On the theory of charged droplet fragmentation in the stream

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The article considers conditions for the equilibrium of a charged drop in a stream. If the liquid constituting the drop is a conductor, the charge will spread over the surface of the drop and the forces of the Coulomb repulsion will be directed against the force of surface tension. This is the physical reason for facilitating the drop disintegration. In determining the stability of a drop, a method is used, the essence of which is that the drop is considered to be in equilibrium if the pressure inside it at the points on the large and small semi-axes of the ellipse are equal. It is assumed that the drop has the shape of a spheroid. The Weber number is determined from the equilibrium condition. At some critical value of the Weber number the drop becomes unstable and disintegrates. The effect of the drop charge is mathematically expressed through a parameter equal to the ratio of the pressures caused by the forces of electrostatic repulsion and surface tension. According to the calculation results, the presence of charge on the surface of the drop is manifested in two ways. On the one hand, the limiting aerodynamic action, leading to drop fragmentation decreases; on the other hand, the equilibrium value of the ellipsoid semi-axes ratio increases and becomes difficult to achieve, which also contributes to drop fragmentation.

Keywords: *equilibrium condition, drop fragmentation, ellipsoid, electric charge, surface tension*

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