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Experimental study of fog physical response to chemical compounds dissolved in pure water

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The goal of this work is to study the impact of aerosols on fog formation in lab environments. Physical and chemical properties of aerosol affect droplet formation and its size spectra, which are dependent on thermodynamical conditions. Fog, as a natural phenomenon, is widely studied because it can affect visibility, air quality, climate, agriculture, and human health. In order to better understanding of fog prediction, earlier works have extensively studied natural fog with respect to its formation and dissipation processes. Similarly, artificially produced fog types have been studied improve firefighting, agriculture, and transportation capabilities and to understand conditions that lead to deterioration of air quality. Both fog and rain are natural "cleaners" of the lower atmosphere because their droplets attract or wash out various aerosol particles as they fall at varying speeds to the ground. Lab experiments related to artificial fog studies are limited, therefore, this study will evaluate aerosol effects on fog physical properties in a lab environment. To reach the goal, an automated fog generating system was designed and that includes controlled chemical compounds dissolved in pure water. The results suggested that increasing the concentration of potassium dihydrogen phosphate (KH_2PO_4), urea ($CO(NH_2)_2$), and potassium hexacyanoferrate trihydrate ($K_3(Fe(CN)_6)$), as well as aerosol types (chemical compounds) can lead to changes in number concentration of fog droplets; therefore reducing visibility. In the analysis, various physical conditions, such as fog droplet size and concentration, were analysed using changing aerosol composition. The results obtained showed that the particle size distribution of fog droplets changes with the addition of chemical impurities and their mass concentration. Overall, both issues and challenges of the experimental fog generating system used in this study are provided and future work is described.