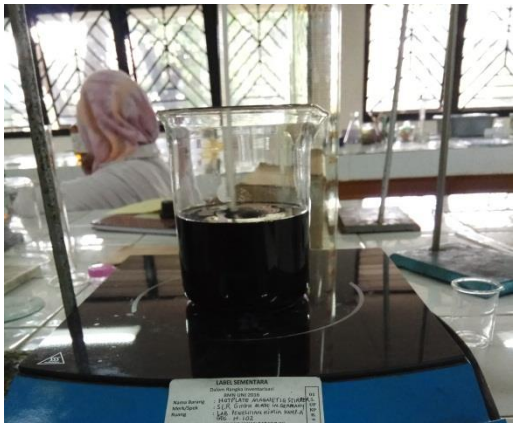
Lampiran 1. Dokumentasi

Proses Penghalusan Ampas Tebu

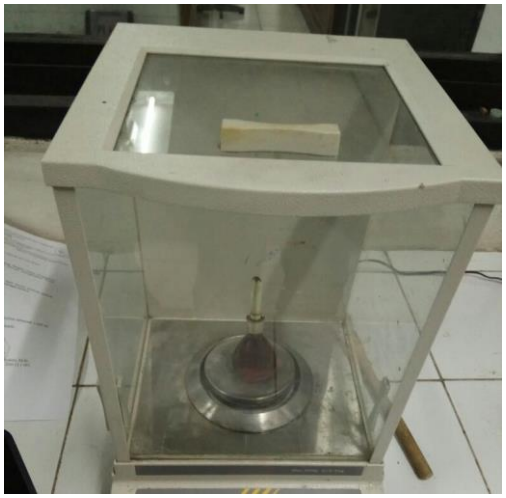
Minyak Nyamplung Mentah



Proses Degumming

Perendaman Ampas Tebu

Pengujian Viskositas



Pengujian Densitas

Lampiran 2. Perhitungan Densitas Minyak nyamplung

Pengukuran		Massa Minyak nyamplung dalam pikno 25 ml (gr)	Berat Minyak (gr)	Densitas (gr/cm3)	Densitas (kg/m3)	Densitas Rata-rata (kg/m^3)
N1	1	45.2294	22.0966	0.88386	883.86	883.98
	2	45.2307	22.0979	0.88392	883.92	
	3	45.2295	22.0967	0.88387	883.87	
	4	45.2042	22.1014	0.88406	884.06	
	5	45.2375	22.1047	0.88419	884.19	
N2	1	44.7102	21.5774	0.8631	863.1	863.33
	2	44.7347	21.6019	0.86408	864.08	
	3	44.7025	21.5697	0.86279	862.79	
	4	44.7106	21.5778	0.86311	863.11	
	5	44.7231	21.5903	0.86361	863.61	
N3	1	43.8467	20.7139	0.82855	828.55	830.00
	2	43.9047	20.7719	0.83088	830.87	
	3	43.8782	20.7454	0.82982	829.81	
	4	43.8074	20.6746	0.82698	826.98	
	5	43.9782	20.8454	0.83382	833.82	

NB: Berat Pikno: 23,1328 gr

1. Densitas minyak nyamplung dengan perendaman ampas tebu selama 1 hari (N1)

$\rho 1 = \frac{massa}{volume}$ (gr/ml) = 22.0966/25 = 0.88386	$\rho 2 = \frac{massa}{volume}$ (gr/ml) = 22.0979/25 = 0.88392	$\rho 3 = \frac{massa}{volume}$ (gr/ml) = 22.0967/25 = 0.88387	$\rho 4 = \frac{massa}{volume}$ (gr/ml) = 22.1014/25 = 0.88406	$\rho 5 = \frac{massa}{volume}$ (gr/ml) = 22.1047/25 = 0.88419

Densitas rata – rata untuk produk minyak nyamplung N1 adalah:

$$\frac{(\rho 1+\rho 2+\rho 3+\rho 4+\rho 5)}{5} =$$

$$= \frac{0.88386 + 0.88392 + 0.88387 + 0.88406 + 0.88419}{5}$$

$$= 0.88398 \text{ gr/ml} = 883.98 \text{ kg/m}^3$$

2. Densitas minyak nyamplung dengan perendaman ampas tebu selama 2 hari (N2)

$\rho 1 = \frac{massa}{volume}$ (gr/ml)	$\rho 2 = \frac{massa}{volume}$ (gr/ml)	$\rho 3 = \frac{massa}{volume}$ (gr/ml)	$\rho 4 = \frac{massa}{volume}$ (gr/ml)	$\rho 5 = \frac{massa}{volume}$ (gr/ml)
= 21.5774/25	= 21.6019/25	= 21.5697/25	= 21.5778/25	= 21.5903/25
= 0.8631	= 0.86408	= 0.86279	= 0.86311	= 0.86361

Densitas rata – rata untuk produk minyak nyamplung N2 adalah:

$$\frac{(\rho 1+\rho 2+\rho 3+\rho 4+\rho 5)}{5} =$$

$$= \frac{0.8631 + 0.86408 + 0.86279 + 0.86311 + 0.86361}{5}$$

= 0.86333 gr/ml = 863.33 kg/m^3

3. Densitas minyak nyamplung dengan perendaman ampas tebu selama 3 hari (N3)

$\rho 1 = \frac{massa}{volume}$ (gr/ml)	$\rho 2 = \frac{massa}{volume}$ (gr/ml)	$\rho 3 = \frac{massa}{volume}$ (gr/ml)	$\rho 4 = \frac{massa}{volume}$ (gr/ml)	$\rho 5 = \frac{massa}{volume}$ (gr/ml)
= 20.7139/25	= 20.7719/25	= 20.7454/25	= 20.6746/25	= 20.8454/25
= 0.82855	= 0.83088	= 0.82982	= 0.82698	= 0.83382

Densitas rata – rata untuk produk minyak nyamplung N1 adalah:

$$\frac{(\rho 1+\rho 2+\rho 3+\rho 4+\rho 5)}{5} =$$

$$= \frac{0.82856 + 0.83088 + 0.82982 + 0.82698 + 0.83382}{5}$$

= 0.8300096 gr/ml = 830.0096 kg/m^3

Lampiran 3. Perhitungan Viskositas Minyak nyamplung

Pengukuran		Waktu Alir (s)	Viskositas (cSt)	Viskositas Rata-rata (cSt)
N1	1	380	2.71	2.71
	2	379	2.70	
	3	381	2.72	
	4	380	2.71	
	5	379	2.70	
N2	1	340	2.42	2,43
	2	344	2.45	
	3	339	2.41	
	4	341	2.43	
	5	342	2.44	
N3	1	299	2.13	2,15
	2	303	2.16	
	3	298	2.12	
	4	302	2.15	
	5	305	2.17	

1. Viskositas minyak nyamplung dengan perendaman ampas tebu selama satu hari (N1)

Diketahui :

η_{air} = 0,891x10^{-3} kg/ms t_1 = 380 detik

t_{air} = 126 detik ρ_1 = 883.73 kg/m^3

ρ_{air} = 992,2 kg/m^{3}s

Ditanyakan η_1 . . . . . .?

Penyelesaian :

$$\frac{\eta_1}{\eta_{air}} = \frac{\rho_1 t_1}{\rho_{air} t_{air}} \qquad \upsilon = \frac{\eta}{\rho}$$

$$\frac{\eta_1}{0{,}891\ x\ 10^{-3}} = \frac{883.73\ \text{kg}/m^3 x\ \ 380\ \ \text{s}}{992{,}2\ \text{kg}/m^3 x\ \ 126\ \ \text{s}} \qquad = \frac{2{,}39\text{x}\ 10^{-3}\ \text{kg/m.s}}{883.73\ \text{kg/m3}}$$

$$\eta_1 = \frac{335820.59}{125017.2} \bullet 0{,}891\text{x}10^{-3}\ \text{kg/m.s} \qquad = 2{,}71\ \text{x}\ 10^{-6}\ \text{m}^2/\text{s} \bullet \frac{1\ cSt}{10^{-6}\ m^2/s}$$

= 2,39x 10^{-3} kg/m.s = 2,71 cSt

Diketahui :

η_{air} = 0,891x10^{-3} kg/ms t_2 = 379 detik

t_{air} = 126 detik ρ_2 = 883.73 kg/m^3

ρ_{air} = 992,2 kg/m^3s

Ditanyakan η_2 . . . . . .?

Penyelesaian :

$$\frac{\eta_2}{\eta_{air}} = \frac{\rho_2 t_2}{\rho_{air} t_{air}} \qquad \upsilon = \frac{\eta}{\rho}$$

$$\frac{\eta_2}{0{,}891\ x\ 10^{-3}} = \frac{883.73\ \text{kg}/m^3 x\ \ 379\ \ \text{s}}{992{,}2\ \text{kg}/m^3 x\ \ 126\ \ \text{s}} \qquad = \frac{2{,}38\text{x}\ 10^{-3}\ \text{kg/m.s}}{883.73\ \text{kg/m3}}$$

$$\eta_2 = \frac{334936.85}{125017.2} \bullet 0{,}891\text{x}10^{-3}\ \text{kg/m.s} \qquad = 2{,}70\ \text{x}\ 10^{-6}\ \text{m}^2/\text{s} \bullet \frac{1\ cSt}{10^{-6}\ m^2/s}$$

= 2,38x 10^{-3} kg/m.s = 2,70 cSt

Diketahui :

η_{air} = 0,891x10^{-3} kg/ms t_3 = 381 detik

t_{air} = 126 detik ρ_3 = 883.73 kg/m^3

ρ_{air} = 992,2 kg/m^3s

Ditanyakan η_3 . . . . . .?

Penyelesaian :

$$\frac{\eta_3}{\eta_{air}} = \frac{\rho_3 t_3}{\rho_{air} t_{air}} \qquad \upsilon = \frac{\eta}{\rho}$$

$$\frac{\eta_3}{0{,}891\ x\ 10^{-3}} = \frac{883.73\ \text{kg}/m^3 x\ \ 381\ \ \text{s}}{992{,}2\ \text{kg}/m^3 x\ \ 126\ \ \text{s}} \qquad = \frac{2{,}4\ \text{x}\ 10^{-3}\ \text{kg/m.s}}{883.73\ \text{kg/m3}}$$

$$\eta_3 = \frac{336704.33}{125017.2} \bullet 0{,}891\text{x}10^{-3}\ \text{kg/m.s} \qquad = 2{,}72\ \text{x}\ 10^{-6}\ \text{m}^2/\text{s} \bullet \frac{1\ cSt}{10^{-6}\ m^2/s}$$

= 2,4 x 10^{-3} kg/m.s = 2,72 cSt

Vikositas rata – rata untuk minyak nyamplung dengan lama perendaman ampas tebu selama 1 hari (N1):

$$\frac{2.71+2.70+2.72+2.71+2.70}{5} = \frac{13.53}{5} = 2.71\ cSt$$

2. Viskositas minyak nyamplung dengan perendaman ampas tebu selama 2 hari (N2)

Diketahui :

η_{air} = 0,891x10^{-3} kg/ms t_1 = 340 detik

t_{air} = 126 detik ρ_1 = 863,34 kg/m^3

ρ_{air} = 992,2 kg/m^3s

Ditanyakan η_1 . . . . . .?

Penyelesaian :

$$\frac{\eta_1}{\eta_{air}} = \frac{\rho_1 t_1}{\rho_{air} t_{air}} \qquad \upsilon = \frac{\eta}{\rho}$$

$$\frac{\eta_1}{0{,}891\ x\ 10^{-3}} = \frac{863{,}34 \text{kg}/m^3 x\ \ 340\ \ \text{s}}{992{,}2\ \text{kg}/m^3 x\ \ 126\ \ \text{s}} \qquad = \frac{2{,}09\text{x}\ 10^{-3}\ \text{kg/m.s}}{863{,}34\ \text{kg/m3}}$$

$$\eta_1 = \frac{293534.51}{125017.2} \bullet 0{,}891\text{x}10^{-3}\ \text{kg/m.s} \qquad = 2.42\ \text{x}\ 10^{-6}\ \text{m}^2/\text{s} \bullet \frac{1\ cSt}{10^{-6}\ m^2/s}$$

$$= 2{,}09\text{x}\ 10^{-3}\ \text{kg/m.s} \qquad = 2.42\ \text{cSt}$$

Diketahui :

η_{air} = 0,891x10^{-3} kg/ms t_2 = 344 detik

t_{air} = 126 detik ρ_2 = 863,34 kg/m^3

ρ_{air} = 992,2 kg/m^3s

Ditanyakan η_2 . . . . . .?

Penyelesaian :

$$\frac{\eta_2}{\eta_{air}} = \frac{\rho_2 t_2}{\rho_{air} t_{air}} \qquad \upsilon = \frac{\eta}{\rho}$$

$$\frac{\eta_2}{0{,}891\ x\ 10^{-3}} = \frac{863{,}34 \text{kg}/m^3 x\ \ 344\ \ \text{s}}{992{,}2\ \text{kg}/m^3 x\ \ 126\ \ \text{s}} \qquad = \frac{2{,}12\text{x}\ 10^{-3}\ \text{kg/m.s}}{863{,}34\ \text{kg/m3}}$$

$$\eta_2 = \frac{296987.86}{125017.2}\ \text{x}\ 0{,}891 \bullet 10^{-3}\ \text{kg/m.s} \qquad = 2.45\ \text{x}\ 10^{-6}\ \text{m}^2/\text{s} \bullet \frac{1\ cSt}{10^{-6}\ m^2/s}$$

$$= 2{,}12\text{x}\ 10^{-3}\ \text{kg/m.s} \qquad = 2.45\ \text{cSt}$$

Diketahui :

η_{air} = 0,891x10^{-3} kg/ms t_3 = 339 detik

t_{air} = 126 detik ρ_3 = 863,34 kg/m^3

ρ_{air} = 992,2 kg/m^{3}s

Ditanyakan η_3 . . . . . .?

Penyelesaian :

$$\frac{\eta_3}{\eta_{air}} = \frac{\rho_3 t_3}{\rho_{air} t_{air}} \qquad \upsilon = \frac{\eta}{\rho}$$

$$\frac{\eta_3}{0{,}891\ x\ 10^{-3}} = \frac{863{,}34 \text{kg}/m^3 x\ \ 339\ \ \text{s}}{992{,}2\ \text{kg}/m^3 x\ \ 126\ \ \text{s}} \qquad = \frac{2{,}08\text{x}\ 10^{-3}\ \text{kg/m.s}}{863{,}34\ \text{kg/m3}}$$

$$\eta_3 = \frac{292671.18}{125017.2} \bullet 0{,}891\text{x}10^{-3}\ \text{kg/m.s} \qquad = 2.41\ \text{x}\ 10^{-6}\ \text{m}^2/\text{s} \bullet \frac{1\ cSt}{10^{-6}\ m^2/s}$$

$$= 2{,}08\text{x}\ 10^{-3}\ \text{kg/m.s} \qquad = 2.41\ \text{cSt}$$

Diketahui :

η_{air} = 0,891x10^{-3} kg/ms t_4 = 341 detik

t_{air} = 126 detik ρ_4 = 863,34 kg/m^3

ρ_{air} = 992,2 kg/m^{3}s

Ditanyakan η_3 . . . . . .?

Penyelesaian :

$$\frac{\eta_4}{\eta_{air}} = \frac{\rho_4 t_4}{\rho_{air} t_{air}} \qquad \upsilon = \frac{\eta}{\rho}$$

$$\frac{\eta_4}{0{,}891\ x\ 10^{-3}} = \frac{863{,}34 \text{kg}/m^3 x\ \ 341\ \ \text{s}}{992{,}2\ \text{kg}/m^3 x\ \ 126\ \ \text{s}} \qquad = \frac{2{,}098\text{x}\ 10^{-3}\ \text{kg/m.s}}{863{,}34\ \text{kg/m3}}$$

$$\eta_4 = \frac{294397.85}{125017.2} \bullet 0{,}891\text{x}10^{-3}\ \text{kg/m.s} \qquad = 2.43\ \text{x}\ 10^{-6}\ \text{m}^2/\text{s} \bullet \frac{1\ cSt}{10^{-6}\ m^2/s}$$

$$= 2{,}098\text{x}\ 10^{-3}\ \text{kg/m.s} \qquad = 2.43\ \text{cSt}$$

Diketahui :

η_{air} = 0,891x10^{-3} kg/ms t_5 = 342 detik

t_{air} = 126 detik ρ_5 = 863,34 kg/m^3

ρ_{air} = 992,2 kg/m^{3}s
Ditanyakan η_3 . . . . . .?
Penyelesaian :

$$\frac{\eta_5}{\eta_{air}} = \frac{\rho_5 t_5}{\rho_{air} t_{air}} \qquad \upsilon = \frac{\eta}{\rho}$$

$$\frac{\eta_5}{0{,}891\ x\ 10^{-3}} = \frac{863{,}34 \text{kg}/m^3 x\ \ 342\ \ \text{s}}{992{,}2\ \text{kg}/m^3 x\ \ 126\ \ \text{s}} \qquad = \frac{2{,}098\text{x}\ 10^{-3}\ \text{kg/m.s}}{863{,}34\ \text{kg/m3}}$$

$$\eta_5 = \frac{295261.19}{125017.2} \bullet 0{,}891\text{x}10^{-3}\ \text{kg/m.s} \qquad = 2.44\ \text{x}\ 10^{-6}\ \text{m}^2/\text{s} \bullet \frac{1\ cSt}{10^{-6}\ m^2/s}$$

$$= 2{,}098\text{x}\ 10^{-3}\ \text{kg/m.s} \qquad = 2.44\ \text{cSt}$$

Vikositas rata – rata minyak nyamplung dengan perendaman ampas tebu selama 2 hari (N2):

$$\frac{2.42+2.45+2.41+2.43+2.44}{5} = \frac{12.158}{5} = 2.43\ \text{cSt}$$

3. Viskositas minyak nyamplung dengan perendaman amaps tebu selama 3 hari (N3).
Diketahui :
η_{air} = 0,891x10^{-3} kg/ms t_1 = 299 detik
t_{air} = 126 detik ρ_1 = 830,01 kg/m^3
ρ_{air} = 992,2 kg/m^{3}s
Ditanyakan η_1 . . . . . .?
Penyelesaian :

$$\frac{\eta_1}{\eta_{air}} = \frac{\rho_1 t_1}{\rho_{air} t_{air}} \qquad \upsilon = \frac{\eta}{\rho}$$

$$\frac{\eta_1}{0{,}891\ x\ 10^{-3}} = \frac{830{,}01\ \text{kg}/m^3 x\ \ 299\ \ \text{s}}{992{,}2\ \text{kg}/m^3 x\ \ 126\ \ \text{s}} \qquad = \frac{1{,}77\text{x}\ 10^{-3}\ \text{kg/m.s}}{830{,}01\ \text{kg/m3}}$$

$$\eta_1 = \frac{248172.87}{125017.2} \bullet 0{,}891\text{x}10^{-3}\ \text{kg/m.s} \qquad = 2{,}13\ \text{x}\ 10^{-6}\ \text{m}^2/\text{s} \bullet \frac{1\ cSt}{10^{-6}\ m^2/s}$$

$$= 1{,}77\text{x}\ 10^{-3}\ \text{kg/m.s} \qquad = 2{,}13\ \text{cSt}$$

Diketahui :

η_{air} = 0,891x10^{-3} kg/ms t_2 = 303 detik

t_{air} = 126 detik ρ_2 = 830,01 kg/m^3

ρ_{air} = 992,2 kg/m^{3}s

Ditanyakan η_2 . . . . . .?

Penyelesaian :

$$\frac{\eta_2}{\eta_{air}} = \frac{\rho_2 t_2}{\rho_{air} t_{air}} \qquad \upsilon = \frac{\eta}{\rho}$$

$$\frac{\eta_2}{0{,}891\ x\ 10^{-3}} = \frac{830{,}01\ \text{kg}/m^3 x\ \ 303\ \ \text{s}}{992{,}2\ \text{kg}/m^3 x\ \ 126\ \ \text{s}} \qquad = \frac{1{,}79\ \text{x}\ 10^{-3}\ \text{kg/m.s}}{830{,}01\ \text{kg/m3}}$$

$$\eta_2 = \frac{251492.91}{125017.2} \bullet 0{,}891\text{x}10^{-3}\ \text{kg/m.s} \qquad = 2{,}16\ \text{x}\ 10^{-6}\ \text{m}^2/\text{s} \bullet \frac{1\ cSt}{10^{-6}\ m^2/s}$$

$$= 1{,}79\ \text{x}\ 10^{-3}\ \text{kg/m.s} \qquad = 2{,}16\ \text{cSt}$$

Diketahui :

η_{air} = 0,891x10^{-3} kg/ms t_3 = 298 detik

t_{air} = 126 detik ρ_3 = 830,01 kg/m^3

ρ_{air} = 992,2 kg/m^{3}s

Ditanyakan η_3 . . . . . .?

Penyelesaian :

$$\frac{\eta_3}{\eta_{air}} = \frac{\rho_3 t_3}{\rho_{air} t_{air}} \qquad \upsilon = \frac{\eta}{\rho}$$

$$\frac{\eta_3}{0{,}891\ x\ 10^{-3}} = \frac{830{,}01\ \text{kg}/m^3 x\ \ 298\ \ \text{s}}{992{,}2\ \text{kg}/m^3 x\ \ 126\ \ \text{s}} \qquad = \frac{1{,}76\text{x}\ 10^{-3}\text{kg/m.s}}{830{,}01\ \text{kg/m3}}$$

$$\eta_3 = \frac{247342.86}{125017.2} \bullet 0{,}891\text{x}10^{-3}\ \text{kg/m.s} \qquad = 2{,}12\ \text{x}\ 10^{-6}\ \text{m}^2/\text{s} \bullet \frac{1\ cSt}{10^{-6}\ m^2/s}$$

$$= 1{,}76\ \text{x}\ 10^{-3}\ \text{kg/m.s} \qquad = 2{,}12\ \text{cSt}$$

Diketahui :

η_{air} = 0,891x10^{-3} kg/ms t_4 = 302 detik

t_{air} = 126 detik ρ_4 = 830,01 kg/m^3

ρ_{air} = 992,2 kg/m^{3}s

Ditanyakan η_3 . . . . . .?

Penyelesaian :

$$\frac{\eta_4}{\eta_{air}} = \frac{\rho_4 t_4}{\rho_{air} t_{air}} \qquad \upsilon = \frac{\eta}{\rho}$$

$$\frac{\eta_4}{0{,}891\ x\ 10^{-3}} = \frac{830{,}01\ \text{kg}/m^3 x\ \ 298\ \ \text{s}}{992{,}2\ \text{kg}/m^3 x\ \ 126\ \ \text{s}} \qquad = \frac{1{,}786\ \text{x}\ 10^{-3}\text{kg/m.s}}{830{,}01\ \text{kg/m3}}$$

$$\eta_4 = \frac{250662.90}{125017.2} \bullet 0{,}891\text{x}10^{-3}\ \text{kg/m.s} \qquad = 2{,}15\ \text{x}\ 10^{-6}\ \text{m}^2/\text{s} \bullet \frac{1\ cSt}{10^{-6}\ m^2/s}$$

$$= 1{,}786\ \text{x}\ 10^{-3}\ \text{kg/m.s} \qquad = 2{,}15\ \text{cSt}$$

Diketahui :

η_{air} = 0,891x10^{-3} kg/ms t_5 = 309 detik

t_{air} = 126 detik ρ_5 = 830,01 kg/m^3

ρ_{air} = 992,2 kg/m^{3}s

Ditanyakan η_3 . . . . . .?

Penyelesaian :

$$\frac{\eta_5}{\eta_{air}} = \frac{\rho_5 t_5}{\rho_{air} t_{air}} \qquad \upsilon = \frac{\eta}{\rho}$$

$$\frac{\eta_5}{0{,}891\ x\ 10^{-3}} = \frac{830{,}01\ \text{kg}/m^3 x\ \ 309\ \ \text{s}}{992{,}2\ \text{kg}/m^3 x\ \ 126\ \ \text{s}} \qquad = \frac{1{,}8\ \text{x}\ 10^{-3}\text{kg/m.s}}{830{,}01\ \text{kg/m3}}$$

$$\eta_5 = \frac{253152.93}{125017.2} \bullet 0{,}891\text{x}10^{-3}\ \text{kg/m.s} \qquad = 2{,}17\ \text{x}\ 10^{-6}\ \text{m}^2/\text{s} \bullet \frac{1\ cSt}{10^{-6}\ m^2/s}$$

$$= 1{,}8\ \text{x}\ 10^{-3}\ \text{kg/m.s} \qquad = 2{,}17\ \text{cSt}$$

Vikositas rata – rata minyak nyamplung dengan perendaman ampas tebu selama 3 hari (N3):

$$\frac{2.13+2.16+2.12+215+2.17}{5} = \frac{10.73}{5} = 2.15\ cSt$$