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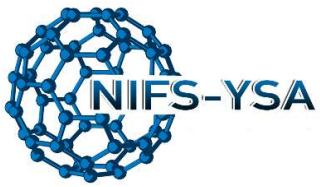

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Investigating the phenomenon of electricity generation by flowing water over a graphene sheet

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Background: Recently published studies show that an electric voltage is generated when a flow of water passes over a graphene layer.

Objective: The objective is to understand the mechanism in which the process generates electricity. Since some researchers hypothesized that this phenomenon might have been caused by the presence of ions in water, in this study, we test and present a novel hypothesis by using de-ionized (DI) water.

Method: We deposited a few layers of graphene on to a silicon dioxide substrate using a thermal evaporation technique. The graphene thin-film system was characterized by means of UV-Visible, X-ray diffraction, and Raman spectroscopy. Then DI water was allowed to flow on the graphene thin film at a constant flow rate. The generated voltage was measured using a digital voltmeter connected to a computer. We changed the water flow rate and measured the corresponding voltages.

Results: We observed a voltage of 0.2 μV for a flow rate of 13.9 mm/s. Consequently, we observed that a higher voltage is generated with a higher flow rate. Our experiment using DI water confirms that this phenomenon of electric voltage generation is not caused by the presence of ions in water as suggested by some of the previous researchers. However, ions may enhance the magnitude of the voltage generated. Moreover, we observed that with changing the direction of the water flow, the polarity of the generated voltage gets changed. Hence, the momentum transfer theory cannot be used to fully explain this phenomenon.

Conclusion: We believe that the dipolar properties of the water molecule generate the voltage observed. Since H_2O is a dipolar molecule, when the DI water flows over the graphene sheet, Pi-cloud of graphene sheet could generate a charge imbalance on nearby water molecules, leading to a flow of electric charges. Further studies are being conducted to test this hypothesis by changing the dipolar property of water flow by applying a strong electric field.

Keywords: *Renewable energy, Graphene, Dipolar property, Energy harvesting*

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