# Pneumatic conveying of wet particles to illustrate offshore drill cutting handling

Disposal of drill cuttings, generated from the drilling operations in offshore rigs has always been a challenge. During the drilling operations the drill cuttings have to be transferred to storage locations on the rig and then must be transferred to the treatment facilities via transport vessels.

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Conveying of drill cuttings is a challenging task due to its sticky nature. Hence a new scientific study is required to optimize the offshore drill cutting handling process.

In a research project, the pneumatic characteristics of particles mixed with a drilling fluid was studied based on pilot scale experiments. The objective of the study was to investigate the impact of the presence of a drilling fluid towards the pneumatic conveying properties of a bulk solid, which can be utilized in offshore drill cutting handling.

**Experiments**

Pneumatic conveying and fluidization tests were conducted for sand samples with different size distributions (particles in the range of 100 µm upto 11 mm). The tests were conducted for both dry and wet (mixed with a drilling fluid) conditions. For this study a premix based on EDC 95/11 was considered. The experiments were conducted at the pilot scale pneumatic conveying rig at SINTEF Tel-Tek, Porsgrunn (Figure 1).

**Results**

The fluidization tests show that the minimum conveying velocity of a dry particle system is significantly increased when a small amount of drilling fluid (1.5% by weight) is introduced to the particle mixture. However, there was no significant deviation of the fluidization behaviour when the drilling fluid concentration was increased further from 1.5% up to 6.3%. (Figure 2)

**Figure 1:** Pilot scale pneumatic conveying rig

Horizontal pneumatic conveying pressure drop displayed a similar behaviour as the minimum fluidization velocity with the drilling fluid concentration. That is, the pressure drop corresponding to the sand-drilling fluid mixture at the concentration of 1.5% was significantly low compared to the pressure drop of the same dry sand mixture. It was also observed that the deviation of the minimum fluidization velocity of a wet sand mixture with respect to its dry condition and the deviation of the horizontal pneumatic conveying pressure drop of the same wet sand mixture with respect to its dry condition are closely correlated.

## Conclusion

The reduction in the pneumatic conveying pressure drop and the increment of the fluidization velocity suggest that the presence of a drilling fluid in a particle mixture acts as a lubricating agent. As a thin layer of drilling fluid is formed on the surface of the particles, the air-particle, particle-particle and particle-wall frictions are reduced. The gradual increment of the drilling fluid concentration does not affect the change of either the minimum fluidization velocity or the pneumatic conveying pressure drop, until reaching a certain critical drilling fluid concentration (approximately 6-10% by weight).

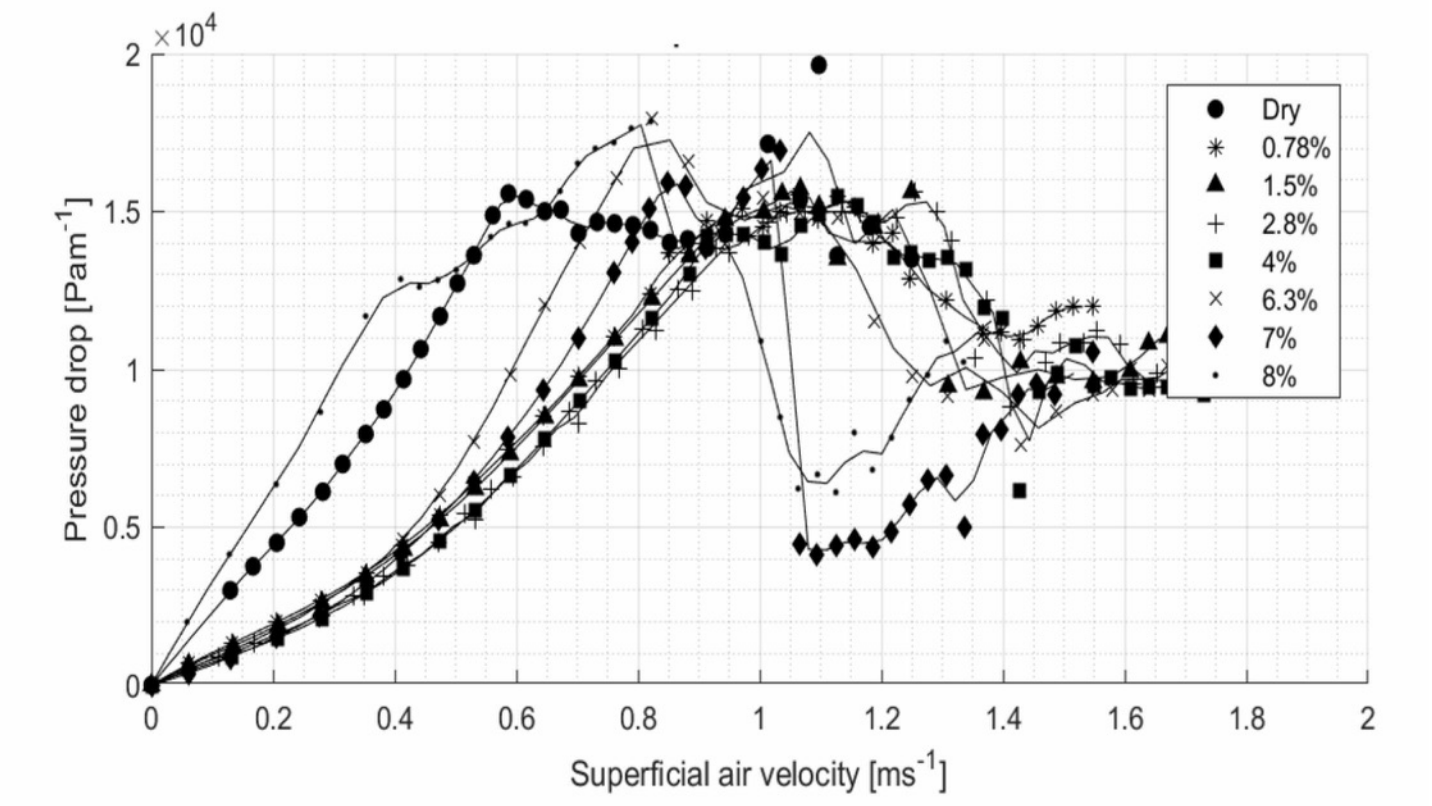


**Figure 2** Deviation of fluidization curves with drilling fluid concentration

## Practical applications

The study shows that an empirical model can be developed to predict the pressure drop in horizontal pneumatic conveying under dilute phase for dry particles. By incorporating the change of minimum fluidization velocity factor to the pneumatic conveying pressure drop model, the pressure drop of the particle -drilling fluid mixtures could be predicted approximately. Therefore, it can be concluded that by conducting pneumatic conveying tests for dry mixtures and fluidization tests for particle - drilling fluid mixtures, a model can be developed to predict the pneumatic conveying pressure drop of the particle - drilling fluid mixtures.

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**References:**
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