**Analysis: Dietrich Model**

**Method of running model**

1. Read in Van Melkebeke dataset.
2. Calculate additional required variables:
   1. Surface area of equivalent sphere
   2. mP surface area
   3. Equivalent spherical volume
   4. mP mass
   5. Corey Shape factor
   6. Relative density
   7. Projected area of volume equivalent sphere
3. For each particle:
   1. Calculate the dimensionless particle size
   2. Calculate the fitted equation for particle size
   3. Calculate the fitted equation for particle shape
   4. Calculate the fitted equation for particle roundness
   5. Calculate the dimensionless particle velocity
   6. Calculate the actual settling velocity
4. Note that R2 is only valid when CSF>0.15 and only recommended for partiles with CSF>0.2. Therefore, particles with CSF<0.2 were assigned NaN and subsequently removed from the output file.
5. Using the output file:
   1. Calculate the average error:
   2. Calculate the root mean squared error:

**Results and discussion**

Chart, scatter chart

Description automatically generated

Chart, scatter chart

Description automatically generated

The model only provides output for half of the fragments and one of the fibres. It cannot calculate the settling velocity of the films and for fragments and fibres that have CSF<0.2.

For the particles that it is applicable to, the model provides a reasonably accurate estimate of the terminal settling velocity, with a gradient close to 1. However, it does underestimate the lowest terminal settling velocities.

Chart, scatter chart

Description automatically generated

Scatter chart

Description automatically generated with medium confidence

The particle terminal settling velocity increases as particle size increases.

The fragments have the largest equivalent spherical diameter. The model cannot predict the settling velocity of the particles with the lowest equivalent spherical diameter (i.e., films and fibres).

Scatter chart

Description automatically generated

The model does not predict the settling velocity of particles with CSF<0.15. It is used here to estimate the settling velocity of particles with 0.15<CSF<0.2, however it is not recommended for use in this range.

Summary table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Shape** | **m** | **R2** | **AE (%)** | **RMSE (%)** |
| All | 0.9247 | 0.7986 | 5.83 | 1.56 |

Based on the values of m, the model performs well at estimating the terminal settling velocity of those particles for which it is applicable. It also has a very low average error and RMSE, further highlighting the accuracy of the model.

**Conclusion**

* Model performs well at predicting the terminal settling velocity of mPs with CSF within the constraints implied by the model.
* The model cannot predict the settling velocity of films or fibres.