INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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This thesis examines the characteristics of the flow of granular systems involving non-spherical particles in a silo. Understanding the flow of solid particles or granular flow is of great importance in industries for effective plant operations and for producing desired products. In this regard, we studied systems involving elongated particles or a mixture of discs and elongated particles. When the orifice is slightly larger the particles flowing out of it, the flow might halt abruptly due to the formation of a stable structure of particles above the orifice. This is commonly termed as clogging phenomena, which is undesirable in industries as it leads to the stoppage of production. In our work, we varied the position and size of a circular insert above the orifice to reduce clogging. One interesting finding is the presence of two local minima in the clogging index when the height of the obstacle is increased from the orifice. Time-averaged flow fields for a mixture of elongated particles and discs revealed an increase in the stagnant zone beside the orifice with an increase in the fraction of dumbbells thus decreasing the velocity and flow rate of the mixtures. Moreover, we investigated how the flow dynamics are affected when the orifice is placed at an unconventional position: on a side wall in one case and in the other case, two orifices on the silo base. The decrease in the velocity and flow rate with an increase in the fraction of dumbbells is also explained by an increase in the dynamic friction near the orifice due to an increase in the affinity to interlock by the dumbbell particles. The timeaveraged flow fields showed the presence of a stagnant zone on the silo base between the two orifices and with an increase in the inter-orifice distance, the stagnant zone is noticed to expand thus hindering the flow of particles through orifices. This is the reason for a decrease in the velocity and flow rate of particles with an increase in the inter-orifice spacing. Moreover, we analyzed how the increase in the size of the head of the snowman-shaped particles influence the clogging probability near the orifice.