BUDGET FOR TURBULENT KINETIC ENERGY AND ENERGY DISSIPATION RATE IN BUBBLE COLUMN REACTORS

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ABSTRACT

CFD simulations (k-ε and LES) have been performed for the flow generated in a cylindrical bubble column having a height of H_D = 1000 mm with inner diameter of D = 150 mm and provided with sieve plate sparger. The superficial gas velocity was 20 mm/s. It is known that the computationally cheaper models such as k-ε model have many simplifying assumptions which limit their accuracy. Therefore, conservation equations for turbulent kinetic energy (k) and turbulent energy dissipation rate (ε) were derived from the governing equations of continuity and motion using two fluid model. For this purpose, Reynolds averaging has been employed. Both the conservation equations consists of terms corresponding to the rates of (a) convective transport, (b) diffusive transport, (c) turbulent transport, (d) production and (e) dissipation. Each of these terms consist of several correlations of mean and fluctuating velocities, mean and fluctuating pressures and their gradients. The values of all these correlations have been estimated by using the values of mean and fluctuating components of velocity, hold-up and pressure, obtained from LES simulations, by taking appropriate precautions. These estimations are expected to be useful in understanding the gravity of assumptions made in the standard k-ε model.