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Analysis of Evaporation of Liquid Ammonia in a Vertical Cylindrical Storage Tank

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Abstract : The present study addresses the problem of ammonia evaporation during filling of a vertical cylindrical tank and the influence of various external factors on the stability of storage by determining the conditions for minimum evaporation. Numerical simulation is carried out by solving the governing equations namely, continuity, momentum, energy, and diffusion of species. The effect of temperature of surrounding air, the filling speed of the reservoir and the temperature of the filling liquid ammonia on the evaporation rate is investigated. Results show that the temperature of the filling liquid has little effect on the liquid ammonia for a short period, which, in fact, is function of the filling speed. The evaporation rate along the free surface of the liquid is non-uniform. The inlet temperature affects the vapor ammonia temperature because of pressure increase. The temperature of the surrounding air affects the temperature of the vapor phase rather than the liquid phase. The maximum of evaporation is reached at the final step of filling. In order to minimize loss of ammonia vapors automatically causing losses in quantity of the liquid stored, it is suggested to ensure the proper insulation for the walls and roof of the reservoir and to increase the filling speed.

Keywords : evaporation, liquid ammonia, storage tank, numerical simulation
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