Abstract

Black carbon is the carbonaceous product generated due to incomplete combustion of fossil fuels and biomass. They can be generated through two different pathways namely by incomplete burning of fossil fuels leaving behind solid residues or by condensation of volatiles forming soot particles. Once entered into the environment, BC particles have adverse health and environmental implications. They are responsible for severe lung and heart diseases and are known for causing asthma, bronchitis, chronic obstructive pulmonary disease. BC particles are also known to scatter and absorb solar radiation, decreasing the planetary albedo and its surface deposition onto snow causes melting of ice.

The main objectives of this study were to examine the aggregation kinetics of the Black carbon particles in aquatic environment under different conditions of cations, anions and pH. Effects of these factors were examined on the effective diameter, electrophoretic mobility, zeta potential and mobility length. The results showed that black carbon particles have negatively charged surfaces. The aggregation of black carbon is governed by a number of factors like the chemistry of dispersion medium, electrolytes and their concentration, pH, temperature etc. Increasing the concentration of cations (Na^{+}, Mg^{+2}, and Ca^{+2}) increases the aggregation of black carbon particles. This is due to increase in the zeta potential of black carbon particles. Also, among these three cations, divalent cations (Mg^{+2} and Ca^{+2}) are more effective in aggregation than monovalent cation (Na^{+}). On the other hand, increasing the concentration of anions (Cl^{-}, SO_4^{-2} and ClO_4^{-}) further decreases the zeta potential of the black carbon particles. Thus anions do not favor aggregation of black carbon particles. Among pH values 2, 5, 10 and 12, maximum aggregation was found at pH 2 while the aggregation was almost negligible for other pH values. River water has highest effective diameter, least absolute value of zeta potential. Thus river water has highest rate of aggregation followed by tap water and the distilled water. Mobility length of anions was more than that for cations due to aggregation by cations.