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The influence of forced ventilation airflow on water spray for dust suppression on heading face in underground coal mine

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Abstract: Water spray is the most commonly used method for suppressing mine dust. On the heading face of high gassy mine, forced ventilation is employed to dilute and discharge methane in order to prevent methane accumulation. In this paper, we utilize the program ANSYS FLUENT to investigate the influence of airflow from forced ventilation on the water spray flow field. The three-dimensional (3D) steady wind and spray flow models are successfully established and simulated under different spray pressures, which range from 0.5 MPa to 3.0 MPa. The results show that the wind wall produces a significant number of vortices from the interaction between the wind and heading face, which blocks the advance of the droplets. As spray pressure increases, the trajectory of the spray droplets is more strongly affected; i.e. the spray was so disturbed that it could not reach the dust source. The average droplet diameter gradually decreases, and the average droplet velocity first decreases and then increases as the spray pressure increases. We find 2.4 MPa to be the optimal operating pressure.

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