Color Coronal Spectral Analysis. Results with EVOdrop Electromagnetic Influenced Water

Ignat Ignatov[1*], Fabio Huether[2], Teodora P. Popova[3]
Chavdar Stoyanov[1] and Alexander I. Ignatov[1]

[1]Scientific Research Center of Medical Biophysics (SRCMB), Sofia, Bulgaria
[2]EVODROP AG, Zurich, Brüttisellen, Switzerland
[3]University of Forestry, Faculty of Veterinary Medicine, Sofia, Bulgaria
Corresponding author: mbioph@abv.bg

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Abstract
This research was conducted through color coronal spectral analysis (Ignatov, 2007). This method was employed under laboratory conditions, utilizing corona glow emitted by liquids and biological objects. The studies were performed with a high voltage of 12 kV and a high frequency of 15 kHz. In 1995, Antonov devised an apparatus with a transparent electrode for research with black-white photographic films. He named this method SHFD. In 2007, the device was improved by Ignatov and Stoyanov, for color Kodak films. Under specific electrical conditions, it is known as electrography. Notably, electrography forms the basis for the invention of the photocopier and the development of Xerox technology. EVOdrop water is a device authors use to transmit electromagnetic waves from 350 to 600 Hz, 20 to 40 kHz, and 7 Schumann frequencies under Color Corona Gas Discharge (CCGD) conditions. A comparative analysis of EVOdrop and tap water corona images was made. Furthermore, this analysis investigated physical and chemical processes occurring under high-frequency CCGD conditions.

Keywords: CCGD; EVOdrop water.

Introduction•

CCGD induces a glow when applied with devices operating at voltages ranging from U = 5 - 30 kV and frequencies between 10 and 150 kHz [1]. In 1949, Kirlian, who was an Armenian inventor from the former USSR, obtained a patent for a "Method for obtaining photographic pictures of different types of objects" [2]. SHFD method allows for the transfer of electric charges and electric fields from one electric medium to another in direct contact [3]. This process hinges on electric discharge occurring at normal electric pressure within a three-layer capacitor: dielectric-air/gap-dielectric [4]. This configuration generates constant and controllable electric fields. In specific regions where the electric fields surprise the breakdown threshold of the air gap, it leads to a perforation. This phenomenon is described by Pashen's law [5]. Due to this perforation, electric discharge is selectively conveyed onto the receiving electric medium.

•The abbreviations list is on page 294.

At the end of 1940s, Carlson invented electrography and now xerography, producing dry copy. In 1965, Schaffert authored the book “Electrophotography” [6], presenting the corresponding technology directly capturing corona gas discharge from objects, particularly around larger contact surfaces.

In 1975, Pehek and his co-authors described as electrophotography the gas discharge effect by copying it onto photographic film [7]. Since the 1960s, [8, 9] have significantly advanced electrophotographic imaging methods.

[10-19] have developed gas discharge techniques by registering electric corona images. During the process, a sliding discharge occurs on a dielectric surface in the ionized zone. The process of driving by a non-uniform electric field near an electrode with a small radius of curvature was observed. This occurred within a narrow gap between the experimental object and the registering medium during the discharge [1, 20-22]. The discharge itself comprises N, O and CO_2 ions, and free electrons. These free electrons are dissociated from N_2, O_2 and CO_2 molecules, ultimately generating a gas discharge between the studied object and the electrode [23, 24]. The research was guided by analyzing and extracting valuable insights from digital gas discharge spectra. This was achieved by implementing a pre-processing procedure to isolate the texture-induced radiation energy signature represented by the most prominent glow in digitally captured isolines. This approach holds significant potential for application in medical biometrics and diseases interpretation [25].

Materials and methods

Experimental setup

Fig. 1 shows the scheme of the study conducted on the electromagnetic influence on tap water with 350-600 Hz, 20-40 kHz, and 7 Schumann frequencies or EVOdrop water. The water for investigation was in a 0.5 L beaker. The control sample was tap water from Sofia exposed to 350-600 Hz, 20-40 kHz [26], and 7 Schumann frequencies [27].

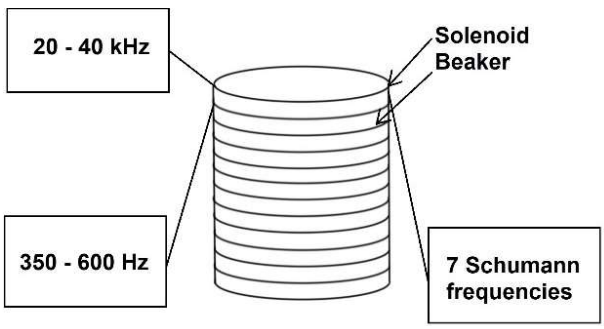


Figure 1: Scheme of electromagnetic effect of 350-600 Hz, 20-40 kHz and 7 Schumann frequencies on tap water.

Device for CCGD spectral analysis

Gas discharge emission for CCGD spectral analysis [1, 21, 24, 28, 29] was investigated in a dark room. It was registered with photosensitive paper or color film placed on a transparent Hostaphan electrode, with an 87 mm diameter. It was filled with a conductive liquid of 1% NaCl solution in deionized water. This study was performed with EVOdrop water. The rear side of the electrode was covered with a thin Cu coating. Investigated objects (water drops and human thumbs) were placed on the corresponding photosensitive material. Pulses with 12 kV voltage and a carrier frequency of 15 kHz were applied between the objects and the electrode Cu coating. The functional scheme of the CCGD device is shown in Fig. 2.

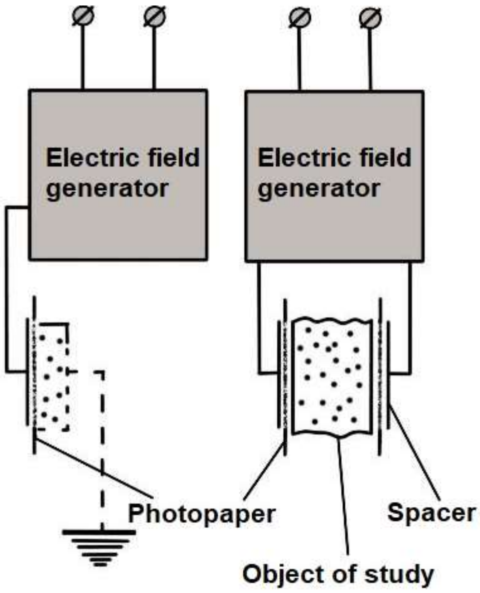


Figure 2: Functional scheme of the CCGD device.

Results

Physical parameters of SHFD and CCGD spectral analysis methods

Electric discharge per unit area of the recording medium can be expressed as follows [20]:

$$\sigma = [\alpha - U_p (d_2+\delta)/d_2]\varepsilon_0(d_2 + \delta)/\delta d_2 \quad (1)$$

The breakdown voltage of the air gap is:

$$U_p = 312 + 62d_2 \quad (2)$$

Consequently, a quadratic equation describing the width of the air gap is obtained:

$$6.2d_2^2 - (\alpha T - 6.2\delta - 312)d_2 + 312\delta = 0 \quad (3)$$

It has the following solutions:

$$d_2 = [\alpha T - 6,2\delta - 312] \pm [(\alpha T - 6,2\delta - 312)^2 - 7738\delta)^{1/2}/12.4 \quad (4)$$

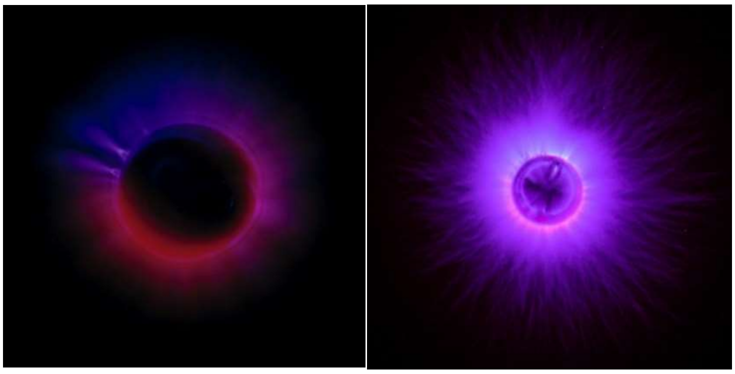
$$\delta = d_1/\varepsilon_1 + d_3/\varepsilon_3 \quad (5)$$

where α: electric pulse slope rate; T: electric pulse duration: U_p: breakdown voltage of air gap between experimental object and recording medium; d_1, d_2 and d_3: object's thickness, air gap's and photosensitive material's thicknesses, respectively; ε_0 (1.00057 F/m), ε_1 and ε_3 are air's, experimental object's dielectric and photosensitive material's dielectric permittivities, respectively.

The method for CCGD holds significant implications for researching the electrical properties of water droplets under gas discharge conditions [22]. The dielectric constant, a critical parameter in CCGD, has been detailed in [20, 22]. It represents the dependable dielectric permittivity in a homogeneous medium. The object's conductivity has minimal impact on the formation of the electric image. The image provides insights into the dielectric and geometrical characteristics of the object, including the distribution of permittivity and surface irregularities [1, 20]. Dielectric permittivity is determined by a material's capacity to polarize in response to an applied electric field, thereby partially offsetting the field within the material. Polarization involves the displacement or orientation of associated electrical charges, when subjected to a field.

Parameters of EVOdrop with the CCGD spectral analysis method

The investigation, employing the CCGD spectral analysis method [28, 29], was conducted on the electric glow of two samples. The control sample was with tap water, from Sofia, Bulgaria. The experimental sample was tap water exposed to 350-600 Hz, 20-40 kHz, and 7 Schumann frequencies (Fig. 3). The electrode was positively charged, and the negative electrode was brought closer until a corona breakdown voltage occurred.



(a) **(b)**

Figure 3: (a) Color coronal images of the control sample in tap water; and **(b)** experimental sample exposed to 350-600 Hz, 20-40 kHz and 7 Schumann frequencies.

The results of Fig. 3 illustrate that the photon emission for the control sample was E = 2.32 eV or λ = 534.4, and for the experimental sample was E = 3.03 eV or λ = 409.2. The difference is E = 0.71 eV. The radius of the water drop was 0.41 cm or $S = \pi r^2 = 3.14 \times 0.41^2 = 0.528$ cm^2. For the experimental sample, the result was 3.03 eV/0.528 cm^2 = 5.73 eV/cm^{-2}. For the control sample, the result was 2.32 eV/0.528 cm^2 = 4.39 eV/cm^{-2}.

The result of a discharge at the point of contact of the liquid drops with the photo film is valuable. For tap water, the breakdown voltage had a 17% discharge, with photons with E = 1.74 eV or λ = 713 nm. The experimental sample obtained 81% discharge with photons with E = 3.03 eV nm or λ = 409.2 nm.

The method for brightness estimation from the CCGD emission research was developed [28-30].

The effective power of the device for CCGD was calculated by the formula $P_{eff} = U^2/R$. Where U = 12 kV and CCGD for water drop was R = 10^9 Ω. $P_{eff} = U^2/R = 12^2 10^6/10^9 = 0.144$ W [28].

Discussion

The observed results showed a notable augmentation in the photon emission of the water sample influenced by electromagnetic waves [31] and from biological objects [32] relative to the control samples. This augmentation indicates the structuring of the water molecules in clusters, observed in the CCGD effect. Specifically, water demonstrated enhanced hydrating properties due to its molecular structure reconfiguration into clusters. *Haberlea rhodopensis friv*. is an excellent model system for research on hydration properties and the structuring of water clusters. The proofs for structuring binary clusters after more than one year of dry state were investigated [33]. The effect of hydration was studied with spectral analysis [34].

The structured water exhibits a heightened permeability through the cellular membrane, a phenomenon that has been shown to yield favorable effects on various physiological parameters of plants. Notably, this augmented permeability facilitates a more efficient uptake of essential nutrients, fostering improved metabolic processes within the plant cells. Furthermore, the enhanced water structure contributes to an overall bolstering cellular integrity and resilience.

In addition to its positive impacts on nutrient uptake and cellular integrity, the restructured water has been observed to mitigate various environmental stressors significantly. It demonstrates an increased capacity to buffer against oxidative stress, conferring a heightened protection level against reactive oxygen species and anti-oxidant effects [35].

This phenomenon presents a potential avenue for enhancing agricultural productivity, and allows further investigation into the underlying molecular mechanisms governing these observed effects [36].

Conclusion

In this study, CCGD spectral analysis was employed to investigate the corona glow emitted by liquids under laboratory conditions. Operating at high voltage (12 kV) and frequency (15 kHz), this method builds upon Antonov's SHFD apparatus, initially designed for black-and-white photographic films, which was enhanced by Ignatov and Stoyanov, in 2007, for colour Kodak films. This electrography technique was the foundation for developing photocopiers and Xerox technology. This study focused on EVOdrop water, subjecting it to CCGD conditions at various frequencies. A comparative study between EVOdrop and tap water corona images provided valuable insights into the physical and chemical processes occurring under high-frequency CCGD conditions. This research contributes to the understanding of electric discharge phenomena, particularly in the context of water droplets. Dielectric permittivity, a key parameter, emerged as a crucial factor in CCGD. It characterizes the reliable dielectric behaviour in a homogenous medium. Notably, the object' s conductivity has minimal influence on the formation of electric images, primarily offering information on dielectric and geometrical object characteristics. By meticulously examining CCGD emissions, the understanding of associated physical parameters has been further refined. The radiation energy signature was isolated by employing pre-processing techniques, presenting significant potential for applications in medical biometrics and disease interpretation. Experiments with EVOdrop water, influenced by various electromagnetic frequencies, shed light on the intricate interplay of electric fields and dielectric materials. The resulting data provides valuable insights for various applications, from medical biophysics to materials science. This study significantly advances the knowledge of CCGD and its applications, particularly in the realm of water droplet behaviour under electric fields. The results offer valuable contributions to both theoretical understanding and practical applications in various scientific disciplines. The observed augmentation in photon emission suggests a restructuring of water molecules, leading to enhanced hydrating properties. This restructured water demonstrates increased permeability through cellular membranes, positively impacting plant physiological parameters. This facilitates more efficient nutrient uptake, enhancing metabolic processes and cellular integrity. Additionally, the enhanced water structure aids against environmental stressors, particularly oxidative stress. This phenomenon holds promise for enhancing agricultural productivity, and warrants further investigation into its underlying molecular mechanisms, highlighting the interplay between water structure and cellular function in plant physiology and agricultural science.

Authors' contributions

Ignat Ignatov: device and experiments with CCGD method. **Fabio Huether**: device for electromagnetic waves. **Teodora P. Popova**: preparation of the draft, references. **Chavdar Stoyanov**: device and experiments CCGD method. **Alexander I. Ignatov**: experiments with CCGD method.

Abbreviations

ASL: above sea level
BH: brightness histogram
CCGD: color corona gas discharge
NaCl: sodium chloride
SHFD: Selective High-Frequency Discharge
USSR: Union of Soviet Socialist Republics

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