Lord Kelvin's Thunderstorm: Improving Power Generation with Ionic Solutions

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Lord Kelvin’s Thunderstorm, also known as Lord Kelvin’s Water Dropper, is a type of electrostatic generator that utilizes natural charge imbalances in falling streams of water to generate electricity. A series of electrostatic charge inductors, collectors, and cross-connected wires make this possible. This experiment researched the effects of using ionic solutions in place of distilled water as in the original device. The device was assembled from a PVC frame with cylindrical copper inductors, fine-mesh wire strainer collectors, and glass droppers water nozzles. A basin collected the falling solution at the bottom, and a pump recycled it. The spark gap was two spherical brass knobs 2.35+/-0.05 mm apart. For each solution, the average time per spark was found by timing a total of 100 sparks. 0.1M solutions of NaCl, KCl, and LiCl were used, as well as tap water (sourced Bountiful, UT, USA) and distilled water. The research found that KCl resulted in the largest power increase of 10.9%, followed by NaCl (4.9%) and LiCl (2.8%) over the original distilled water, which had an average period of sparking of 3.028 seconds. This correlation demonstrates that the power generation of a hypothetical device utilizing the principle of the Water Dropper would improve by using these solutions. The tap water showed a negative improvement of 2.1%. This indicates that not only do some ionic solutions improve power generation, but some caused it to decrease. Further research would study more types of salts, as well as the effects of varying concentration.

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