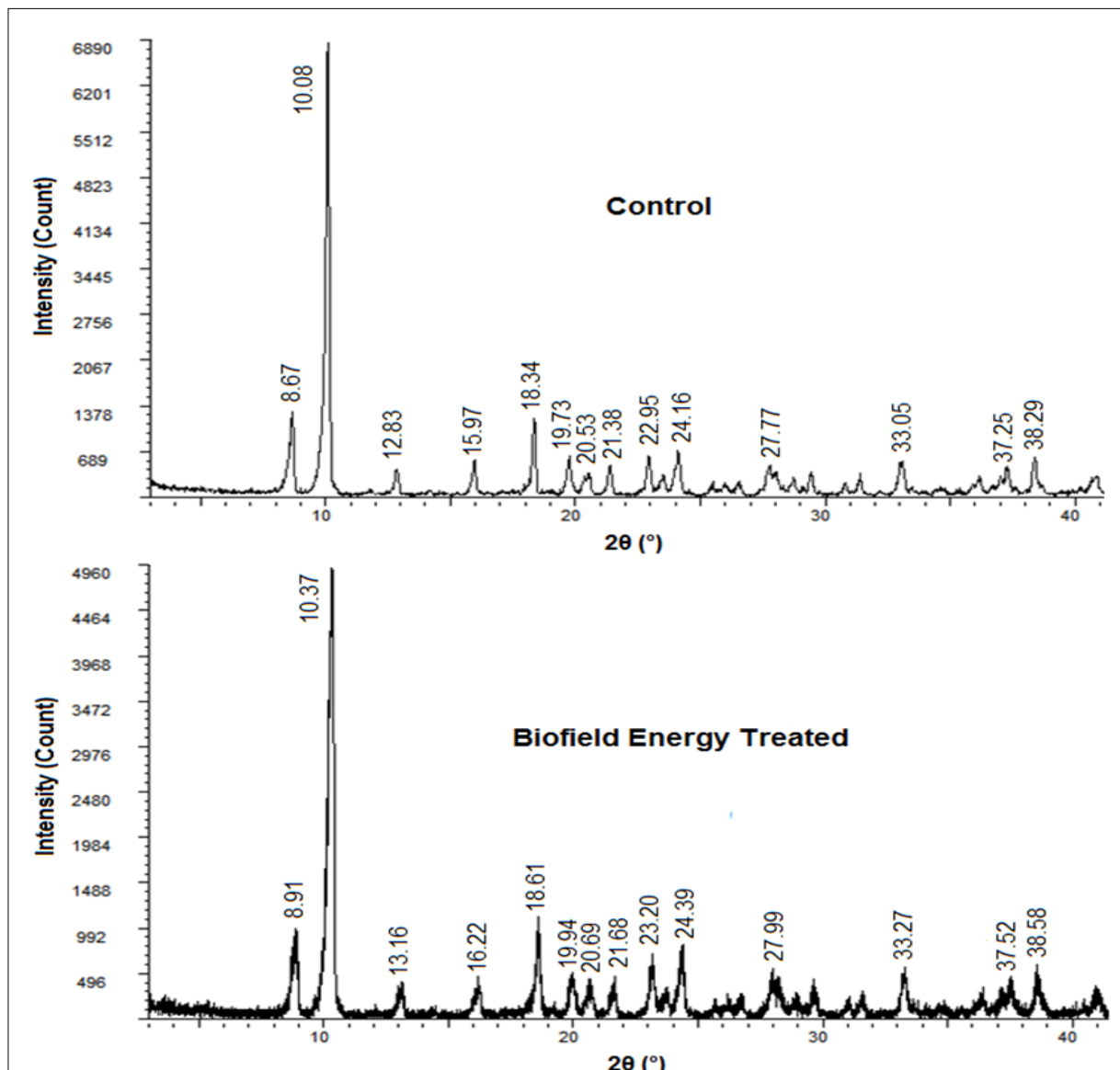


Figure 1. PXRD diffractograms of the control and Biofield Energy Treated silver sulfadiazine.

Table 2. Particle size distribution of the control and Biofield Energy Treated silver sulfadiazine.

Parameter	$d_{10}$ ( $\mu\text{m}$ )	$d_{50}$ ( $\mu\text{m}$ )	$d_{90}$ ( $\mu\text{m}$ )	$D(4,3)$ ( $\mu\text{m}$ )	SSA ( $\text{m}^2/\text{g}$ )
Control	7.92	32.09	93.61	43.51	0.52
Biofield Treated	6.91	30.49	92.78	42.24	0.61
Percent change* (%)	-12.75	-4.98	-0.89	-2.92	17.31

$d_{10}$ ,  $d_{50}$ , 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. \*denotes the percentage change in the Particle size distribution of the Biofield Energy Treated sample with respect to the control sample.

by 17.31% as compared with the control sample (0.52m<sup>2</sup>/g). Thus, it could be presumed that the Trivedi Effect<sup>®</sup>-Consciousness Energy Healing Treatment might help in reducing the particle size of the treated sample by acting like an external force [45]. Besides, it is established in various studies that the reduced particle size ensures increased surface area that ultimately helps to improve the bioavailability of the drug [46-48]. Hence, the Biofield Energy Treated silver sulfadiazine might offer improved absorption and in comparison to the untreated sample.

#### *Differential Scanning Calorimetry (DSC) Analysis*

The DSC analysis of the control and Biofield Energy Treated sample has been done (Table 3 and Figure 2) for characterizing the thermal behavior of both the samples. The DSC thermograms of both the samples showed two peaks among which, one was endothermic while the other was exothermic in nature. The thermograms of the control and treated sample showed the sharp endothermic peak at 262.90°C and 262.55°C, respectively that is considered as their melting point (Figure 2). The further analysis revealed a slight decrease in the melting point of the treated sample by 0.13% in comparison to the control sample (Table 3).

However, the latent heat of fusion ( $\Delta H_{\text{fusion}}$ ) of the treated silver sulfadiazine was found to be significantly increased by 24.62% compared with the control sample (Table 3). Besides, the exothermic peak observed in the thermograms of both the samples represents the decomposition temperature of silver sulfadiazine. Although, the decomposition temperature of the Biofield Energy Treated sample was slightly decreased by 1.65%, however, the corresponding  $\Delta H$  was significantly increased by 156.28% that could be due to the disruption in the molecular chains present in the crystal structure [45]. Hence, it is presumed that the Biofield Energy Treatment might disrupt the crystal structure of silver sulfadiazine that ultimately resulted in the decreased melting point of the Biofield Energy Treated sample in comparison to the control sample.

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

The TGA thermograms of the control and Biofield Energy Treated samples are shown in Figure 3

and the data were presented in Table 4. The data reported the increase in the total weight loss of the treated sample by 3.08% and the residue amount was decreased by 4.44% compared with the control sample (Table 4).

The DTG thermograms of both, the control and the treated silver sulfadiazine sample showed only one peak (Figure 4). The  $T_{\text{max}}$  of the control sample was observed at 281.80°C, while the treated sample showed it at 277.10°C. Thus, the Biofield Energy Treated sample showed a slight reduction in the  $T_{\text{max}}$  by 1.67% as compared with the control sample (Table 4). Overall, TGA/DTG revealed that the thermal stability of the Biofield Energy Treated silver sulfadiazine was altered compared with the control sample that might occur due to the reduction in the particle size of the sample [49].

#### **Conclusions**

The Trivedi Effect<sup>®</sup>-Consciousness Energy Healing Treatment has a profound impact on various physicochemical and thermal properties of silver sulfadiazine. The powder XRD data showed significant alterations in the peak intensities of the Biofield Energy Treated sample ranging from -30.71% to 47.54% compared to the control sample. The crystallite size was altered ranging from -78.12% to 1.47%; and the average crystallite size was significantly reduced by 31.62% in the Biofield Energy Treated sample compared to the control sample. The particle sizes were decreased in the Biofield Energy Treated sample by 12.75%(d<sub>10</sub>), 4.98%(d<sub>50</sub>), 0.89%(d<sub>90</sub>), and 2.92%{D(4,3)}; thus, the specific surface area was significantly increased by 17.31% compared with the control sample. The  $\Delta H_{\text{fusion}}$  and  $\Delta H_{\text{decomposition}}$  were profoundly increased by 24.62% and 156.28%, respectively in the Biofield Energy Treated sample compared to the control sample. The total weight loss was increased by 3.08% and the residue amount was reduced by 4.44% in the Biofield Energy Treated sample compared to the control sample. Overall, it is concluded that the Trivedi Effect<sup>®</sup>-Consciousness Energy Healing Treatment might have generated a novel polymorph of silver sulfadiazine that may show better bioavailability in comparison to the control sample. Hence, the Consciousness Energy Healing Treated silver sulfadiazine would be more useful in designing the formulations with improved efficacy

Table 3. DSC data for both control and Biofield Energy Treated samples of silver sulfadiazine.

Sample	Melting point (°C)	$\Delta H(J/g)$	Decomposition temperature	$\Delta H(J/g)$
Control Sample	262.90	45.29	282.29	3.50
Biofield Energy Treated	262.55	56.44	277.64	8.97
% Change*	-0.13	24.62	-1.65	156.28

$\Delta H$ : Latent heat of fusion/ decomposition, \*denotes the percentage change of the Biofield Energy Treated sample with respect to the control sample.

Table 4. TGA/DTG data of the control and Biofield Energy Treated samples of silver sulfadiazine.

Sample	TGA		DTG
	Total weight loss (%)	Residue %	$T_{max}$ (°C)
Control	58.99	41.01	281.80
Biofield Energy Treated	60.81	39.19	277.10
% Change*	3.08	-4.44	-1.67

\*denotes the percentage change of the Biofield Energy Treated sample with respect to the control sample,  $T_{max}$  = the temperature at which maximum weight loss takes place in TG or peak temperature in DTG.

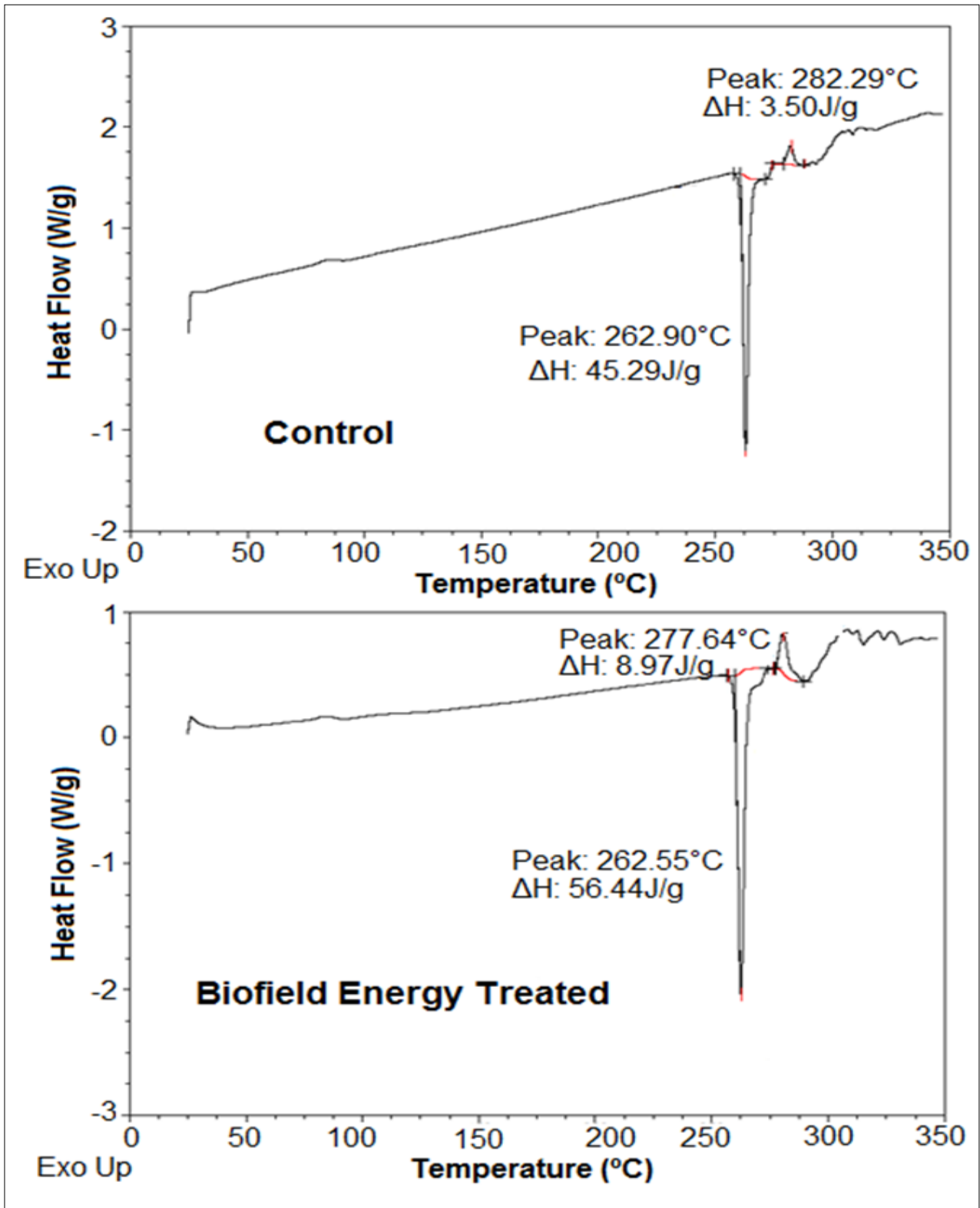


Figure 2. DSC thermograms of the control and Biofield Energy Treated silver sulfadiazine.



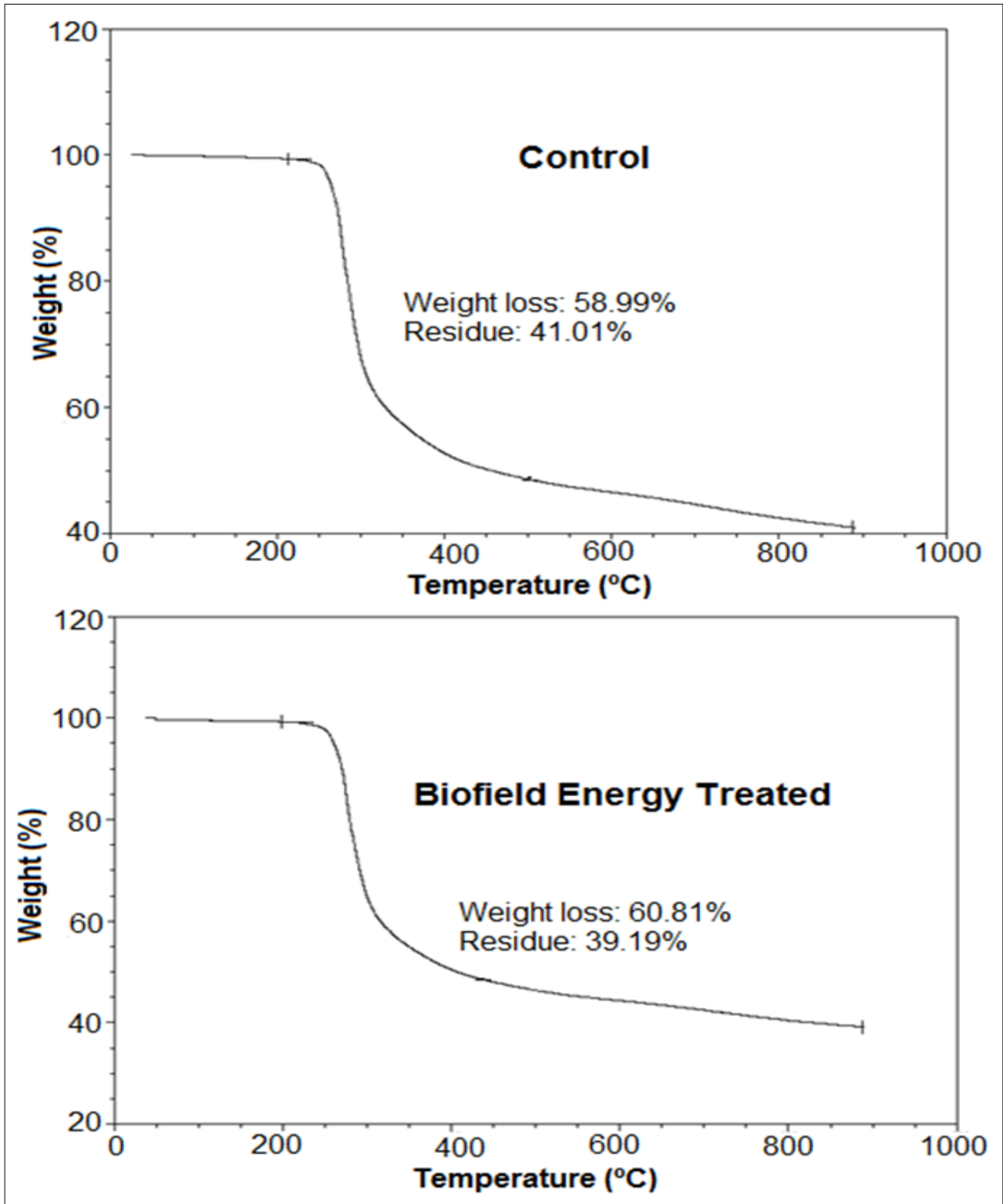


Figure 3. TGA thermograms of the control and Biofield Energy Treated silver sulfadiazine.

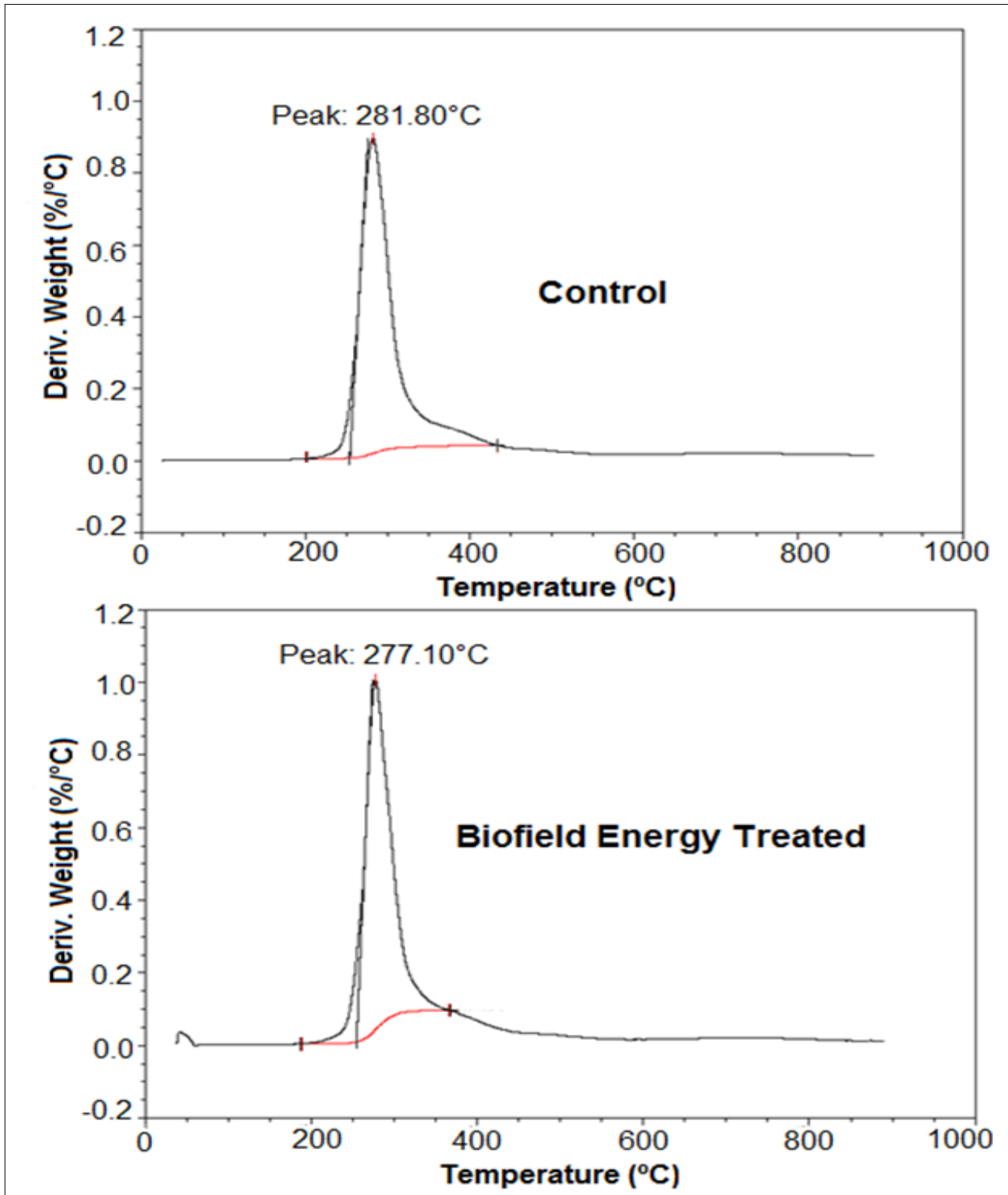


Figure 4. DTG thermograms of the control and Biofield Energy Treated silver sulfadiazine

against burning infections.

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### Conflict of Interest

Authors declare no conflict of interest.

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