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Potential Impact of BioField Treatment on Atomic and Physical Characteristics of Magnesium

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Abstract

Magnesium (Mg), present in every cell of all living organisms, is an essential nutrient and primarily responsible for catalytic reaction of over 300 enzymes. The aim of present study was to evaluate the effect of biofield treatment on atomic and physical properties of magnesium powder. Magnesium powder was divided into two parts denoted as control and treatment. Control part was remained as untreated and treatment part received biofield treatment. Both control and treated magnesium samples were characterized using X-ray diffraction (XRD), surface area and particle size analyzer. XRD data showed that biofield treatment has altered the lattice parameter, unit cell volume, density, atomic weight, and nuclear charge per unit volume of treated magnesium powder, as compared to control. In addition, the crystallite size of treated magnesium was significantly reduced up to 16.70, 16.70, and 28.59% on day 7, 41 and 63 respectively as compared to control. Besides this, the surface area of treated magnesium powder was increased by 36.5 and 10.72% on day 6 and 72 respectively, whereas it was reduced by 32.77% on day 92 as compared to control. In addition, biofield treatment has also altered the particle sizes d_{10}, d_{50}, and d_{99} (size, below which 10, 50, and 99% particles were present, respectively) as compared to control. Overall, data suggest that biofield treatment has substantially altered the atomic and physical properties of treated magnesium powder.

Keywords: Biofield treatment; Magnesium powder; X-ray diffraction; Fourier transform infrared; Particle size; Surface area

Introduction

Magnesium (Mg) is the third most abundant metal in the earth's crust. It exists in the form of hexagonal closed packed (HCP) crystal structure. Magnesium is the fourth most abundant mineral in the human body, which are responsible for various metabolic reactions and biological mechanisms. A normal human body contains about 22-26 grams of magnesium, in which 60% is present in skeleton, 39% in intracellular medium, and 1% in extracellular compartment. Furthermore, the main source of energy for living cells *i.e.* adenosine triphosphate (ATP) must require magnesium ions for their biological activity [1]. In addition, magnesium is essential for plants in chlorophyll synthesis and photosynthesis [2]. Although the magnesium is found in many food ingredients, but it is usually present in very low levels [3]. Thus, deficiency of magnesium is likely common among geriatric [4], obese, diabetics, and alcoholic people [5]. Deficiency of the magnesium in human body, known as hypomagnesaemia that causes many diseases such as osteoporosis, diabetes, and heart disease [6,7]. Currently, magnesium deficiency can be overcome by increase of magnesium concentration in diet or through oral supplements. Nevertheless, in oral supplement of magnesium, the dissolution, absorption, bioavailability, and permeability plays a major role. It was reported that dissolution and bioavailability of minerals are closely related to its crystal structure, crystallite size, and physical properties such as particle size and surface area [8]. Recently, dissolution, absorption and bioavailability of magnesium is improved by using various kind of magnesium-salts such as magnesium oxide, magnesium chloride, magnesium sulphate, and magnesium citrate [9,10]. Besides this, magnesium is also utilized in synthesis of Grignard reagent, which is primarily responsible for the formation of carbon-carbon bonds, carbon-silicon bonds, carbon-boron bonds, carbon-phosphorus bonds in synthesis of various pharmaceutical products [11]. After considering the vast importance of magnesium in life of living organisms, authors wish to investigate an economically safe approach that could be beneficial to modify the atomic and physical properties of magnesium powder.

In physics, the energy is considered as the ability to do work; which fundamentally interrelates with matter as $E=mc^2$ (Einstein's famous equation). However the energy can be considered as a field of force which effectively interacts with any matter at a distance and cause action. Researchers have confirmed that bio magnetic fields are present around human body, which have been evidenced by electromyography (EMG), electrocardiography (ECG) and electroencephalogram (EEG) [12]. Scientists have postulated that it is due to the flow of bioelectricity (generated from heart, brain functions or due to the motion of charged particles such as protons, electrons, and ions) in the human body. As per the basic fundamental law in physics, when an electrical signal passes through any material, a magnetic field is generated in the surrounding space [13]. Hence, a magnetic field is created along with the bioelectricity in human body, known as bio magnetic field. Due to this, a human has ability to harness the energy from environment/universe and can transmit into any object (living or non-living) around the Globe. The object(s) always receive the energy and responded into useful way that is called biofield energy. This process is termed as biofield treatment. Mr. Trivedi's biofield treatment is known as Trivedi Effect®. Mr. Trivedi's biofield treatment is known to alter the physical, structural and atomic level in various metals [14-16] and ceramics [17,18] in material science. Additionally, biofield treatment has significantly studied in the field of microbiology [19-21], biotechnology [22,23], and agriculture [24-26]. Recently, it was reported that biofield treatment had increased the particle size by six fold and enhanced the crystallite size by two fold in zinc powder [27]. In another report,

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biofield treatment has shown the significant effect in carbon allotropes, where the unit cell volume was decrease by 1% and crystallite size was increased by 100% [28]. Based on the outstanding result achieved by biofield treatment on metals and ceramics, an attempt was made to evaluate the effect of biofield treatment on atomic and physical properties of magnesium powder.

Experimental

The magnesium powder was purchased from MEPCO, India. The sample was equally divided into two parts, considered as control and treated. Treated group was in sealed pack and handed over to Mr. Trivedi for biofield treatment under laboratory condition. Mr. Trivedi provided the biofield treatment through his energy transmission process to the treated group without touching the sample. The control and treated samples were characterized using X-ray diffraction (XRD), surface area analyzer, and particle size analyzer at different time periods.

X-ray diffraction study

XRD analysis of control and treated magnesium powder was carried out on Phillips, Holland PW 1710 X-ray diffractometer system, which had a copper anode with nickel filter. The radiation of wavelength used by the XRD system was 1.54056Å. The data obtained from this XRD were in the form of a chart of 2θ vs. intensity and a detailed table containing peak intensity counts, d value (Å), peak width (θ°), relative intensity (%) etc. Additionally, PowderX software was used to calculate lattice parameter and unit cell volume of magnesium powder samples.

Weight of the unit cell was calculated as, atomic weight multiplied by the number of atoms present in a unit cell. Density of the unit cell was computed as follows:

$$Density = \frac{Weight\ of\ unit\ cell}{Volume\ of\ unit\ cell}$$

Atomic Weight = [(Number of total proton × mass of proton) + (Number of total neutron × mass of neutron) + (Number of total electron × mass of electron)]

Atomic weight in g/mol was calculated as multiplying the atomic weight by the Avogadro number (6.023×10^{23}). Total nuclear charge was calculated as the number of protons multiplied by charge on a proton (1.6×10^{-19}C). Nuclear charge per unit volume was computed as follow:

$$Nuclear\ charge\ per\ unit\ volume = \frac{Total\ nuclear\ charge\ in\ an\ atom}{Volume\ of\ an\ atom}$$

The crystallite size (G) was calculated by using formula:

$G = k\lambda/(b\cos\theta)$,

Here, λ is the wavelength of radiation used, b is full width half maximum (FWHM) and k is the equipment constant (0.94). Furthermore, the percent change in the lattice parameter was calculated using following equation:

$$\%\ change\ in\ lattice\ parameter = \frac{[A_{Treated} - A_{control}]}{A_{control}} \times 100$$

Where $A_{Control}$ and $A_{Treated}$ are the lattice parameter of treated and control samples respectively. Similarly, the percent change in all other parameters such as unit cell volume, density, atomic weight, nuclear charge per unit volume and crystallite size were calculated.

Surface area analysis

The surface area was measured by the Surface area analyzer, Smart SORB 90 based on Brunauer–Emmett–Teller (BET), which had a detection range of 0.20–1000 m^2/g. Percent changes in surface area were calculated using following equation:

$$\%\ change\ in\ surface\ area = \frac{[S_{Treated} - S_{control}]}{S_{control}} \times 100$$

Where, $S_{Control}$ and $S_{Treated}$ are the surface area of control and treated samples respectively.

Particle size analysis

Particle size of control and treated magnesium powder was evaluated using, laser particle size analyzer SYMPATEC HELOS-BF, which had a detection range of 0·1-875 μm. The particle size data was collected in the form of a chart of particle size *vs.* cumulative percentage. Four parameters of particle sizes *viz.* $d_{10,}$ d_{50}, and d_{99} (size below which 10%, 50% and 99% particles are present, respectively) were calculated from the particle size distribution curve. The percent change in particle size was calculated using following equation:

$$\%\ change\ in\ particle\ size, d_{10} = \frac{[(d_{10})_{Treated} - (d_{10})_{control}]}{(d_{10})_{control}} \times 100$$

Where, $(d_{10})_{Control}$ and $(d_{10})_{Treated}$ are the particle size, d_{10} of control and treated samples respectively. Similarly, the percent change in particle size d_{50} and d_{99} were calculated.

Results and Discussion

X-ray diffraction (XRD)

XRD results of control and treated magnesium samples are presented in Table 1. It was found that that lattice parameter of unit cell was slightly increased by 0.08, 0.07, 0.05 % on day 7, 41, and 63 respectively as compared to control. The increase in lattice parameter leads to increase the unit cell volume by 0.16, 0.13, and 0.09% on day 7, 41 and 63 respectively as compared to control. While the density was reduced by 0.16, 0.13 and 0.09% on day 7, 41 and 63 respectively as compared to control (Figure 1). The decrease in density could be due to increase in unit cell volume in magnesium powder after biofield treatment. Furthermore, data exhibited that atomic weight of treated magnesium was increased by 0.16, 0.13, and 0.09% on day 7, 41, and 63 respectively as compared to control. In addition, nuclear charge per unit volume was reduced by 0.24, 0.20, and 0.14% on day 7, 41, and 63 respectively as compared to control (Figure 2). It was previously reported that biofield treatment has altered the atomic weight and

Group	Lattice parameter (Å)	Unit cell volume ($\times 10^{-23} cm^3$)	Density (g/cc)	Atomic weight (g/mol)	Nuclear Change per unit volume (C/cm^3)	Crystallite size (nm)
Control, Day 0	3.2094	4.6525	1.7275	24.205	110892.80	87.16
Treated, Day 7	3.2120	4.6600	1.7248	24.244	110625.20	72.60
Treated, Day 41	3.2115	4.6586	1.7253	24.237	110675.07	72.60
Treated, Day 63	3.2109	4.6568	1.7260	24.228	110739.24	62.23

Table 1: X-ray diffraction analysis of magnesium powder.

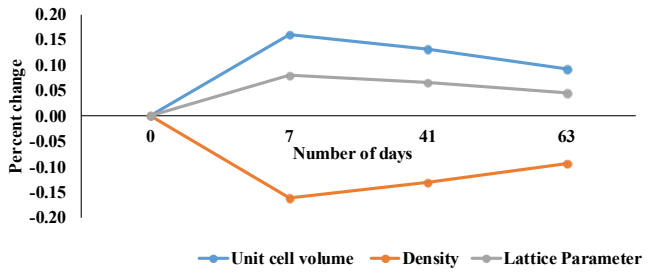

Figure 1: Effect of biofield treatment on unit cell volume and density of magnesium powder.

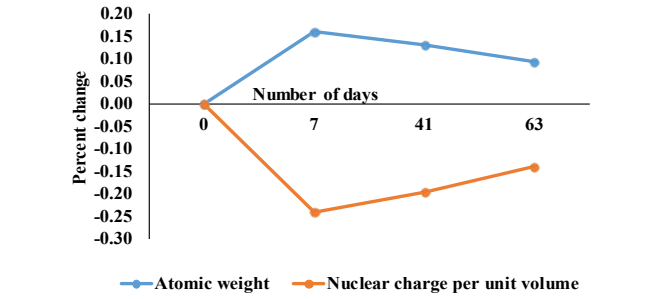

Figure 2: Effect of biofield treatment on atomic weight and nuclear charge per unit volume of magnesium powder.

nuclear charge per unit volume in iron, zinc and copper [27,28]. The change in atomic weight and nuclear charge per unit volume indicates that number of protons and neutron probably altered after biofield treatment. It could be possible if a weak reversible nuclear level reaction occurred in treated magnesium after biofield treatment. Thus, it is assumed that biofield treatment probably transferred the energy to magnesium atoms and that might cause these alteration at nuclear level [29]. Besides this, the crystallite sizes of control and treated magnesium powder were computed using Scherrer formula and presented in Table 1. Data showed that the crystallite size was decreased from 87.16 (control) to 72.60, 72.60, and 62.23 nm in treated magnesium sample on day 7, 41, and 63, respectively. It suggests that crystallite size of treated magnesium powder was significantly reduced by 16.70, 16.70, and 28.60% on day 7, 41, and 63, respectively as compared to control (Figure 3). It was previously reported that biofield treatment has reduced the crystallite size in cobalt (Co), manganese (Mn), and titanium (Ti) [27]. Moreover, the existence of severe lattice strains in treated magnesium are evidenced by the change in unit cell volume (Figure 1). Thus, it is assumed that presence of these internal strains may lead to fracture the grains into sub grains and decrease the crystallite size. Furthermore, it is demonstrated that the rate of dissolution may also be altered by choosing a suitable polymorph of a compound, which has low crystallinity or high amorphous phase and hence exhibits higher solubility [30]. Torrado *et al.* reported that solids with small crystallite size exhibits faster dissolution rate as compared to solids with higher crystallite size [31]. Thus, it is hypothesized that biofield treated magnesium powder may exhibit the higher dissolution rate as compared to control.

Surface area analysis

Surface area analysis of magnesium powder is illustrated in Table 2 and Figure 4. Data showed that surface area of treated magnesium powder was increased from 0.30 m^2/g (control) to 0.41 and 0.33 m^2/g on day 6 and 72 respectively, whereas it was decreased to 0.20 m^2/g on day 92 as compared to control (Table 2). This indicates that surface area of treated magnesium powder was increased by 36.5 and 10.72% on day 6 and 72 respectively, whereas it was decreased by 32.77% on day 92 as compared to control (Figure 4). Our group previously reported that biofield treatment has significantly increased the surface area in zirconium oxide [32]. Besides, Noyes-Whitney proposed the relationship between rate of dissolution (R) and surface area (S) of a solid as following [33]:

$$R = \frac{DS(C_s - C)}{L}$$

Where, D is diffusion constant, C_s and C are the concentration in the bulk dissolution medium and diffusion layer surrounding the solid, respectively, L is diffusion layer thickness. Thus, Noyes-Whitney equation, inferred that the rate of dissolution may be modified primarily by altering the surface area of the solid. Hence, it is assumed that biofield treated magnesium powder, having higher surface area may exhibit higher rate of dissolution as compared to control. This higher dissolution of a mineral in the human gastric fluid, make it easily available for absorption in the body, which may results into higher bioavailability as compared to control.

Particle size analysis

The effect of biofield treatment on particle sizes d_{10} and d_{50} was analyzed and results are presented in Table 3 and Figure 5. Data showed that smaller particle size d_{10}, was changed from 89.75 µm (control) to 79.79, 137.87, 83.69 and 76.79 µm in treated magnesium powder on day 10, 75, 80, and 98, respectively (Table 3). It indicates that d_{10} in treated sample was reduced by 11.09% on day 10 as compared to control, which might be responsible for increase in surface area. Our group previously reported that biofield treatment has induced energy milling in metal powder, which fractured the titanium and chromium powder [27]. Thus, it is hypothesized that reduction in particle size in magnesium powder could be due to energy milling induced through biofield treatment. Further, d_{10} was increased by 53.61% as compared

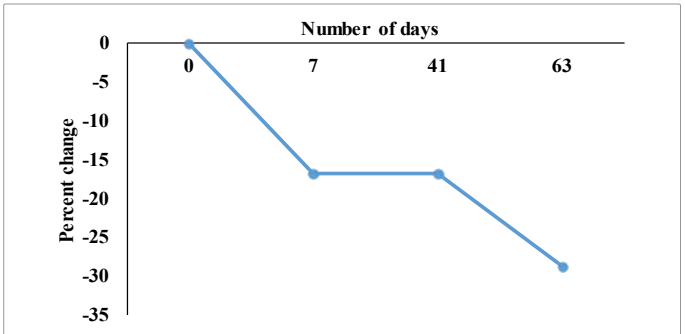

Figure 3: Effect of biofield treatment on crystallite size of magnesium powder.

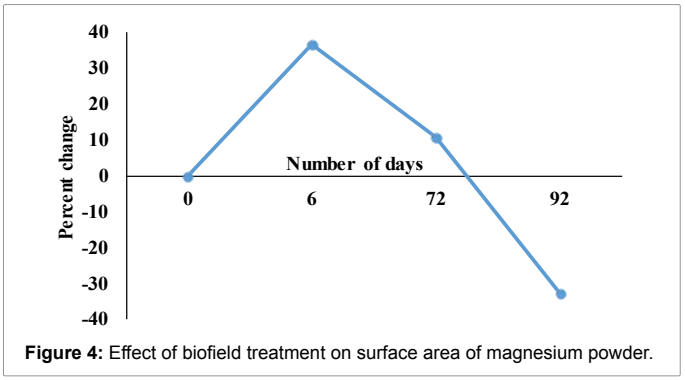

Figure 4: Effect of biofield treatment on surface area of magnesium powder.

Group	Surface Area (m^2/g)
Control, Day 0	**0.2975**
Treated, Day 6	**0.4061**
Treated, Day 72	**0.3294**
Treated, Day 92	**0.2000**

Table 2: Surface area analysis of magnesium powder.

Groups	d_{10} (µm)	d_{50} (µm)	d_{99} (µm)
Control, Day 0	89.75	256.7	501.5
Treated, Day 10	79.79	260.7	502.3
Treated, Day 75	137.87	290.5	500.1
Treated, Day 80	83.69	261.5	498.4
Treated, Day 98	76.79	252.6	498.9

d_{10}, d_{50}, and d_{99}, size below which 10, 50, and 99% particles are present, respectively

Table 3: Particle size analysis of magnesium powder.

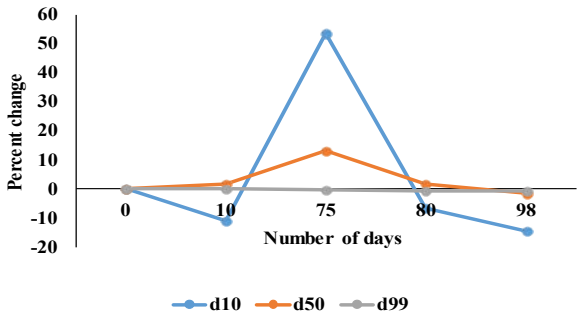

Figure 5: Effect of biofield treatment on particle size d_{10}, d_{50}, and d_{99} of magnesium powder.

to control on day 75. It is possible that fresh surface generated through fracturing, possibly welded with each other and increased particle size [16]. Furthermore, d_{10} was reduced by 6.75 and 14.44% on day 80 and 98 respectively as compared to control. In addition, average particle size, d_{50} was changed from 256.7 µm (control) to 260.7, 290.5, 261.5, and 252.6 µm in treated magnesium powder on day 10, 75, 80, and 98, respectively. It suggests that d_{50} was increased by 0.16, 13.17, and 1.87% powder on day 10, 75, and 80 respectively, whereas it was slightly decreased by 1.59% as compared to control on day 98 (Figure 5). In addition, larger particle size d_{99} was reduced from 501.5 µm (control) to 502.3, 500.1, 498.4, and 498.9 µm in treated magnesium powder on day 10, 75, 80, and 98, respectively (Table 3). It suggests that d_{99} was not significantly changed after biofield treatment. Thus, the particle size data suggest that medium (d_{50}) and smaller (d_{10}) size particles were more affected through biofield treatment as compared to large (d_{99}) particles. It was previously reported that biofield treatment has significantly altered the particle size in aluminium [15] and zinc powder [27]. Moreover, it is well established fact that particle size and surface area are having inverse relationship *i.e.* smaller the particle size, the larger the surface area. The increase in surface area on day 6 (Figure 4) can be correlated to reduction in particle size of smaller particles (d_{10}) on day 10 (Figure 5). Further, data showed that on day 72 surface area reduces up to 0.33 m^2/g as compared to 0.41 m^2/g *i.e.* found on day 6, which may be due to increase in particle size d_{10} and d_{50}. Furthermore, the reduction in particle size (after day 75) and surface area (after day 72) is contrary. It is possible that the fresh surfaces of the particles obtained after fracture got oxidized and which probably results into low surface area as compared to control [34]. Therefore, particle size and surface area result suggest that biofield treatment has altered the physical properties of magnesium powder.

Conclusion

In summary, the biofield treatment has significantly altered the atomic and physical properties of magnesium powder. XRD data revealed that biofield treatment has increased the unit cell volume and atomic weight up to 0.16% and reduced the nuclear charge per unit volume up to 0.24%, as compared to control. The crystallite size of treated magnesium was significantly reduced up to 28.59% as compared to control. It is assumed that the internal strain induced by biofield treatment may fracture the crystallite and reduced crystallite size. Besides, the surface area of treated magnesium was increased up to 36.5% as compared to control. It is assumed that higher surface area and lower crystallite size in treated magnesium might exhibits the higher dissolution rate in human gastric fluid and may lead to increase the bioavailability of magnesium ions in the body.

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