## Slurry System (Liquid+Sand) Pressure Drop

**Saeed Abdollahi**
**Process Engineer at Wood Group - CCC Ltd (Oman)**

Hi Guys,

Does anybody have experience or information regarding hydraulic calculation of slurry systems(Liquid+Sand)?
Thanks in advance.

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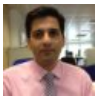

**Saeid Rahimi Mofrad**
**Senior Specialty Process Engineer at Fluor**

A. From frictional pressure drop viewpoint, the slurries have two main categories:
1. Newtonian slurries for which the shear stress is a linear function of shear rate.
2. Non-Newtonian slurries where the above mentioned relation is not linear.

For slurries with Newtonian behaviour, pressure drop can be calculated using Hagen-Poiseuille equation (DP = f L/D Ro V^2 /2)

For non-Newtonian slurries refer to the literature.

B. From the solid particle distribution (size) viewpoint, they have also two main categories:
1. Non-homogenous slurries where solid particles are large (> 50 microns) and tend to deposit along the flow path.
2. Homogenous slurries where the concentration of solid particles is low to the extent that you can consider them as liquid (droplet size < 50 microns).

For non-homogenous slurries, the fluid velocity should be maintained above the solid particles settling velocity from Durand equation:

V = F [2gD (Ro_s – Ro_l)/Ro_l ]^0.5
Where
D: pipe diameter in m
G: 9.81
Ro_s: density of dry solid
Ro_l: density of liquid
F: dimensionless factor (depends on particle distribution frequency)

For homogenous slurries, the solid particles don't deposit, so there is no low velocity limit. However, the velocity of fluid with solid particles in oil and gas applications the higher velocity limit gets usually restricted to prevent erosion. API 14E for example introduces the following limit:

V = C /Ro^0.5
Where
V: erosional velocity
Ro: mixture density
C: refer to standard

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Saeed

**Saeed Abdollahi**
**Process Engineer at Wood Group - CCC Ltd (Oman)**

Thanks a lot Saeid,

I'v seen some paper in this subject and I'v done some calculation with Unisim but i'm not sure how much is correct.
In none homogeneous (heterogeneous) slurry system the mixture viscosity and "Cmax"(max. concentration of sand which carried by fluid) has a major impact on DP.
What is your idea about none homogeneous system containing water+sand based on your reply?
Is it correct to calculate the deposition velocity of sand and just size the pipe above this velocity?

Regards,

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QAMAR RAZA

**QAMAR RAZA P.Eng.**
**Sr.(Lead) Process Engineer**

Please visit;

http://www.src.sk.ca/facilities/pages/pipe-flow-technology-centre.aspx

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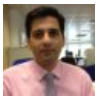

**Saeid Rahimi Mofrad**
**Senior Specialty Process Engineer at Fluor**

In past, I have not calculated the slurry pressure drop personally but you are right the results depend on both particle size range and concentration of solids.

I could find the following categories for heterogeneous slurries in the literature:
1. 50< dp < 300 and Cmax < 40 wt%
2. 50< dp < 300 and Cmax > 40 wt%
3. dp > 300 and Cmax < 20 wt%
4. dp > 300 and Cmax > 20 wt%

dp is in micron.

In the first category for example, the slurry head loss is not much higher than water head loss if the velocity is maintained slightly above (1.1 times) solid settling velocity.

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Saeed

**Saeed Abdollahi**
**Process Engineer at Wood Group - CCC Ltd (Oman)**

Dear Saeid,
Thank you so much for your kind support.

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