



Simulasi CFD pada Mixing Vessel (Multiphase Chemical Reaction)

Analysis Performa Putaran Blade Berotasi 50 RPM pada
Pencampuran Fluida Air dan Udara

- Aji Candra Lestari

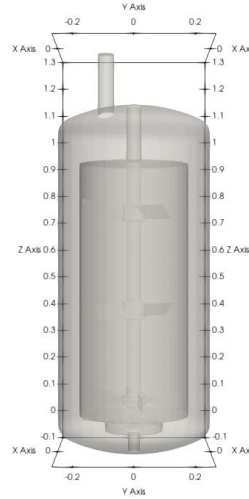
- Geometry
- Mesh
- Patch
- Hasil Simulasi
 - a. Hasil Fasa
 - b. Parameter Lainnya
 - c. Animasi

Geometry

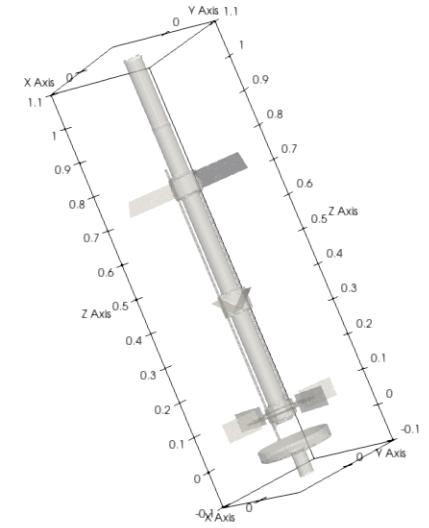
Dalam satuan m (meter)



Gambar Enclosure Nampak ISO



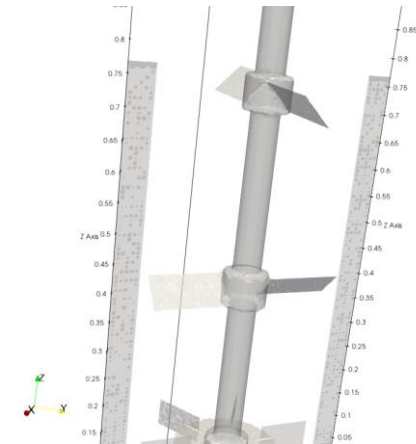
Gambar Enclosure Nampak Atas



Stirrier (Mixer) Geometry

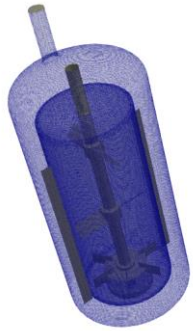


Gambar Enclosure Nampak Depan

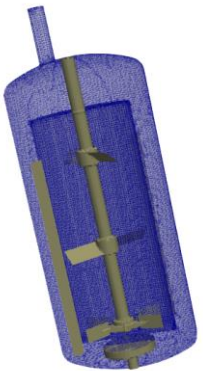


Geometry MHE Nampak ISO

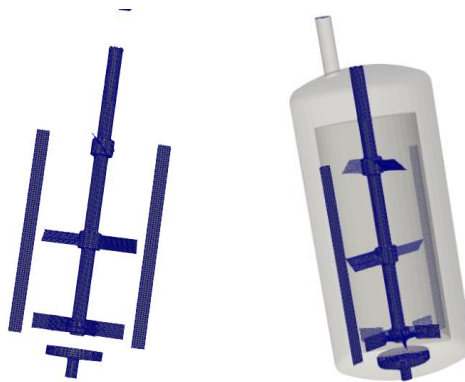
Diskritasi bentuk 3D pada Mixer



Gambar Mesh Nampak ISO



Gambar Mesh Nampak Iso (Cutting Plane)



Gambar Mesh Nampak Sampung (Cutting Plane)

Data Statistics	
Type	Multi-block Dataset
# of Cells	979,903
# of Points	975,033 (float)
# of TimeSteps	80
Current Time	3 (range: [0.025, 3])
Memory:	64.779 GB

```

Checking geometry...
Overall domain bounding box (-0.264997 -0.264997 -0.101301) (0.264997 0.265 1.30004)
Mesh has 3 geometric (non-empty/wedge) directions (1 1 1)
Mesh has 3 solution (non-empty) directions (1 1 1)
Boundary openness (3.8895e-16 1.48841e-15 -6.88092e-17) OK.
Max cell openness = 3.29844e-16 OK.
Max aspect ratio = 7.17755 OK.
Minimum face area = 1.24961e-07. Maximum face area = 8.35932e-05. Face area magnitudes OK.
Min volume = 4.0433e-09. Max volume = 4.57293e-07. Total volume = 0.245883. Cell volumes OK.
Mesh non-orthogonality Max: 64.6492 average: 4.8856
Non-orthogonality check OK.
Face pyramids OK.
***Max skewness = 4.38685, 1 highly skew faces detected which may impair the quality of the results
<<Writing 1 skew faces to set skewFaces
Coupled point location match (average 0) OK.

Failed 1 mesh checks.

End
    
```

>> Acceptable

No	Item	Max	Min	Average	Remark
1	Skewness	19.785%	2.0464e-004	1.40751e-2	Excellent
2	Non - Orthogonality	64.6492%	-	4.38564 %	Excellent
3	Nodes (Points)	975033			
4	Cell (Elements)	979903			
5	faces	2751515			

Depend on average mesh parameter quantity, this simulation has Very Good mesh quality

Patch

Penamaan domain simulasi

Gas inlet



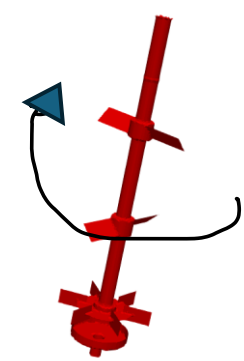
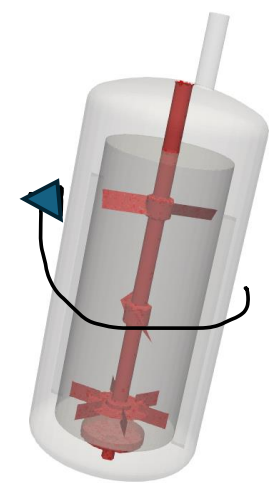
Flow_{inlet} = 16 Lps (axis+z)
 Density = 1.225 kg/m³

outlet

Outlet = pressure outlet
 1 atm



Initial Water Volume



$\omega = 50$ rpm

mixer



Material Information

- Fluida kerja
 - Air (Water)
 - Property Air
 - a. Density = 1027 kg/m³
 - b. Viskositas = 1e-6 cpa
- Tegangan permukaan Air dengan Udara
- 0.07 N/m

Fluida Masuk

- Udara
- Property Udara
 - a. Density = 1.225 kg/m³
 - b. Viskositas = 1.06 e -5 Cpa

Hasil Simulasi

**Analysis Performa Tata Ruang
(Planology – Urban Design)**



Kecepatan

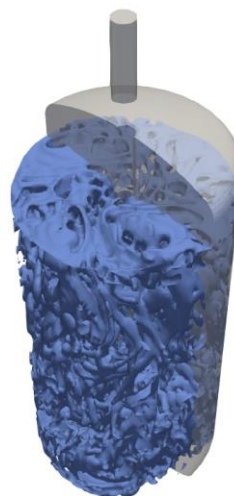
Rotating



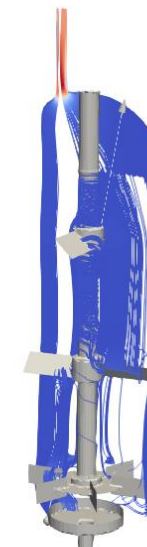
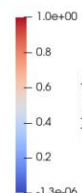
Nampak Iso



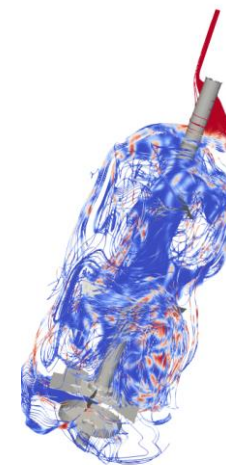
Nampak Samping



Nampak Atas



Streamline Iso



Streamline Samping



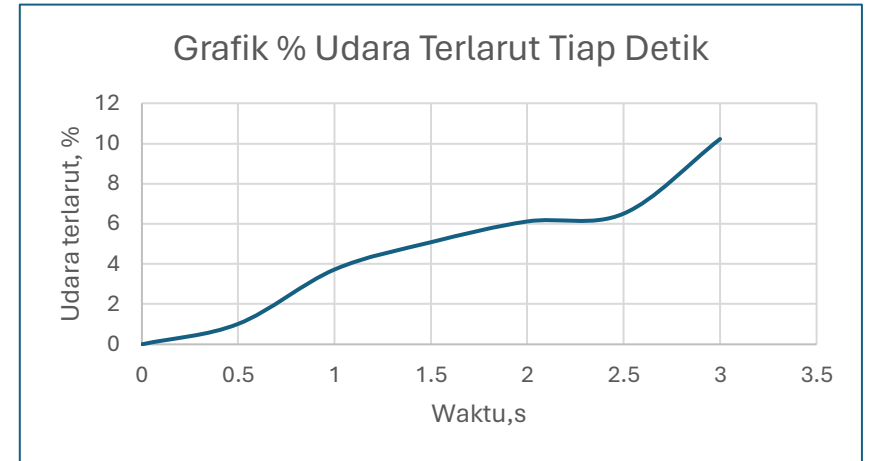


Grafik nilai udara terlarut pada air

Kecepatan injeksi udara masuk 16 Lps

Gambar
Merah => Udara Terlarut
Biru => Air

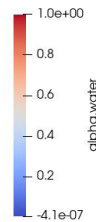
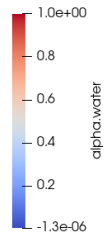
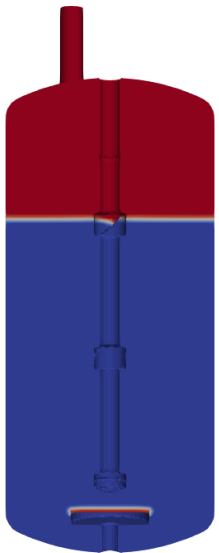
Waktu	Kandungan udara
S	%
0	0
0.5	1.019054695
1	3.728721203
1.5	5.083352092
2	6.118286744
2.5	6.509184133
3	10.22314784



0 s



3 s



Spesifik Udara (Biru) Terlarut

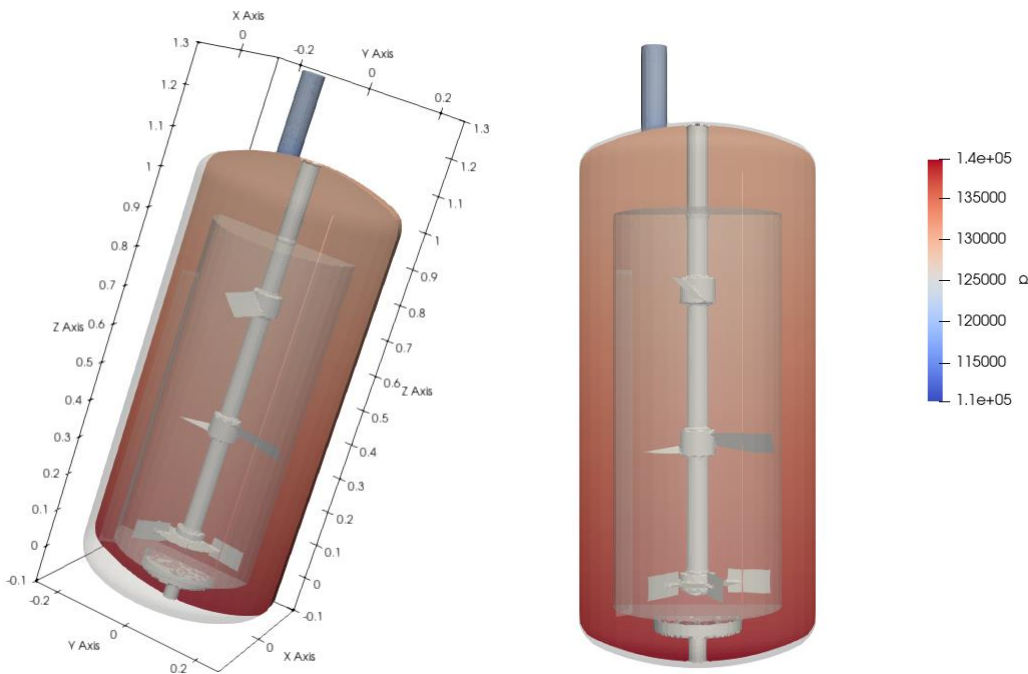
Berikut ini adalah grafik kenaikan konsentrasi udara terlarut di dalam system.

Dalam kondisi 3 detik pertama sebanyak 10% kandungan air di dalam system, Ketika air di dalam tangka diinjek dengan udara sebesar 16 Lps

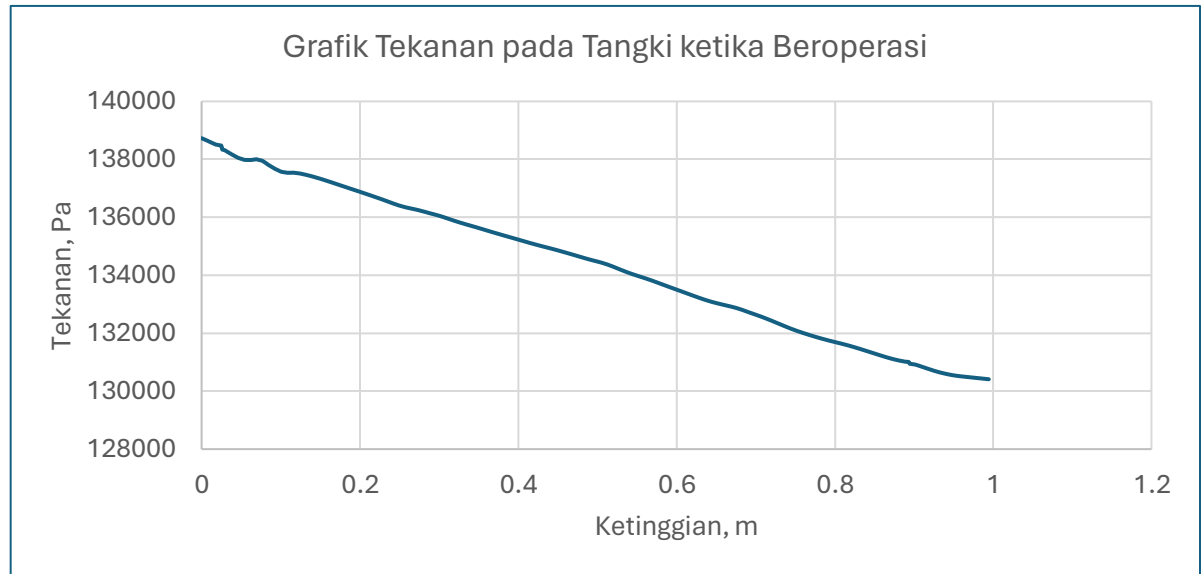
➤ Grafik Tekanan pada Tangki

Tekanan Sistem (Operasi 1 atm)

Pressure drop 8320 Pa



Gambar kondisi tekanan dalam sistem



Berdasarkan dari data tersebut diketahui bahwa system tangki mengalami penurunan Tekanan Ketika beroperasi, dari tekanan eksisting 138724 Pa menuju tekanan keluar 130404 Pa.

Nilai pressure drop sebesar 8320 Pa

➤ Kesimpulan

Udara diinjeksikan ke dalam tangki dengan debit 16 LPS selama 3 detik memberikan dampak sebagai berikut

1. Kenaikan konsentrasi udara terlarut pada tangka dalam 3 detik sebesar 10 %
2. Terjadinya pressure drop pada system sebesar 8320 Pa
3. Kondisi tersebut akan tercapai apabila mixer berputar dengan kecepatan 50 Rpm