Results of Corona Discharge Analysis of Sessile Water Drops Exposed to Analemma Water Inlay

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Summary

Corona discharge is a physical process that occurs when a gas is ionized. It is observed as a bluish glow at high breakdown voltages of 5-30 kV. In the former USSR, the Armenian inventor Kirlian pioneered a laboratory method for recording corona gas discharges on black-and-white photographic film.

The method is classified as electrophotography for recording information. Based on electrophotographic information recording, Carlson developed xerography in the 1960s. Antonov conducted experiments using electrophotographic corona discharge methods to record data. He succeeded in both image registration and silverless photography. Antonov demonstrated that corona gas discharge primarily depends on the dielectric permeability of the object rather than conductivity. In 1975, Pehek and his co-authors in the journal Science described the phenomenon of gas corona discharge and its effect on photographic films as electrophotography

Since 1997, Antonov and Ignatov have performed studies on electrical corona discharge for water drops. Since 2012, Pesotskaya, Glukhova, and co-authors have developed a method for analyzing corona discharge images and assessing emission characteristics in different types of water.

In 2023, Pesotskaya, Glukhova, Ignatov, and Churilov registered a device designed to analyze corona glow using photographic film.

Experimental conditions

The experimental materials and equipment for the research included photographic film and a device with an attachment for liquid-phase objects, developed in collaboration with the "L. Shupik National University of Healthcare of Ukraine" (Kyiv) and Dnipro University of Technology (Dnipro, Ukraine).

The emission associated with an electrical corona discharge is generated at the boundary between the liquid phase of a sessile water drop and the surrounding air, near the discharge source. The resulting image is recorded on photographic film, then scanned and converted to digital format for further analysis. The photon-emission area is then quantified as a parameter for evaluating the observed gas-discharge radiation.

The patent is Pesotskaya, L. A., Churilov, V. V., Glukhova, N. V., Gulevskaya, G. I., Ignatov, I. I. Device for Registration of Gas Discharge Glow of Various Objects “RGS-1”, Patent Ukraine, No. 37, 13.09.2023.

Ignatov, I., Pesotskaya, L., Glukhova, N., Yevdokimenko, N., Popova, T. P., Ignatov, A. I., Stoyanov, Ch. (2025) Registration of Different Types of Water with Corona Gas Discharge Effects and Parameters of Brightness, Portugaliae Electrochimica Acta, 43(4), 217- 224.

Experimental samples

Control sample:
Distilled water not exposed to any external treatment.
Experimental sample:

A distilled water sample was exposed to the Analemma Water Inlay for 10 minutes under controlled and identical experimental conditions.

The experimental conditions, including temperature, relative humidity, and illumination, were standardized throughout the measurements.

Results

Figure 1 shows the results for the control sample of distilled water.

Figure 2 presents the results obtained for distilled water exposed to the Analemma Water Inlay after 10 minutes

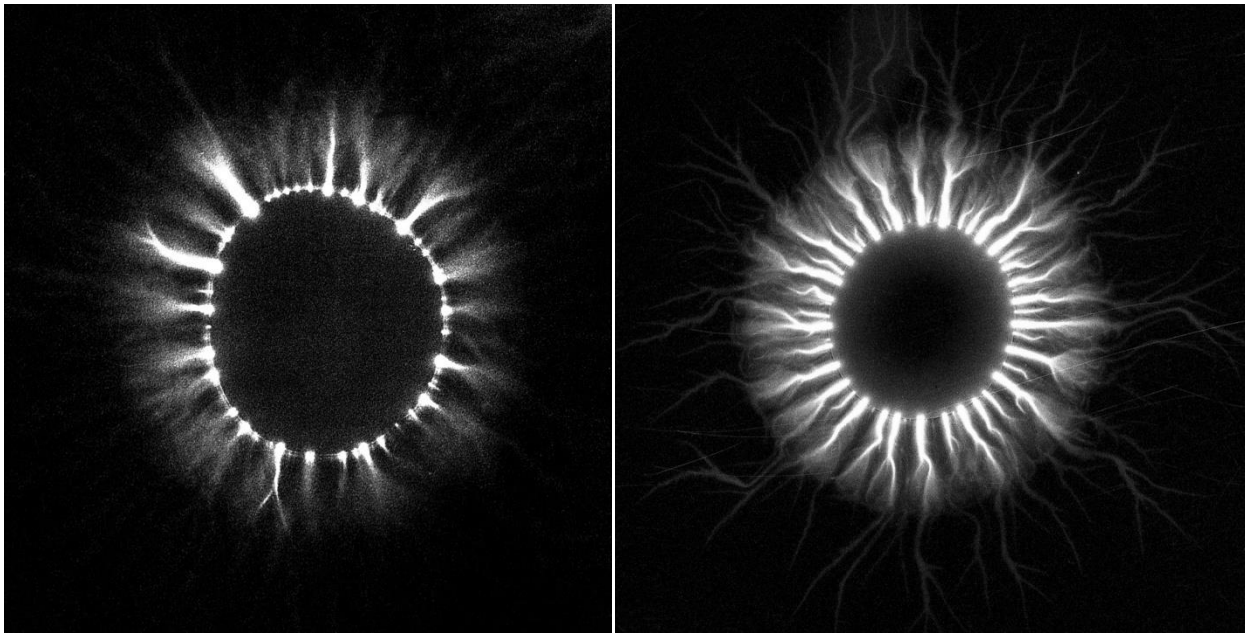

Fig. 1. Control sample **Fig. 2. Sample – Analemma water**

Conclusion:

The distilled water sample exposed to the Analemma Water Inlay demonstrated a 24.7% larger registered photon-emission area compared with the untreated control sample. Under standardized experimental conditions, this result indicates a broader spatial distribution of the observed electrical corona emission. The increased emission area suggests more extensive gas-discharge development at the sessile water drop–air interface in the investigated sample compared with the control.