Project of perforated pipe for inverted-shroud separator

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Motivation

- Increase the efficiency of the inverted-shroud separator when the phenomenon of choking occurs.
Introduction

- Simple modeling of the phenomenon using Homogeneous Model.
- Obtaining the number of holes: pressure drop in the annular = pressure drop in the holes.

\[
\left( \frac{\partial P}{\partial x} \right)_{\text{annular}} = f_m \frac{1}{2} \frac{1}{D_h} \rho_m J^2 + \rho_m g \sin \theta
\]

\[
\left( \frac{\partial P}{\partial x} \right)_{\text{holes}} = f_{ml} \frac{1}{2} \frac{1}{d} \rho_m V^2
\]
Introduction

- Mathematica® was used to implement the equation for the number of holes.
- Points used for the initial calculations for the inclination of 45 °.

![Equation Image]

Number of holes (N)

\[
N = \frac{(64 \cdot A_{\text{annular}}^2 \cdot D/h \cdot \mu_m \cdot Q_{\text{production}})(A_{\text{annular}} \cdot \mu_m)^{-0.25}}{(2 \cdot A_{\text{annular}}^2 \cdot D/h \cdot g \cdot \rho_{\text{in}} \cdot \sin \theta (A_{\text{annular}} \cdot \mu_m)^{-0.25} + 0.3164 \cdot Q_{\text{production}}^2 \cdot \rho_m (D/h \cdot \mu_m Q_{\text{production}})^{-0.25})(A_{\text{hole}} d^2)}
\]

<table>
<thead>
<tr>
<th>Tests</th>
<th>(Q_{\text{production}} (m^3/h))</th>
<th>(\Delta P) (bar)</th>
<th>Mass flow rate upstream gas (Kg/h)</th>
<th>Mass flow rate downstream gas(Kg/h)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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</tr>
</tbody>
</table>
Results

- For the hole with a diameter of 3mm, the number of holes for the most critical case (test 2) was 70.

![Diagram](image-url)

- 1 tube with 34 holes
- 2 pipe with 36 holes
Results

- Perforated pipes and sleeve:
  - 1 tube with 34 holes
  - 2 tube with 36 holes

PVC sleeve
Results

- For the hole with a diameter of 4mm, the number of holes for the most critical case (test 2) was 22.
Results

- Perforated pipes and sleeve:
  - 1 tube with 10 holes
  - 2 tube with 12 holes
  - PVC sleeve
Future procedures

- To perform experimental tests at 45°.
- Develop a more realistic model (real situation well).
- Numerical model for variation of pressure gradient along the well
  - Runge-Kutta 4th Order Method for Ordinary Differential Equation
- To implement the model in Mathematica®.
THANK YOU VERY MUCH!

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