LAMPIRAN

LAMPIRAN 1

Tabel sifat-sifat fluida

Tabel sifat-sifat fluida pada 1 atm dan 20^{o}C (68^{o}F)

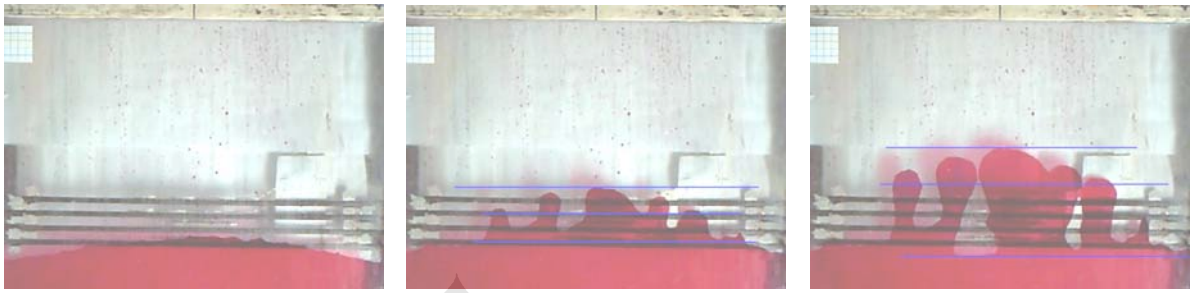
Fluida	ρ (kg/m^3)	μ (N.s/m^2)	σ (N/m)
Glycerine	1260	1.5	0.063
Castor oil	960	0.976	0.039
SAE 30	890	1.05×10^{-1}	0.035

LAMPIRAN 2

Foto-foto aliran fluida

Gambar perkembangan aliran Glycerin dT/dx ≤ 0

I. b = 0.8 mm, α = 15°, dT/dx = - 10 °C/cm



t = 10 detik t = 30 detik t = 60 detik

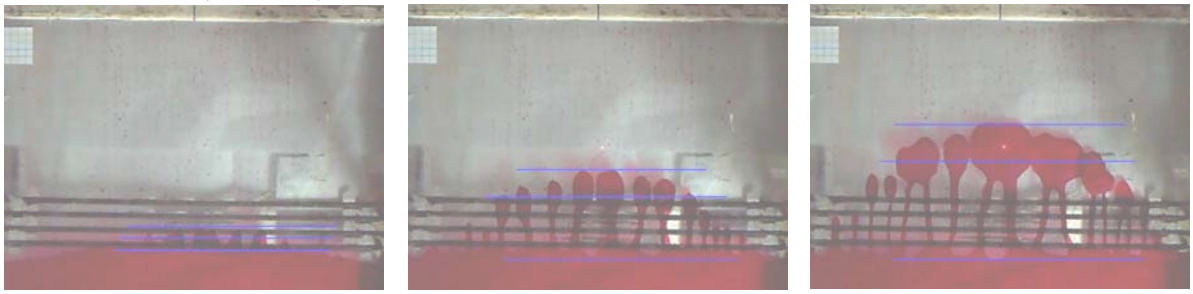
b = 0.8 mm, α = 15°, dT/dx = - 4 °C/cm

t = 14 detik t = 37 detik t = 70 detik

b = 0.8 mm, α = 15°, dT/dx = - 2.5 °C/cm

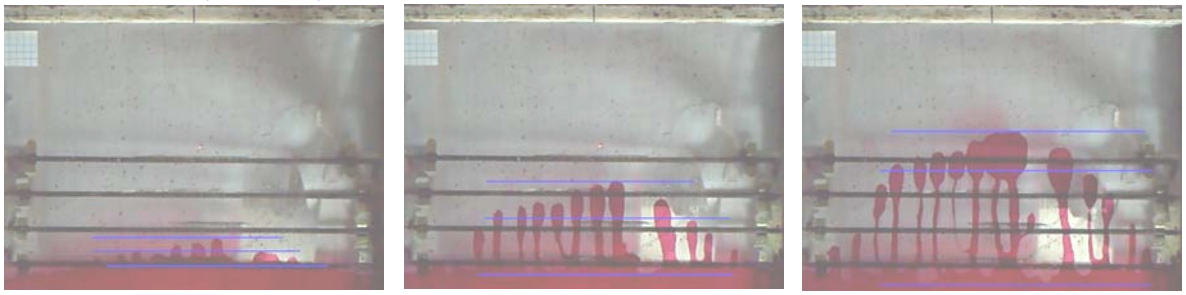
t = 20 detik t = 55 detik t = 105 detik

b = 0.8 mm, α = 45°, dT/dx = - 10 °C/cm



t = 7 detik t = 12 detik t = 20 detik

b = 0.8 mm, α = 45°, dT/dx = - 4 °C/cm

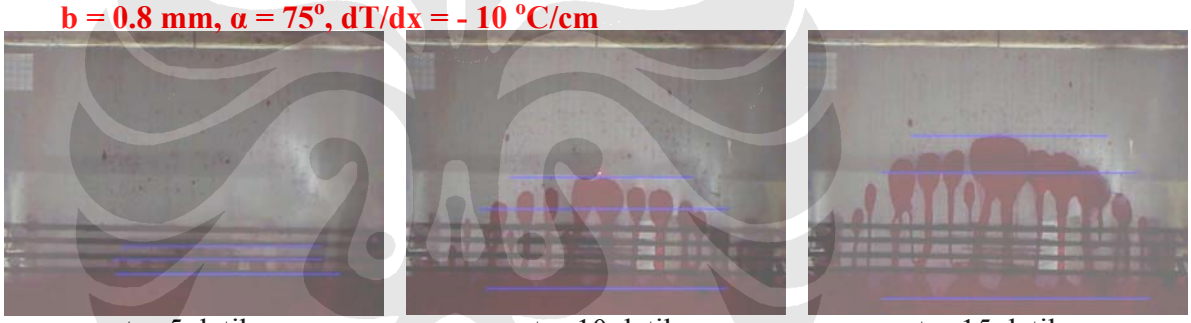


t = 6 detik | t = 10 detik | t = 15 detik

b = 0.8 mm, α = 45°, dT/dx = - 2.5 °C/cm

t = 7 detik | t = 16 detik | t = 30 detik

b = 0.8 mm, α = 75°, dT/dx = - 10 °C/cm



t = 5 detik | t = 10 detik | t = 15 detik

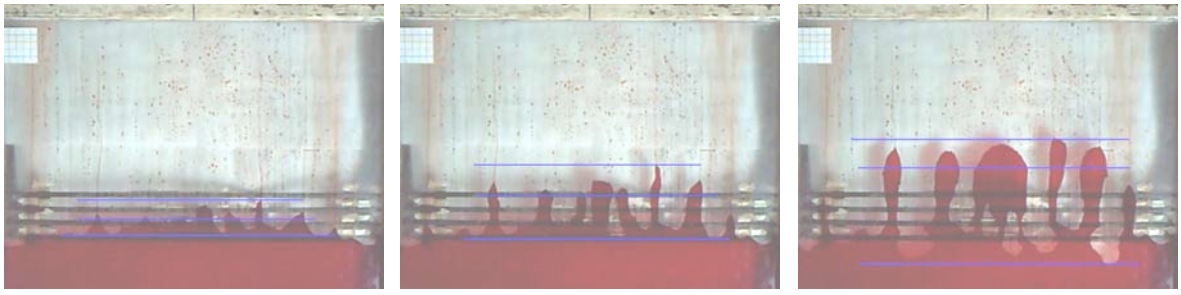
b = 0.8 mm, α = 75°, dT/dx = - 4 °C/cm

t = 5 detik | t = 8 detik | t = 12 detik

b = 0.8 mm, α = 75°, dT/dx = - 2.5 °C/cm

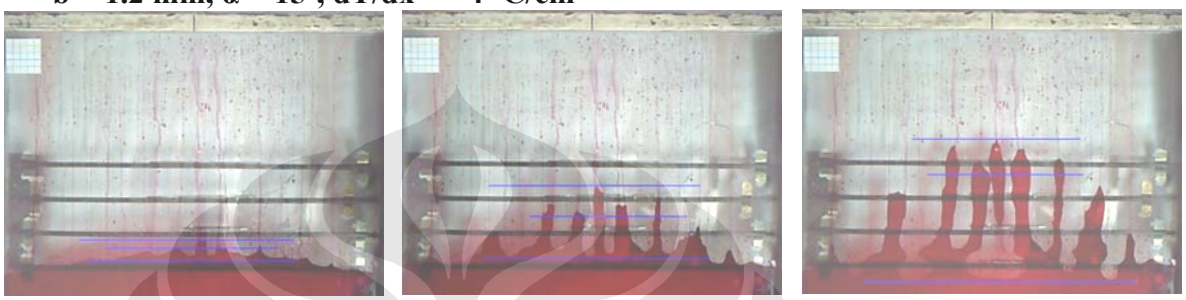
t = 6 detik | t = 10 detik | t = 17 detik

II. b = 1.2 mm, α = 15°, dT/dx = - 10 °C/cm



t = 15 detik | t = 25 detik | t = 45 detik

b = 1.2 mm, α = 15°, dT/dx = - 4 °C/cm



t = 12 detik | t = 28 detik | t = 50 detik

b = 1.2 mm, α = 15°, dT/dx = - 2.5 °C/cm

t = 15 detik | t = 33 detik | t = 70 detik

b = 1.2 mm, α = 45°, dT/dx = - 10 °C/cm

t = 6 detik | t = 8 detik | t = 10 detik

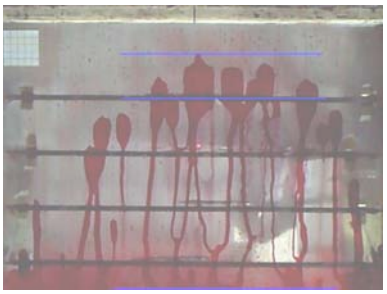
b = 1.2 mm, α = 45°, dT/dx = - 4 °C/cm

t = 6 detik | t = 11 detik | t = 15 detik

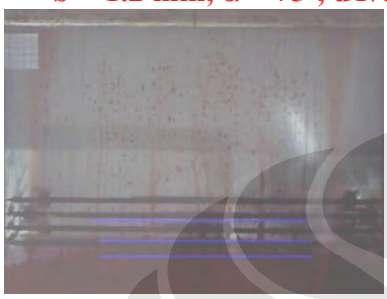
b = 1.2 mm, α = 45°, dT/dx = - 2.5 °C/cm


t = 8 detik


t = 17 detik


t = 26 detik

b = 1.2 mm, α = 75°, dT/dx = - 10 °C/cm


t = 6 detik


t = 8 detik


t = 12 detik

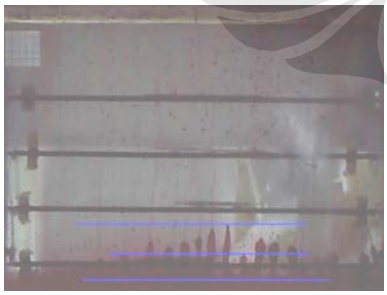
b = 1.2 mm, α = 75°, dT/dx = - 4 °C/cm

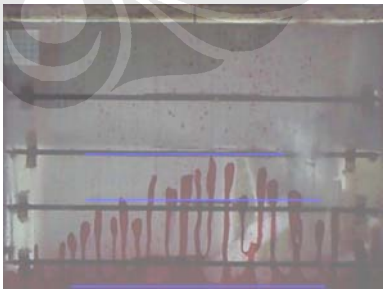

t = 6 detik


t = 8 detik


t = 12 detik

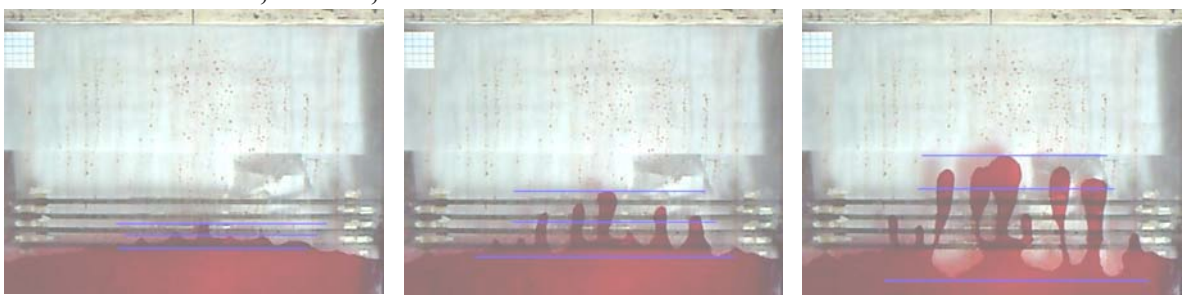
b = 1.2 mm, α = 75°, dT/dx = - 2.5 °C/cm


t = 5 detik


t = 9 detik


t = 14 detik

III. b = 1.5 mm, α = 15°, dT/dx = - 10 °C/cm

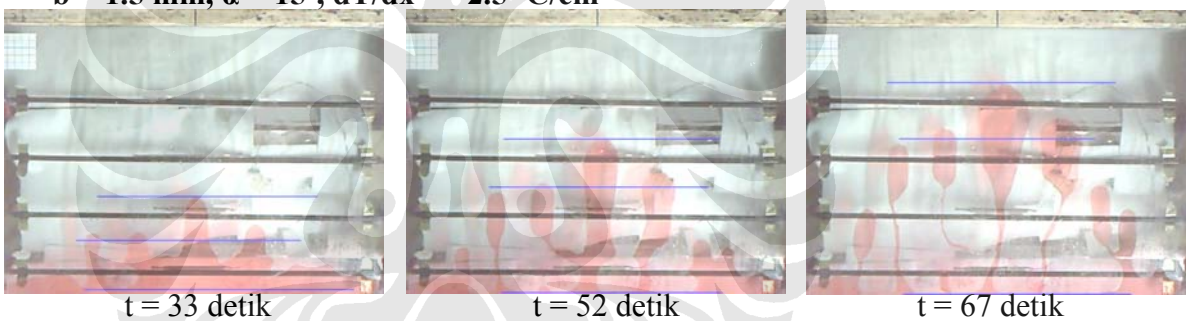


t = 15 detik | t = 27 detik | t = 45 detik

b = 1.5 mm, α = 15°, dT/dx = - 4 °C/cm

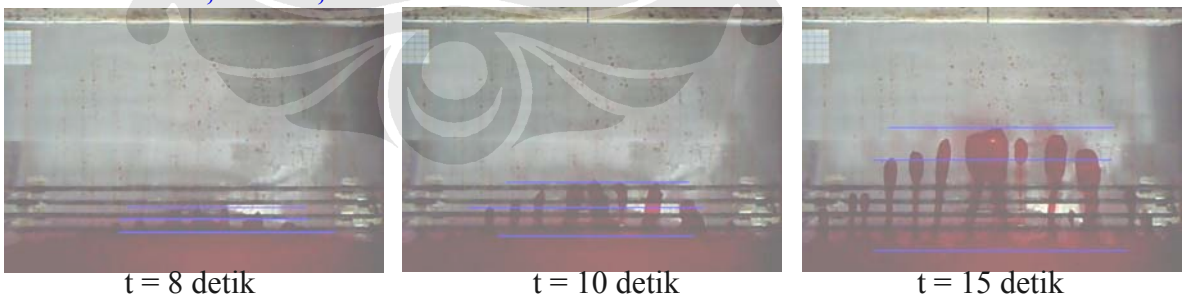
t = 16 detik | t = 32 detik | t = 75 detik

b = 1.5 mm, α = 15°, dT/dx = - 2.5 °C/cm



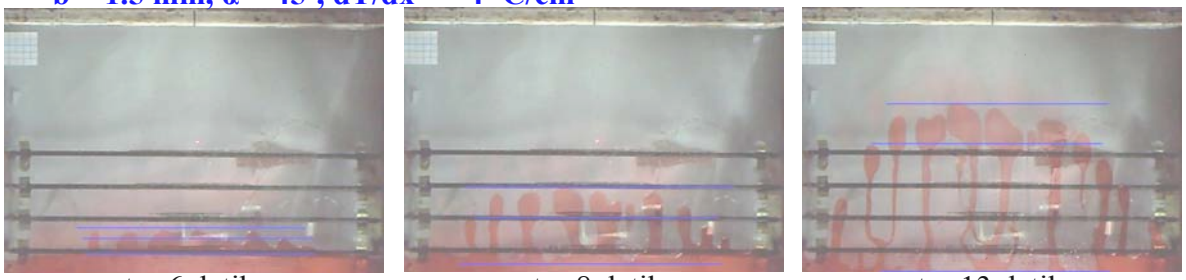
t = 33 detik | t = 52 detik | t = 67 detik

b = 1.5 mm, α = 45°, dT/dx = - 10 °C/cm



t = 8 detik | t = 10 detik | t = 15 detik

b = 1.5 mm, α = 45°, dT/dx = - 4 °C/cm



t = 6 detik | t = 8 detik | t = 13 detik

b = 1.5 mm, α = 45°, dT/dx = - 2.5 °C/cm

t = 10 detik | t = 16 detik | t = 22 detik

b = 1.5 mm, α = 75°, dT/dx = - 10 °C/cm

t = 5 detik | t = 7 detik | t = 10 detik

b = 1.5 mm, α = 75°, dT/dx = - 4 °C/cm

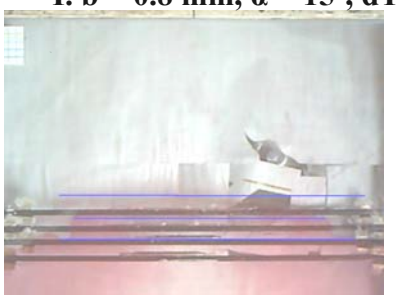
t = 4 detik | t = 6 detik | t = 9 detik

b = 1.5 mm, α = 75°, dT/dx = - 2.5 °C/cm

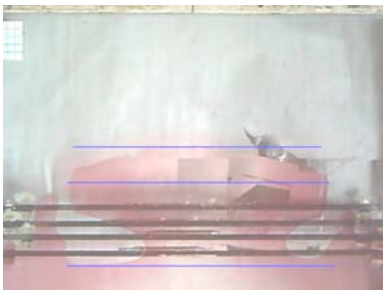
t = 5 detik | t = 10 detik | t = 17 detik

Gambar perkembangan aliran Castor oil dT/dx ≤ 0

I. b = 0.8 mm, α = 15°, dT/dx = - 10 °C/cm


t = 30 detik

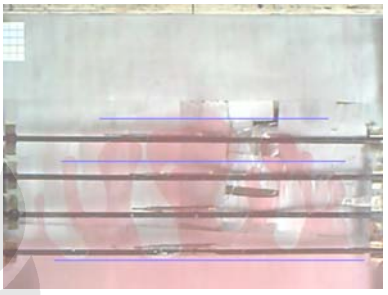

t = 50 detik


t = 90 detik

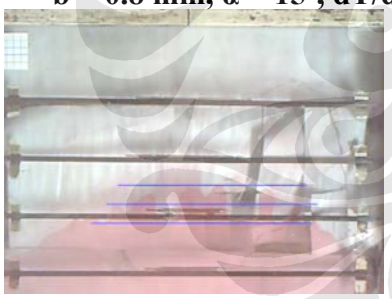
b = 0.8 mm, α = 15°, dT/dx = - 4 °C/cm


t = 35 detik

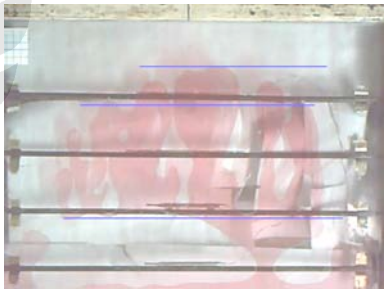

t = 60 detik


t = 100 detik

b = 0.8 mm, α = 15°, dT/dx = - 2.5 °C/cm


t = 35 detik


t = 70 detik


t = 165 detik

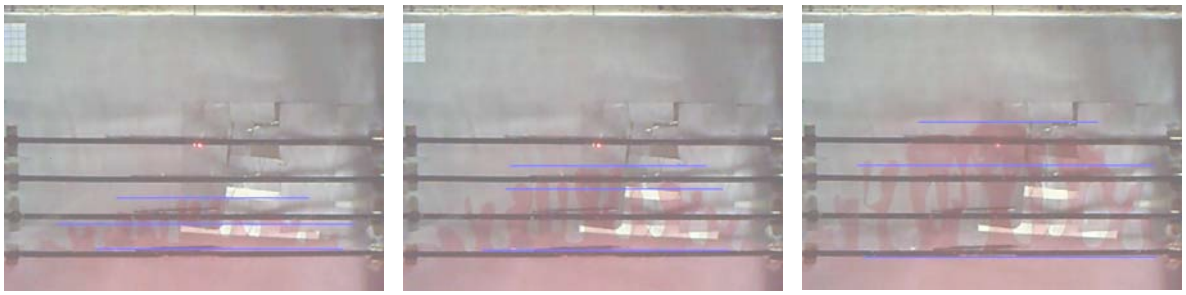
b = 0.8 mm, α = 45°, dT/dx = - 10 °C/cm


t = 8 detik


t = 10 detik


t = 14 detik

b = 0.8 mm, α = 45°, dT/dx = - 4 °C/cm

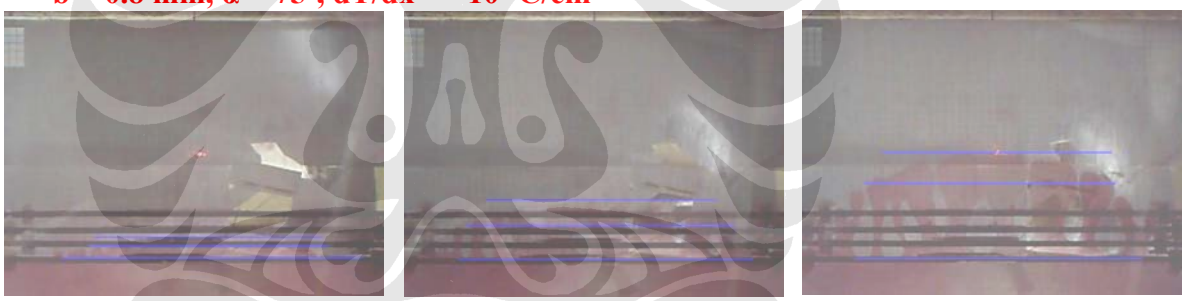


t = 10 detik t = 14 detik t = 22 detik

b = 0.8 mm, α = 45°, dT/dx = - 2.5 °C/cm

t = 7 detik t = 12 detik t = 23 detik

b = 0.8 mm, α = 75°, dT/dx = - 10 °C/cm



t = 6 detik t = 9 detik t = 15 detik

b = 0.8 mm, α = 75°, dT/dx = - 4 °C/cm

t = 7 detik t = 10 detik t = 20 detik

b = 0.8 mm, α = 75°, dT/dx = - 2.5 °C/cm

t = 6 detik | t = 9 detik | t = 16 detik

II. b = 1.2 mm, α = 15°, dT/dx = - 10 °C/cm

t = 30 detik | t = 50 detik | t = 70 detik

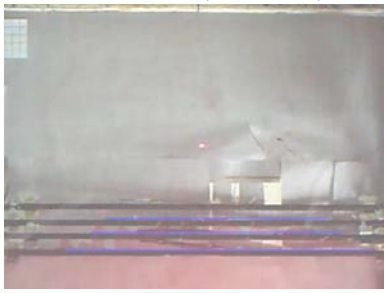
b = 1.2 mm, α = 15°, dT/dx = - 4 °C/cm

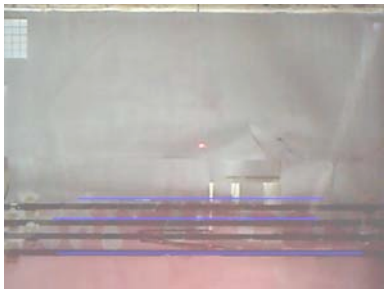
t = 29 detik | t = 57 detik | t = 105 detik

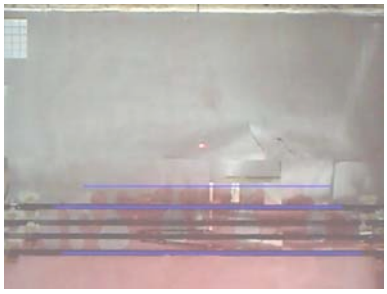
b = 1.2 mm, α = 15°, dT/dx = - 2.5 °C/cm

t = 30 detik | t = 75 detik | t = 180 detik

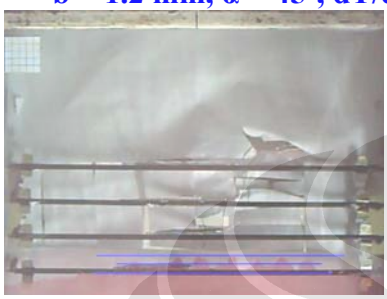
b = 1.2 mm, α = 45°, dT/dx = - 10 °C/cm

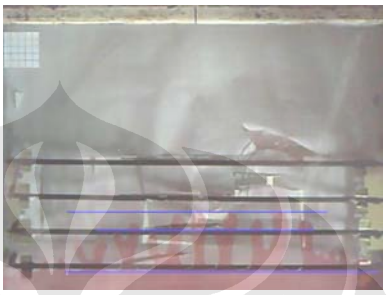

t = 9 detik

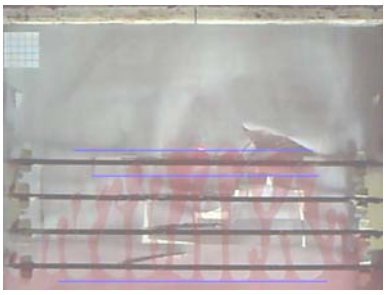

t = 11 detik


t = 13 detik

b = 1.2 mm, α = 45°, dT/dx = - 4 °C/cm


t = 9 detik

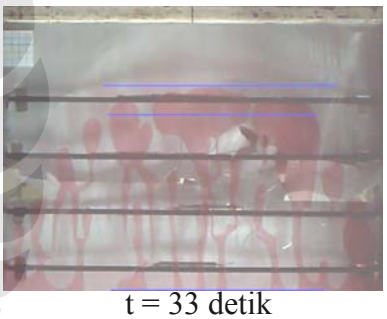

t = 13 detik


t = 22 detik

b = 1.2 mm, α = 45°, dT/dx = - 2.5 °C/cm


t = 10 detik

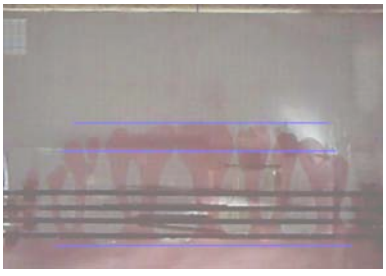

t = 22 detik


t = 33 detik

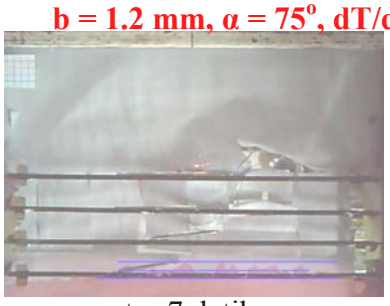
b = 1.2 mm, α = 75°, dT/dx = - 10 °C/cm

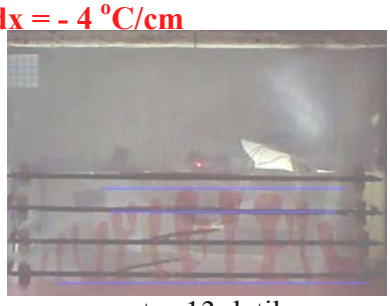

t = 6 detik

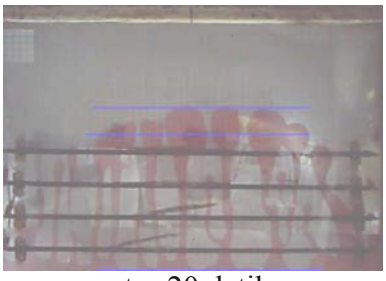

t = 10 detik


t = 15 detik

b = 1.2 mm, α = 75°, dT/dx = - 4 °C/cm


t = 7 detik


t = 13 detik


t = 20 detik

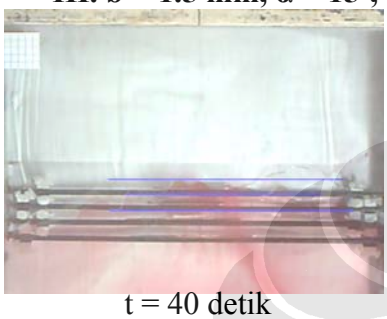
b = 1.2 mm, α = 75°, dT/dx = - 2.5 °C/cm


t = 6 detik

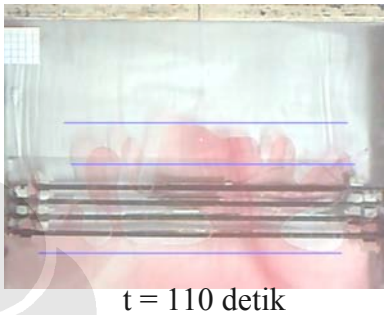

t = 14 detik


t = 23 detik

III. b = 1.5 mm, α = 15°, dT/dx = - 10 °C/cm


t = 40 detik

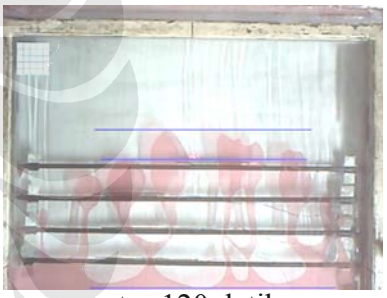

t = 70 detik


t = 110 detik

b = 1.5 mm, α = 15°, dT/dx = - 4 °C/cm

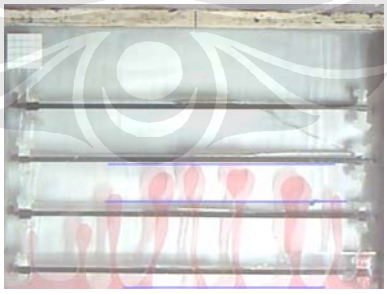

t = 25 detik

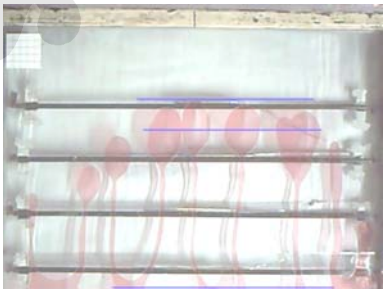

t = 60 detik


t = 120 detik

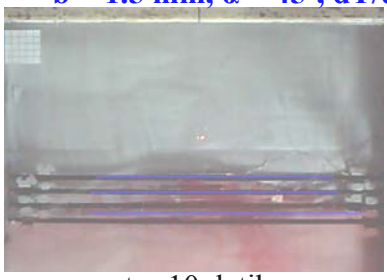
b = 1.5 mm, α = 15°, dT/dx = - 2.5 °C/cm

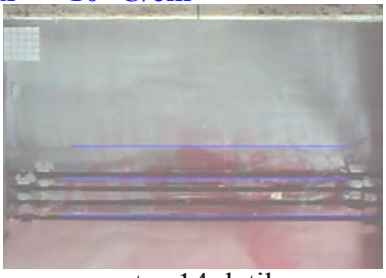

t = 45 detik

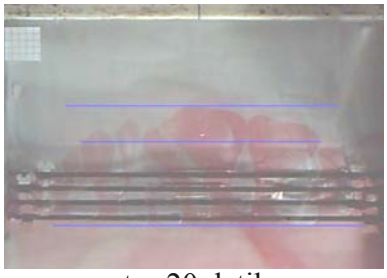

t = 125 detik


t = 225 detik

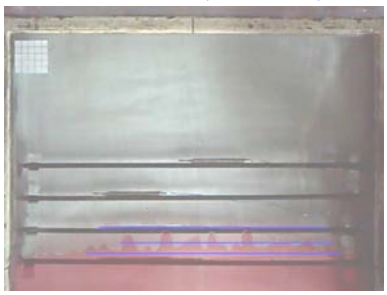
b = 1.5 mm, α = 45°, dT/dx = - 10 °C/cm

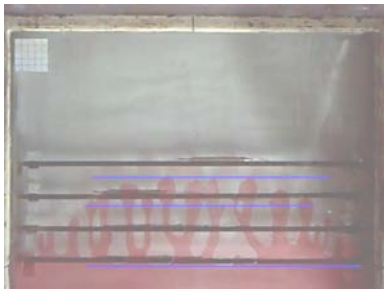

t = 10 detik

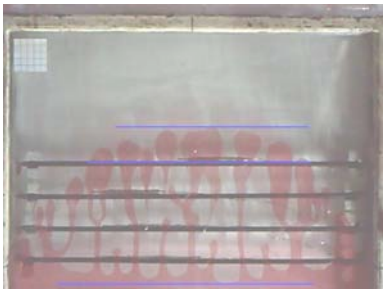

t = 14 detik


t = 20 detik

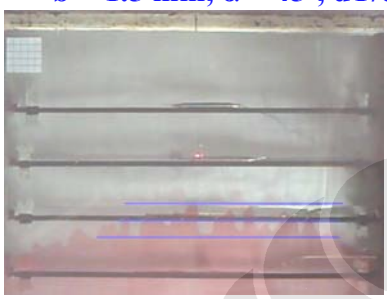
b = 1.5 mm, α = 45°, dT/dx = - 4 °C/cm


t = 9 detik


t = 15 detik


t = 23 detik

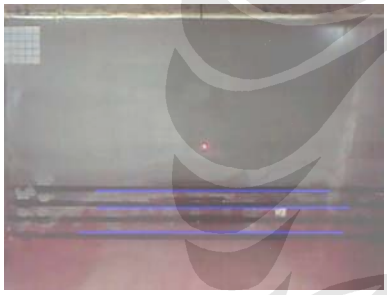
b = 1.5 mm, α = 45°, dT/dx = - 2.5 °C/cm


t = 10 detik

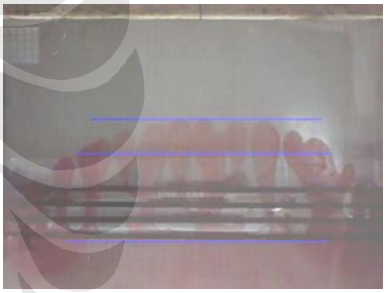

t = 15 detik


t = 30 detik

b = 1.5 mm, α = 75°, dT/dx = - 10 °C/cm


t = 6 detik

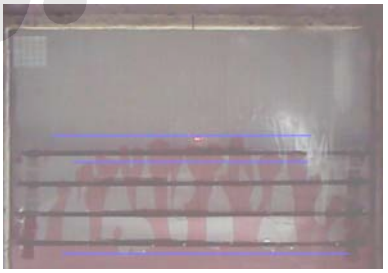

t = 8 detik


t = 13 detik

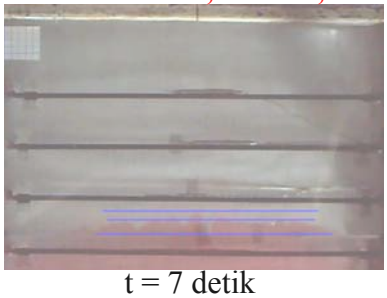
b = 1.5 mm, α = 75°, dT/dx = - 4 °C/cm

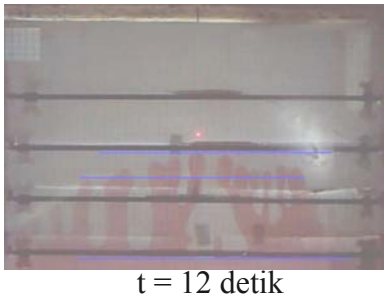

t = 10 detik

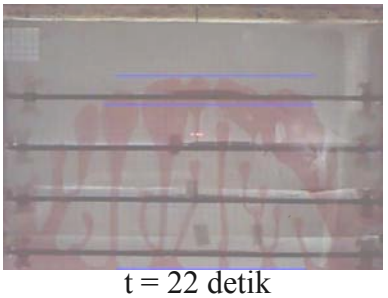

t = 12 detik


t = 15 detik

b = 1.5 mm, α = 75°, dT/dx = - 4 °C/cm

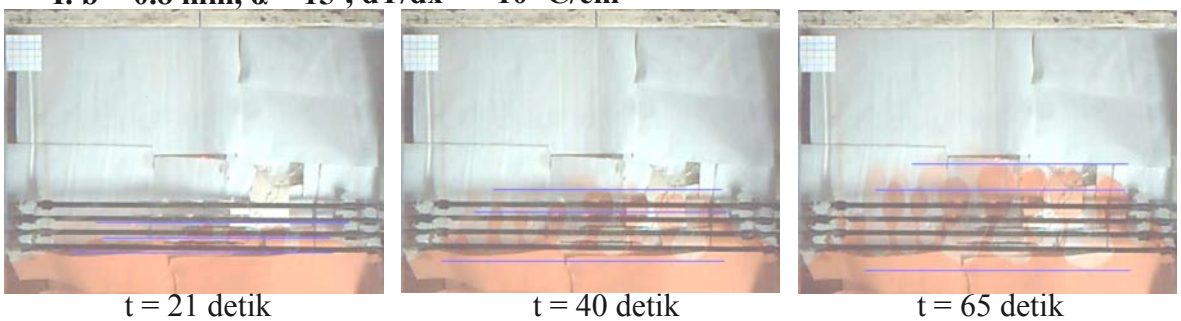

t = 7 detik


t = 12 detik


t = 22 detik

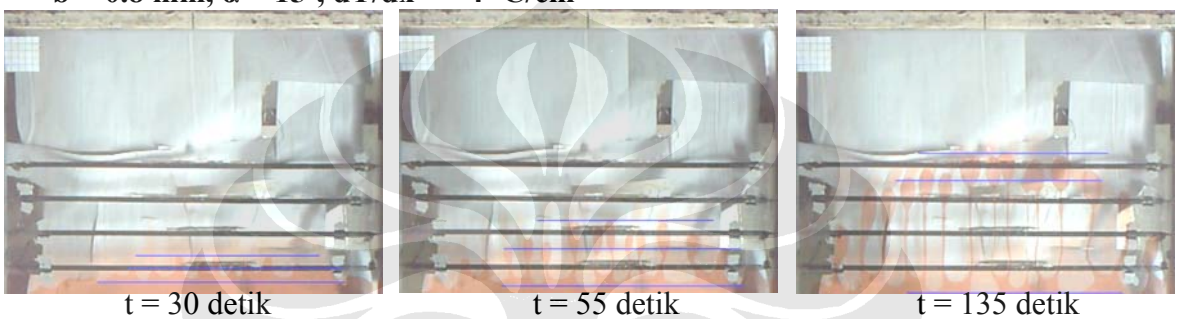
Gambar perkembangan aliran SAE 30 dT/dx ≤ 0

I. b = 0.8 mm, α = 15°, dT/dx = - 10 °C/cm



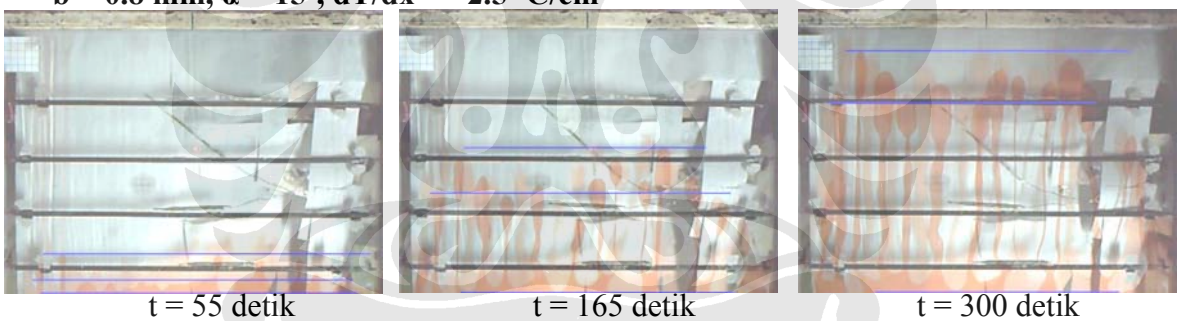
t = 21 detik | t = 40 detik | t = 65 detik

b = 0.8 mm, α = 15°, dT/dx = - 4 °C/cm



t = 30 detik | t = 55 detik | t = 135 detik

b = 0.8 mm, α = 15°, dT/dx = - 2.5 °C/cm



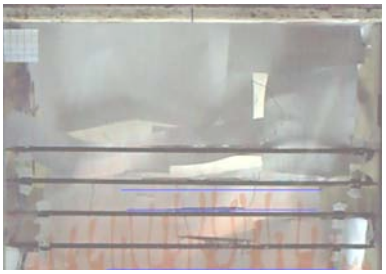
t = 55 detik | t = 165 detik | t = 300 detik

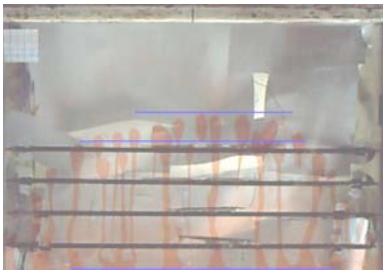
b = 0.8 mm, α = 45°, dT/dx = - 10 °C/cm

t = 9 detik | t = 13 detik | t = 20 detik

b = 0.8 mm, α = 45°, dT/dx = - 4 °C/cm


t = 10 detik

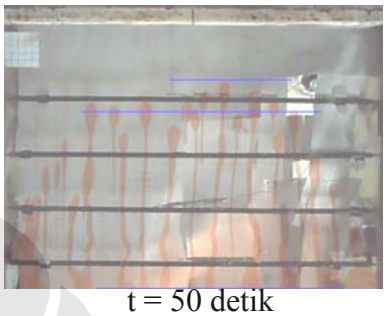

t = 20 detik


t = 40 detik

b = 0.8 mm, α = 45°, dT/dx = - 2.5 °C/cm


t = 18 detik


t = 31 detik


t = 50 detik

b = 0.8 mm, α = 75°, dT/dx = - 10 °C/cm


t = 9 detik


t = 12 detik


t = 20 detik

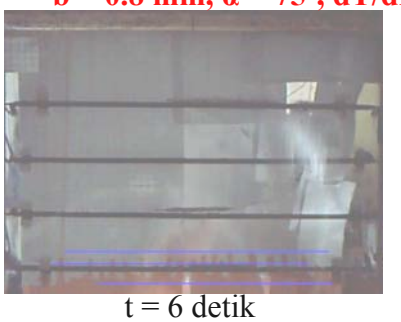
b = 0.8 mm, α = 75°, dT/dx = - 4 °C/cm


t = 6 detik

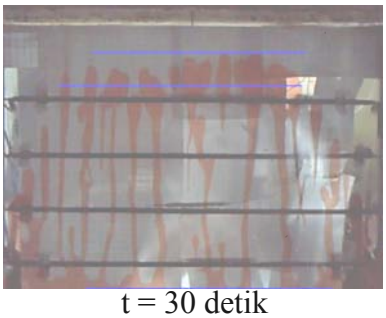

t = 10 detik


t = 17 detik

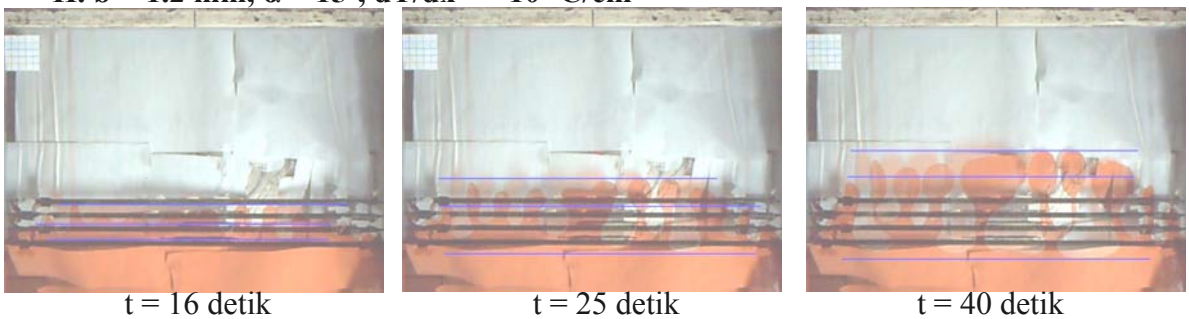
b = 0.8 mm, α = 75°, dT/dx = - 2.5 °C/cm


t = 6 detik


t = 14 detik


t = 30 detik

II. b = 1.2 mm, α = 15°, dT/dx = - 10 °C/cm



t = 16 detik t = 25 detik t = 40 detik

b = 1.2 mm, α = 15°, dT/dx = - 4 °C/cm

t = 30 detik t = 50 detik t = 90 detik

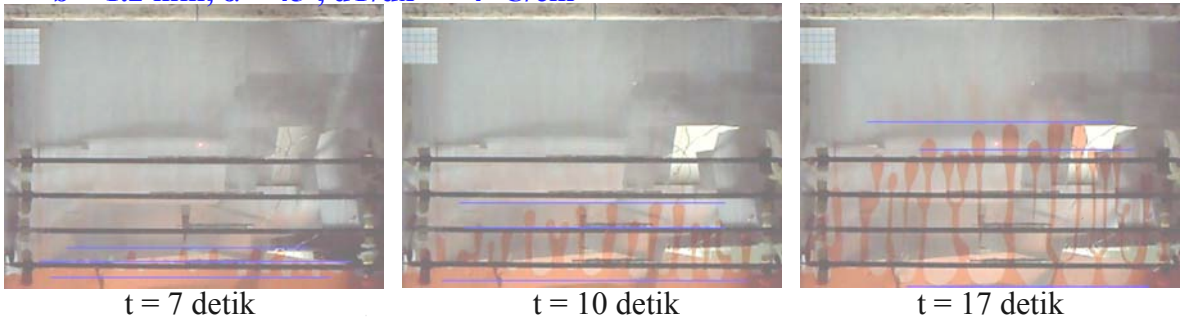
b = 1.2 mm, α = 15°, dT/dx = - 2.5 °C/cm

t = 30 detik t = 71 detik t = 130 detik

b = 1.2 mm, α = 45°, dT/dx = - 10 °C/cm

t = 5 detik t = 7 detik t = 10 detik

b = 1.2 mm, α = 45°, dT/dx = - 4 °C/cm



t = 7 detik t = 10 detik t = 17 detik

b = 1.2 mm, α = 45°, dT/dx = - 2.5 °C/cm


t = 8 detik

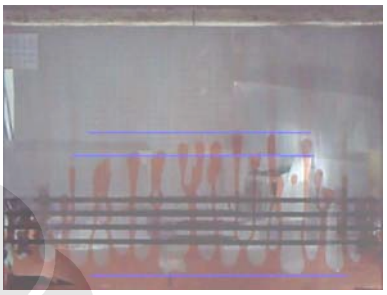

t = 12 detik


t = 17 detik

b = 1.2 mm, α = 75°, dT/dx = - 10 °C/cm


t = 5 detik

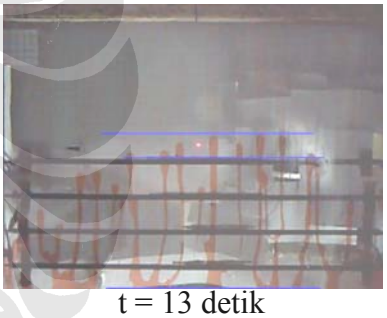

t = 7 detik


t = 10 detik

b = 1.2 mm, α = 75°, dT/dx = - 4 °C/cm

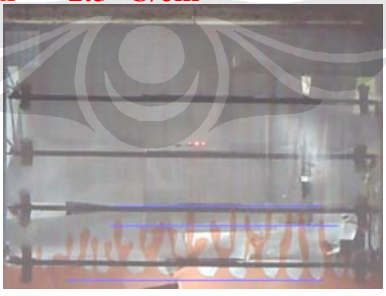

t = 7 detik

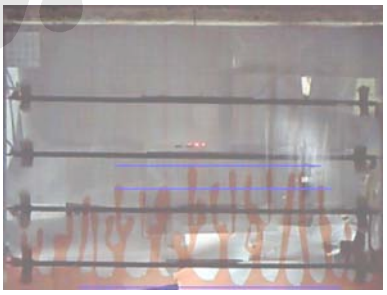

t = 9 detik

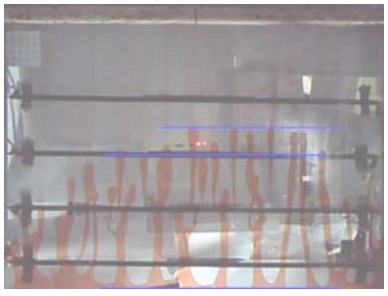

t = 13 detik

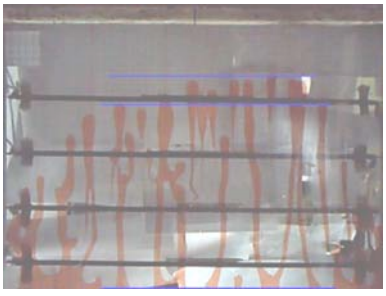
b = 1.2 mm, α = 75°, dT/dx = - 2.5 °C/cm


t = 5 detik


t = 7 detik

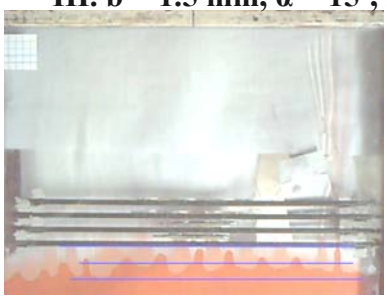

t = 9 detik


t = 11 detik


t = 14 detik


t = 17 detik

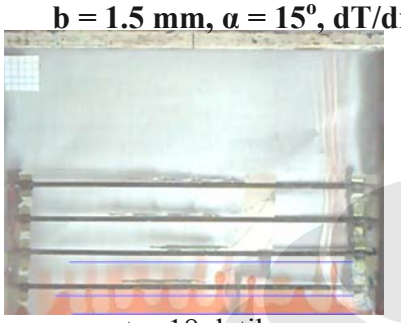
III. b = 1.5 mm, α = 15^o, dT/dx = - 10 ^{o}C/cm

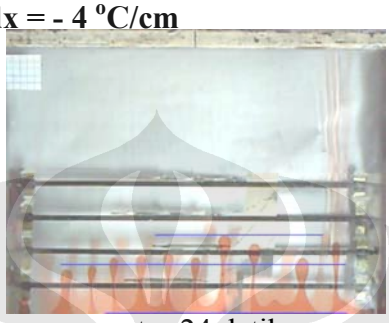

t = 13 detik

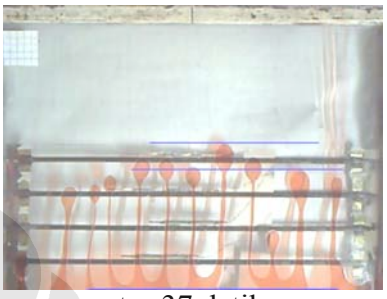

t = 19 detik


t = 25 detik

b = 1.5 mm, α = 15^o, dT/dx = - 4 ^{o}C/cm


t = 18 detik

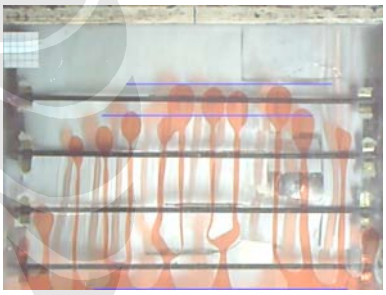

t = 24 detik


t = 37 detik

b = 1.5 mm, α = 15^o, dT/dx = - 2.5 ^{o}C/cm

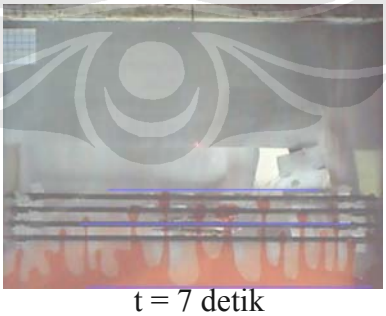

t = 17 detik

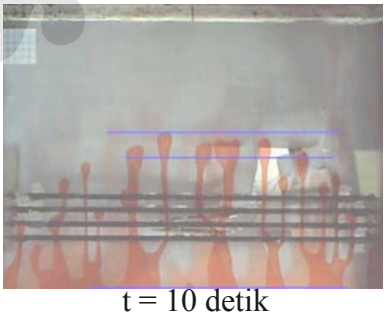

t = 31 detik


t = 45 detik

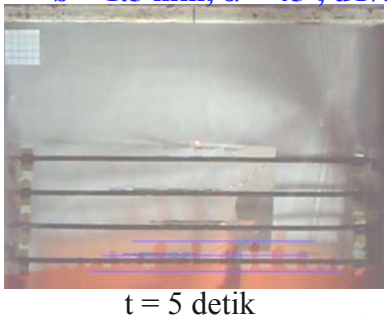
b = 1.5 mm, α = 45^o, dT/dx = - 10 ^{o}C/cm

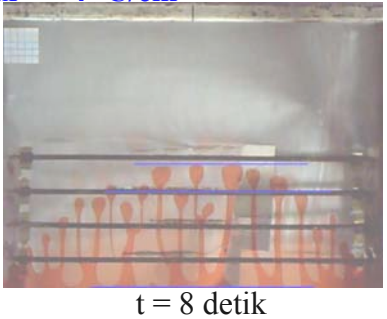

t = 5 detik

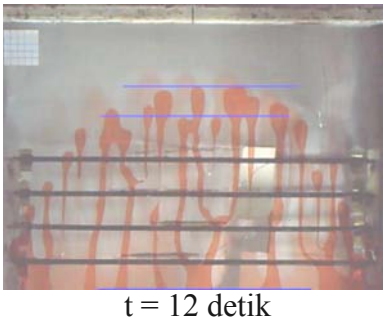

t = 7 detik


t = 10 detik

b = 1.5 mm, α = 45^o, dT/dx = - 4 ^{o}C/cm

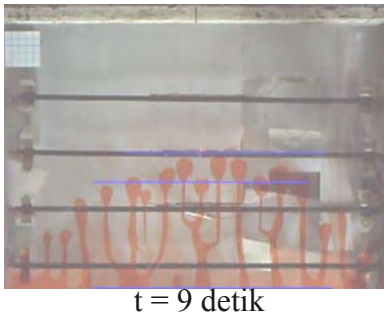

t = 5 detik

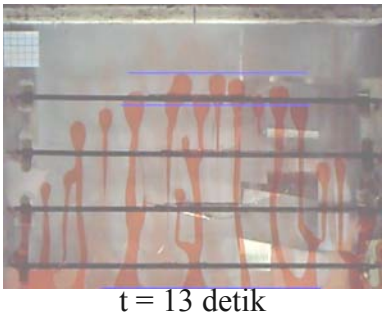

t = 8 detik


t = 12 detik

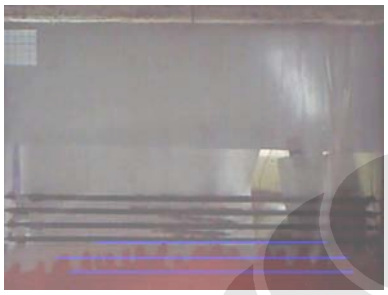
b = 1.5 mm, α = 45°, dT/dx = - 2.5 °C/cm


t = 5 detik

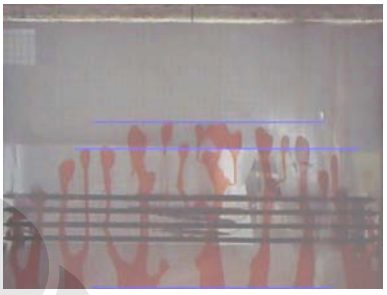

t = 9 detik


t = 13 detik

b = 1.5 mm, α = 75°, dT/dx = - 10 °C/cm


t = 4 detik


t = 6 detik


t = 8 detik

b = 1.5 mm, α = 75°, dT/dx = - 4 °C/cm


t = 4 detik

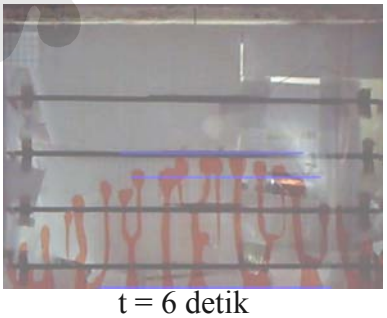

t = 6 detik

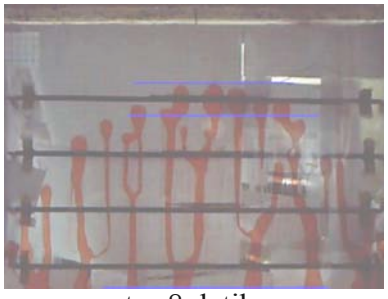

t = 8 detik

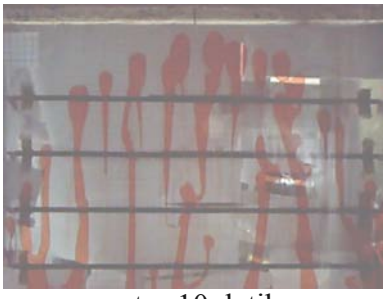
b = 1.5 mm, α = 75°, dT/dx = - 2.5 °C/cm


t = 3 detik


t = 4 detik

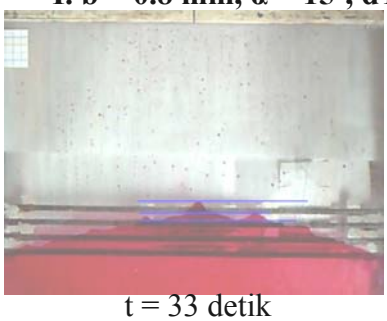

t = 6 detik

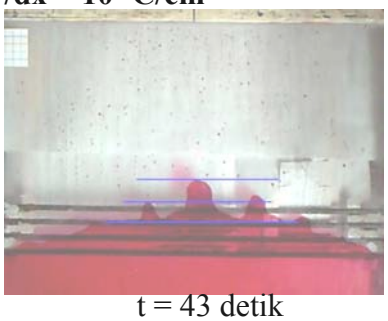

t = 8 detik

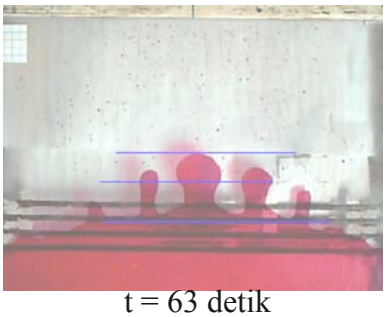

t = 10 detik

Gambar perkembangan aliran Glycerin dT/dx ≥ 0

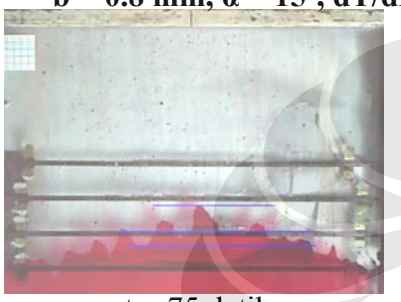
I. b = 0.8 mm, α = 15°, dT/dx = 10 °C/cm

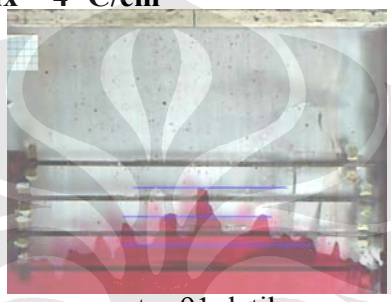

t = 33 detik

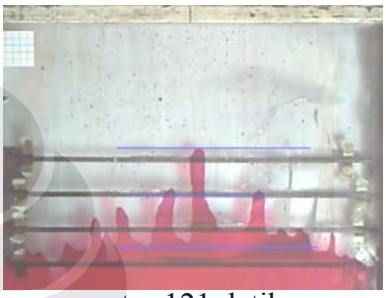

t = 43 detik


t = 63 detik

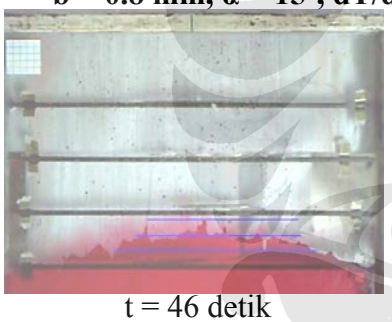
b = 0.8 mm, α = 15°, dT/dx = 4 °C/cm

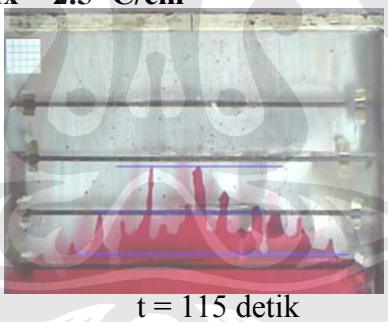

t = 75 detik

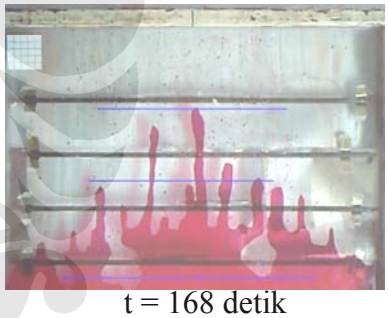

t = 91 detik


t = 121 detik

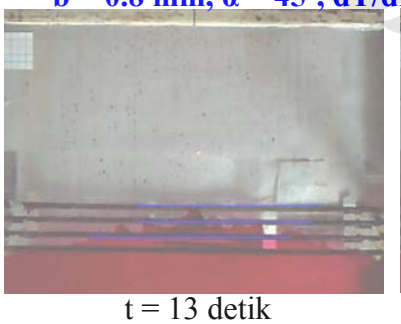
b = 0.8 mm, α = 15°, dT/dx = 2.5 °C/cm

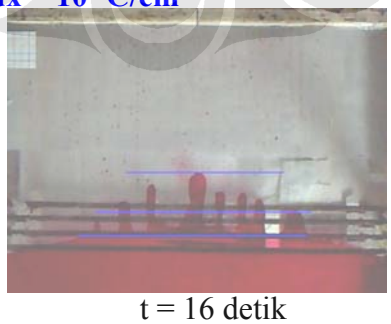

t = 46 detik

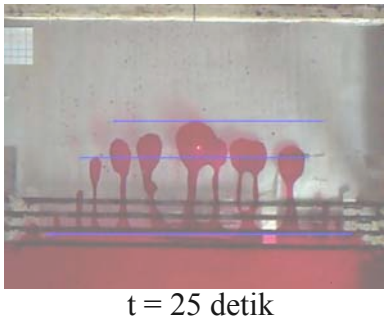

t = 115 detik


t = 168 detik

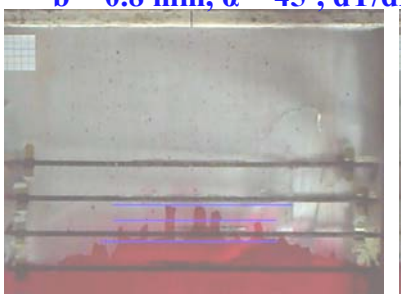
b = 0.8 mm, α = 45°, dT/dx = 10 °C/cm

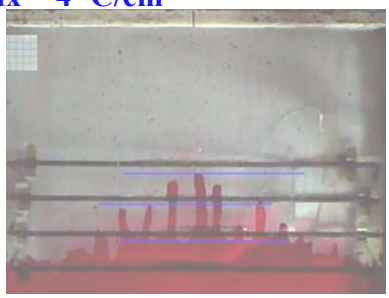

t = 13 detik

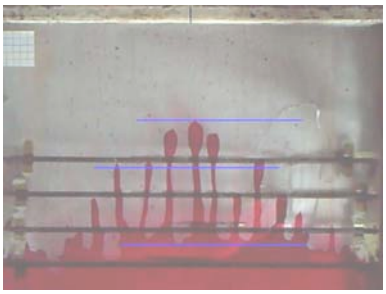

t = 16 detik


t = 25 detik

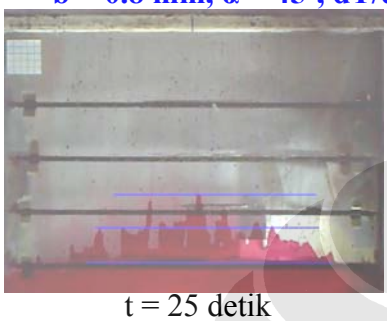
b = 0.8 mm, α = 45°, dT/dx = 4 °C/cm

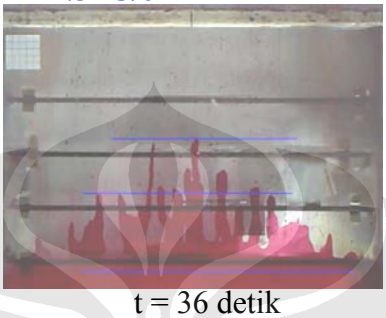

t = 23 detik

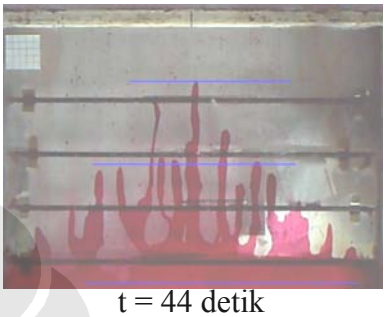

t = 28 detik


t = 35 detik

b = 0.8 mm, α = 45°, dT/dx = 2.5 °C/cm


t = 25 detik

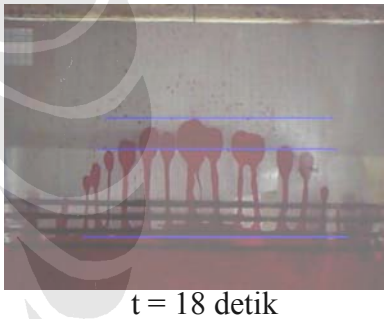

t = 36 detik


t = 44 detik

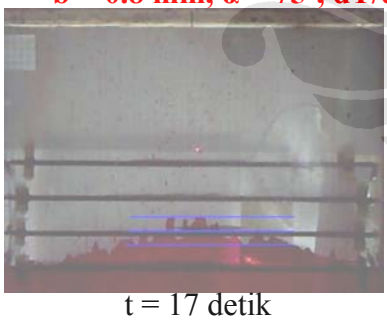
b = 0.8 mm, α = 75°, dT/dx = 10 °C/cm

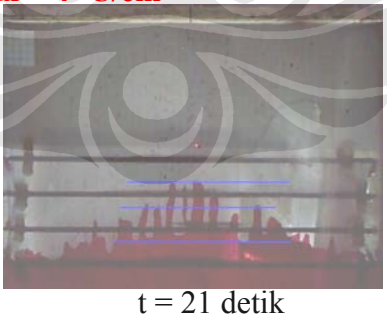

t = 10 detik

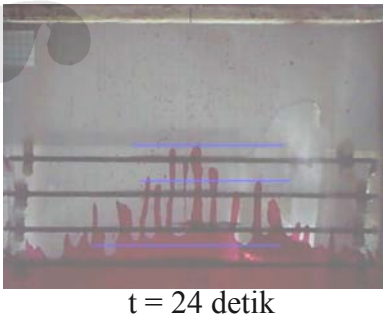

t = 13 detik


t = 18 detik

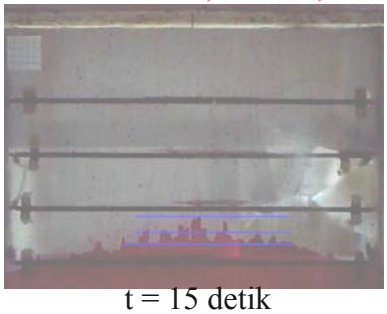
b = 0.8 mm, α = 75°, dT/dx = 4 °C/cm

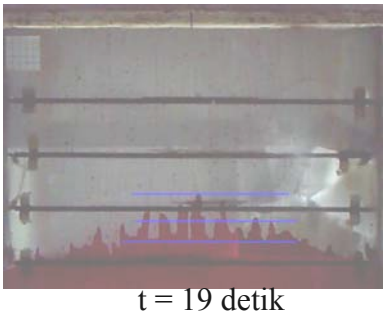

t = 17 detik

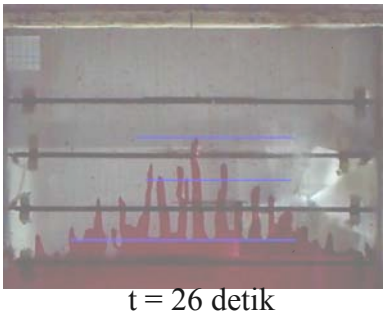

t = 21 detik


t = 24 detik

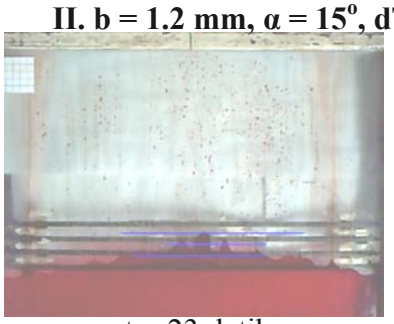
b = 0.8 mm, α = 75°, dT/dx = 2.5 °C/cm

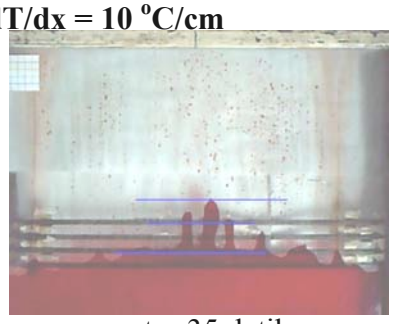

t = 15 detik

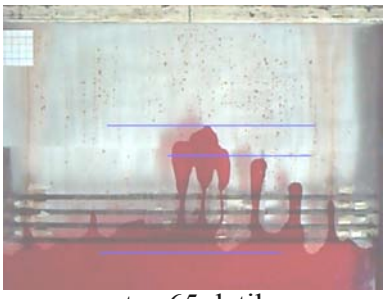

t = 19 detik


t = 26 detik

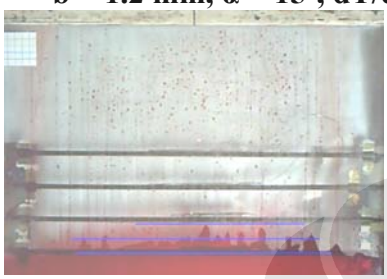
II. b = 1.2 mm, α = 15°, dT/dx = 10 °C/cm

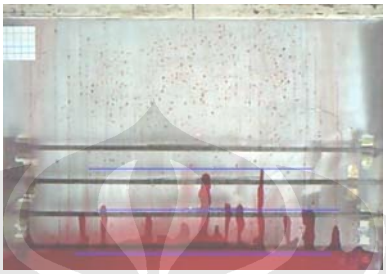

t = 23 detik

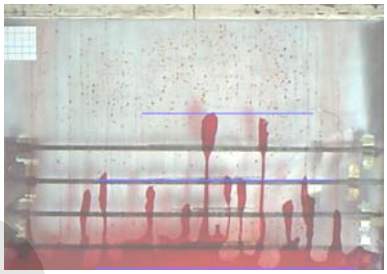

t = 35 detik


t = 65 detik

b = 1.2 mm, α = 15°, dT/dx = 4 °C/cm

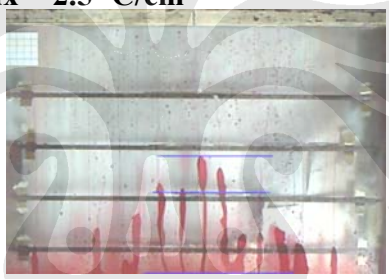

t = 30 detik

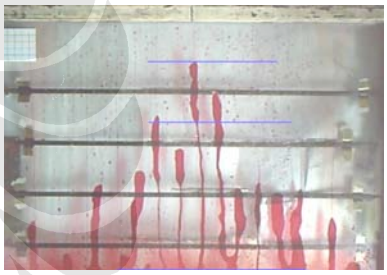

t = 70 detik


t = 105 detik

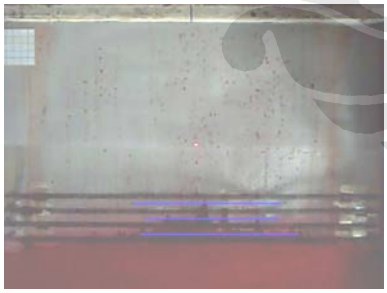
b = 1.2 mm, α = 15°, dT/dx = 2.5 °C/cm


t = 50 detik

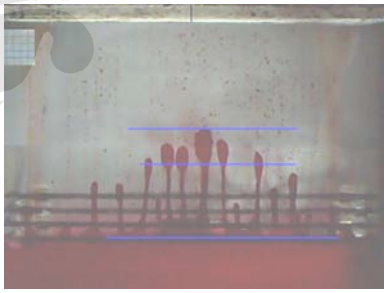

t = 170 detik


t = 245 detik

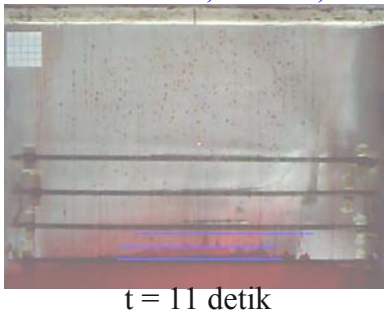
b = 1.2 mm, α = 45°, dT/dx = 10 °C/cm

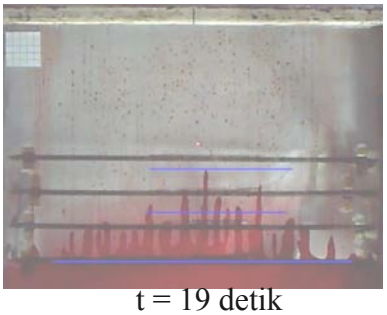

t = 10 detik

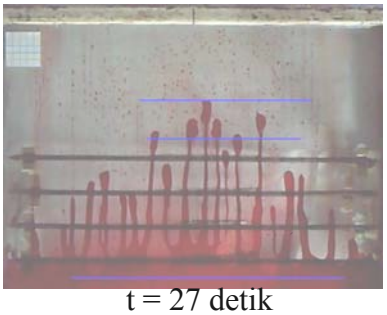

t = 13 detik


t = 17 detik

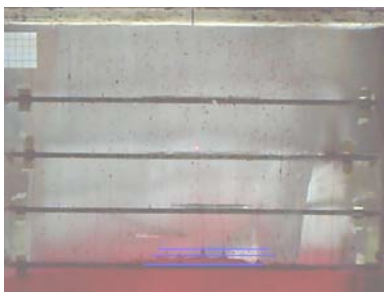
b = 1.2 mm, α = 45°, dT/dx = 4 °C/cm

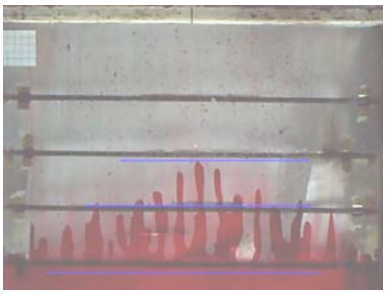

t = 11 detik

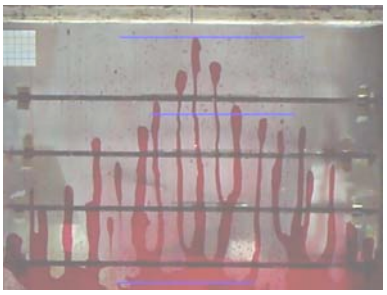

t = 19 detik


t = 27 detik

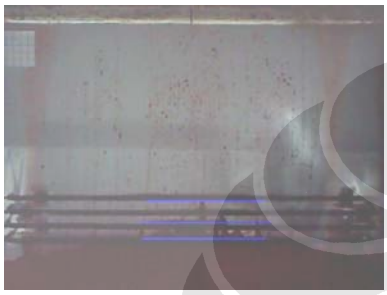
b = 1.2 mm, α = 45°, dT/dx = 2.5 °C/cm


t = 10 detik


t = 28 detik


t = 42 detik

b = 1.2 mm, α = 75°, dT/dx = 10 °C/cm

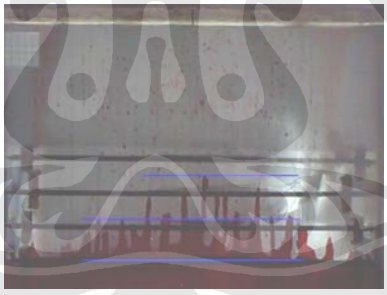

t = 8 detik

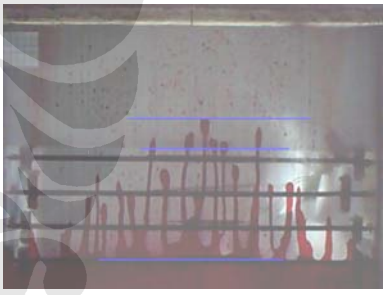

t = 10 detik


t = 14 detik

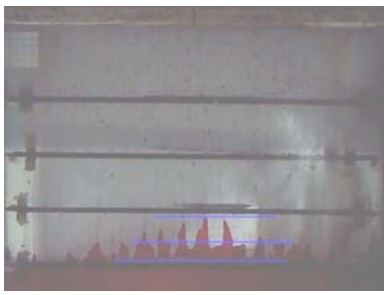
b = 1.2 mm, α = 75°, dT/dx = 4 °C/cm

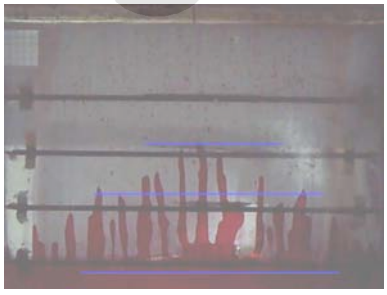

t = 8 detik

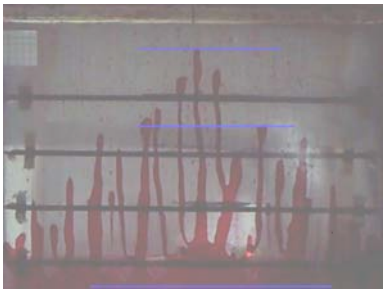

t = 13 detik


t = 17 detik

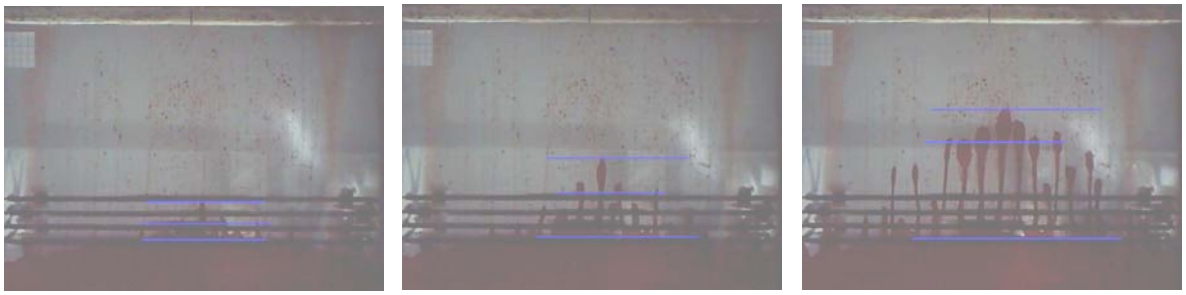
b = 1.2 mm, α = 75°, dT/dx = 2.5 °C/cm


t = 12 detik


t = 20 detik

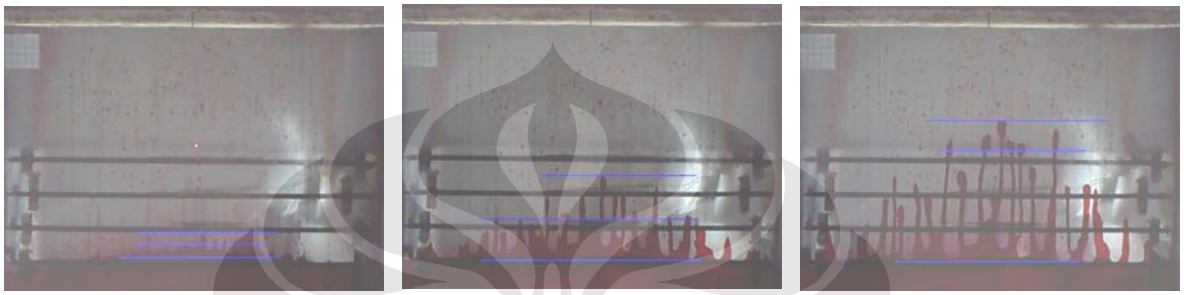

t = 26 detik

III. b = 1.5 mm, α = 15^o, dT/dx = 10 ^{o}C/cm



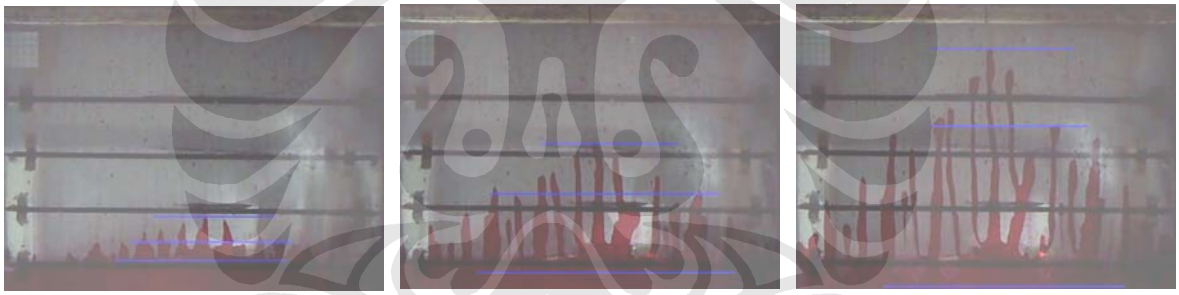
t = 8 detik t = 10 detik t = 14 detik

b = 1.5 mm, α = 15^o, dT/dx = 4 ^{o}C/cm



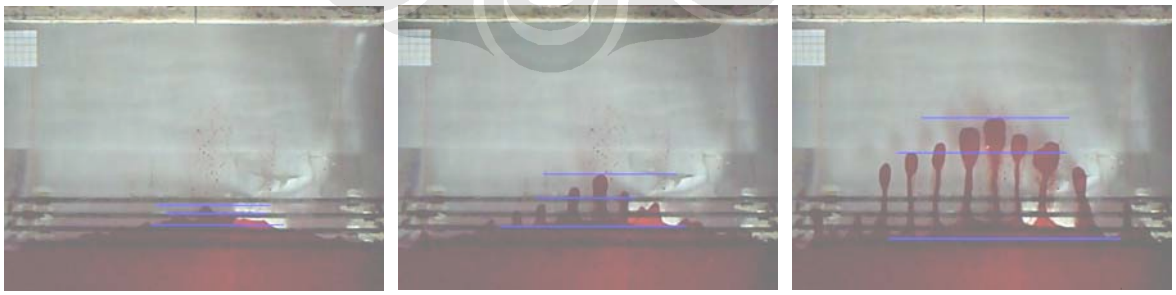
t = 8 detik t = 13 detik t = 17 detik

b = 1.5 mm, α = 15^o, dT/dx = 2.5 ^{o}C/cm



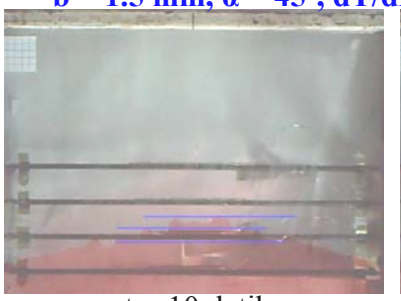
t = 12 detik t = 20 detik t = 26 detik

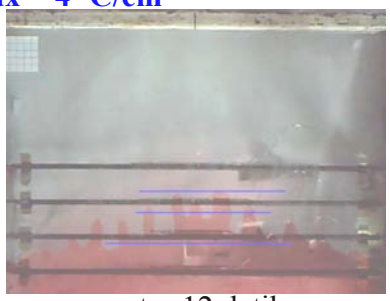
b = 1.5 mm, α = 45^o, dT/dx = 10 ^{o}C/cm

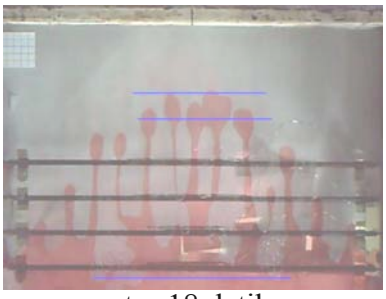


t = 10 detik t = 12 detik t = 14 detik

b = 1.5 mm, α = 45°, dT/dx = 4 °C/cm


t = 10 detik

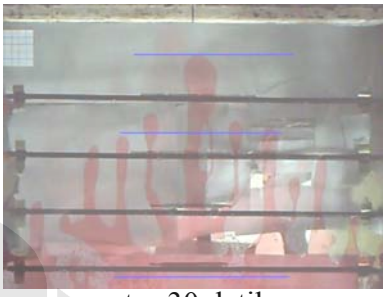

t = 12 detik


t = 18 detik

b = 1.5 mm, α = 45°, dT/dx = 2.5 °C/cm


t = 17 detik

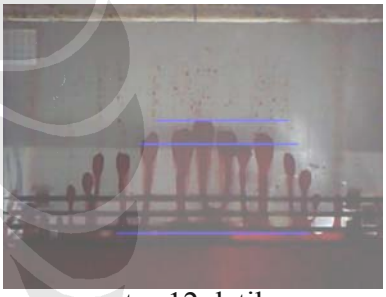

t = 24 detik


t = 30 detik

b = 1.5 mm, α = 75°, dT/dx = 10 °C/cm

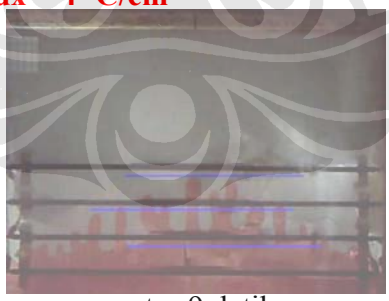

t = 7 detik

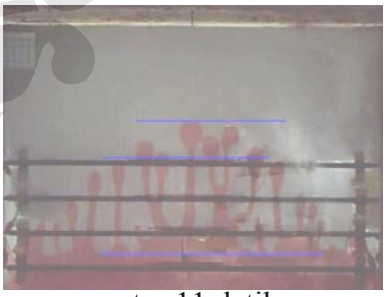

t = 10 detik


t = 12 detik

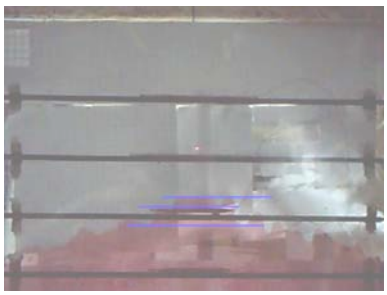
b = 1.5 mm, α = 75°, dT/dx = 4 °C/cm


t = 7 detik

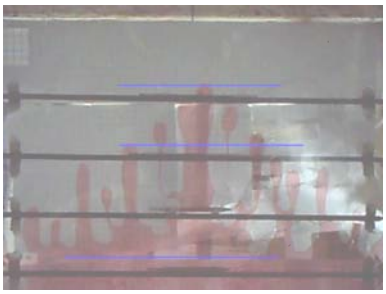

t = 9 detik


t = 11 detik

b = 1.5 mm, α = 75°, dT/dx = 2.5 °C/cm

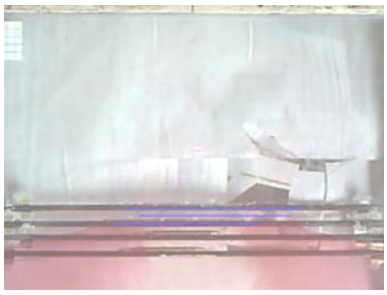

t =13 detik


t = 17 detik

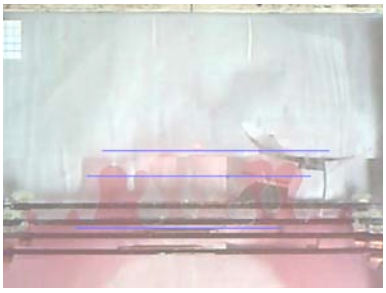

t = 20 detik

Gambar perkembangan aliran Castor oil dT/dx ≥ 0

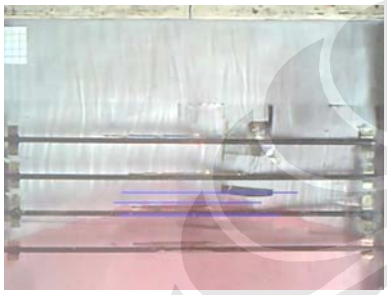
I. b = 0.8 mm, α = 15°, dT/dx = 10 °C/cm


t = 18 detik

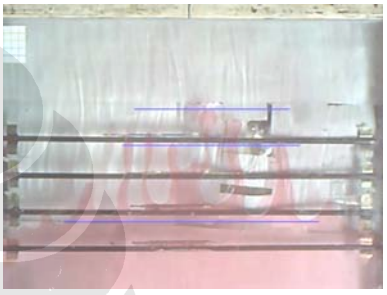

t = 30 detik


t = 50 detik

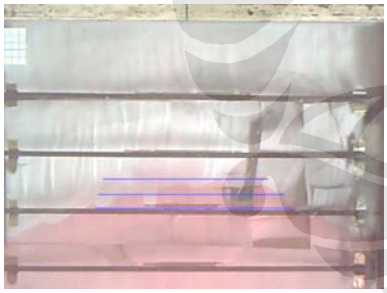
b = 0.8 mm, α = 15°, dT/dx = 4 °C/cm


t = 35 detik

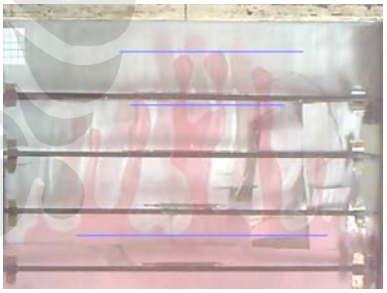

t = 60 detik


t = 80 detik

b = 0.8 mm, α = 15°, dT/dx = 2.5 °C/cm


t = 45 detik

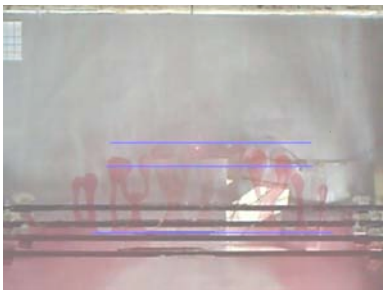

t = 100 detik


t = 160 detik

b = 0.8 mm, α = 45°, dT/dx = 10 °C/cm

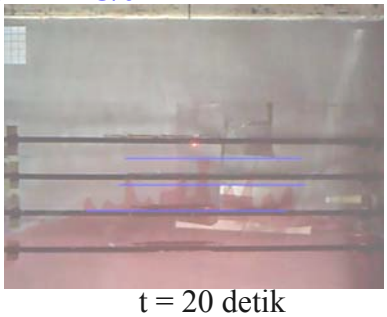

t = 10 detik

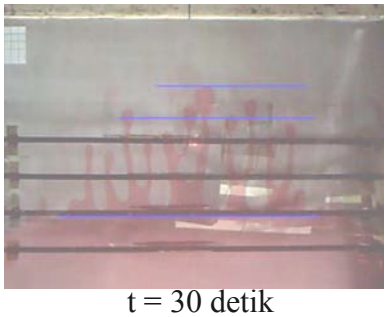

t = 14 detik


t = 20 detik

b = 0.8 mm, α = 45°, dT/dx = 4 °C/cm


t = 14 detik

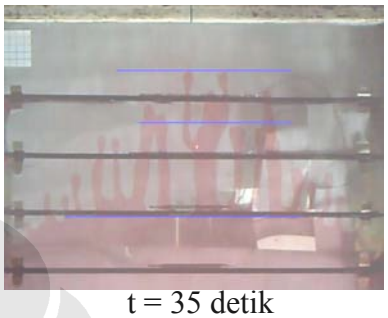

t = 20 detik


t = 30 detik

b = 0.8 mm, α = 45°, dT/dx = 2.5 °C/cm


t = 10 detik


t = 25 detik


t = 35 detik

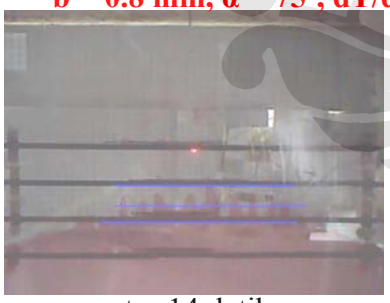
b = 0.8 mm, α = 75°, dT/dx = 10 °C/cm


t = 9 detik

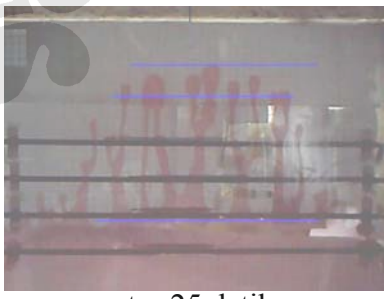

t = 12 detik


t = 17 detik

b = 0.8 mm, α = 75°, dT/dx = 4 °C/cm


t = 14 detik

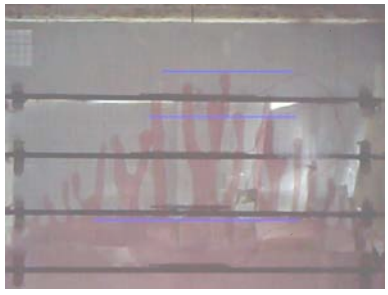

t = 18 detik


t = 25 detik

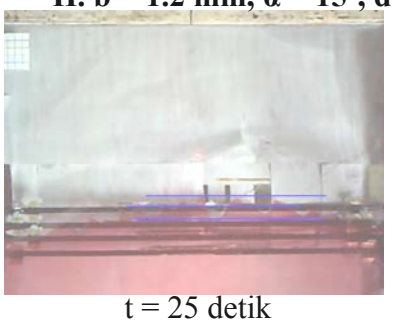
b = 0.8 mm, α = 75°, dT/dx = 2.5 °C/cm

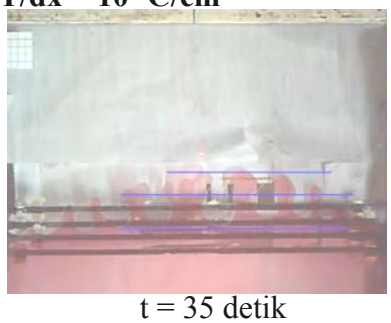

t = 12 detik

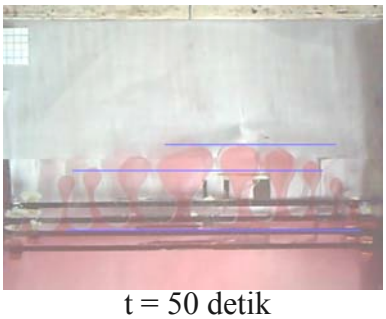

t = 19 detik


t = 26 detik

II. b = 1.2 mm, α = 15°, dT/dx = 10 °C/cm


t = 25 detik

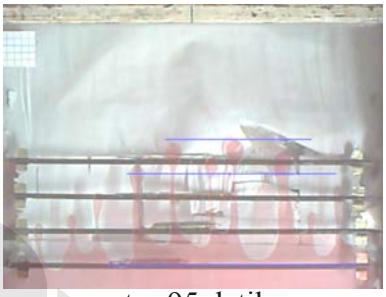

t = 35 detik


t = 50 detik

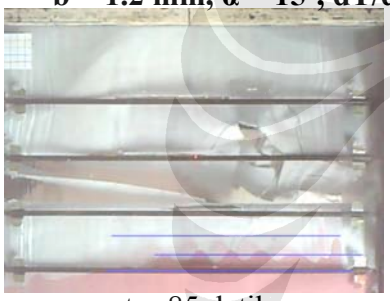
b = 1.2 mm, α = 15°, dT/dx = 4 °C/cm

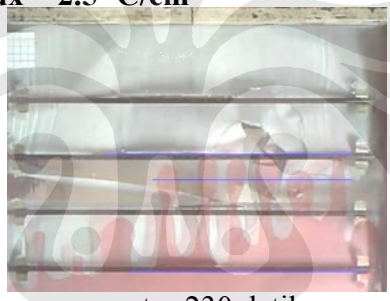

t = 45 detik

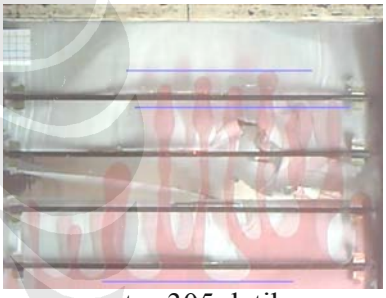

t = 75 detik


t = 95 detik

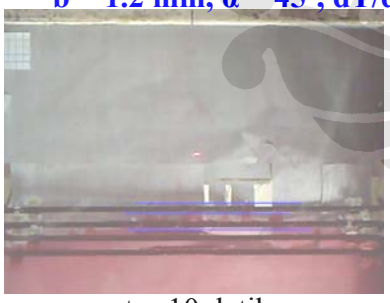
b = 1.2 mm, α = 15°, dT/dx = 2.5 °C/cm


t = 85 detik

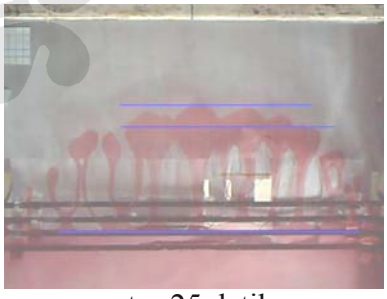

t = 230 detik


t = 305 detik

b = 1.2 mm, α = 45°, dT/dx = 10 °C/cm


t = 10 detik

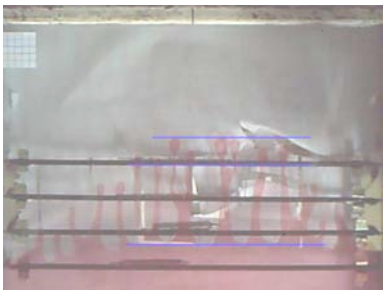

t = 15 detik


t = 25 detik

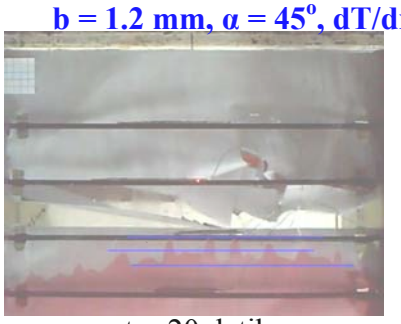
b = 1.2 mm, α = 45°, dT/dx = 4 °C/cm

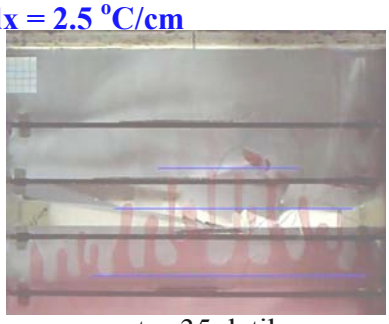

t = 15 detik

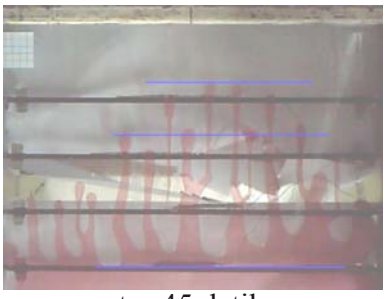

t = 20 detik


t = 25 detik

b = 1.2 mm, α = 45°, dT/dx = 2.5 °C/cm


t = 20 detik

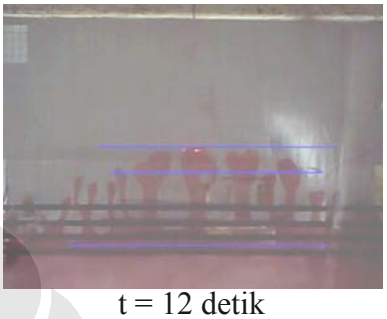

t = 35 detik


t = 45 detik

b = 1.2 mm, α = 75°, dT/dx = 10 °C/cm


t = 7 detik


t = 9 detik


t = 12 detik

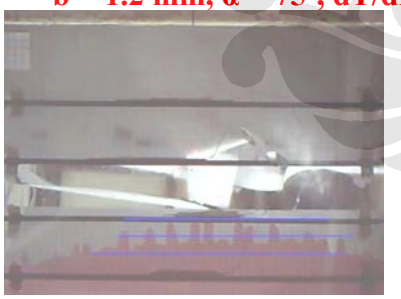
b = 1.2 mm, α = 75°, dT/dx = 4 °C/cm


t = 9 detik

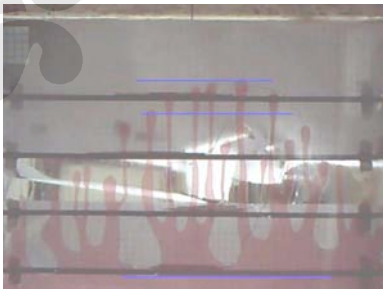

t = 15 detik


t = 20 detik

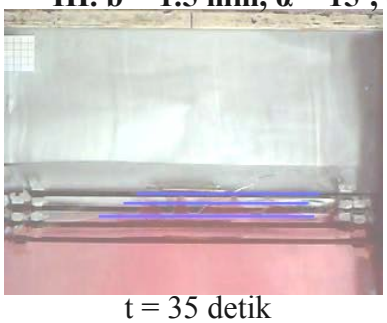
b = 1.2 mm, α = 75°, dT/dx = 2.5 °C/cm

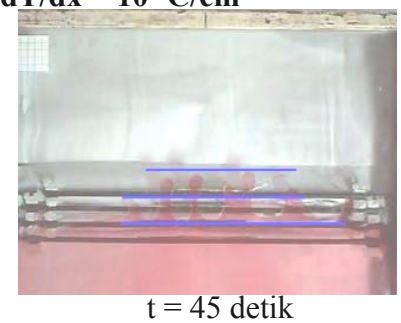

t = 15 detik

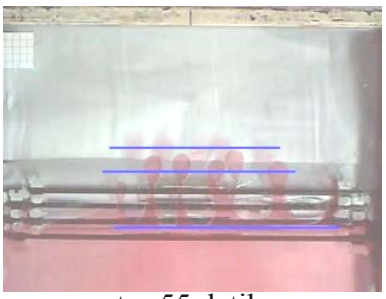

t = 26 detik


t = 32 detik

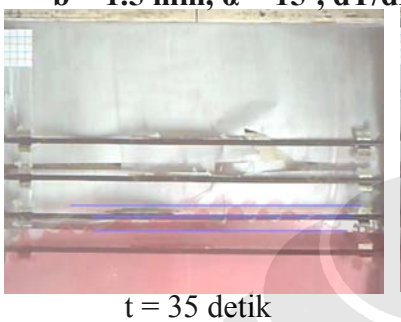
III. b = 1.5 mm, α = 15^o, dT/dx = 10 ^{o}C/cm


t = 35 detik

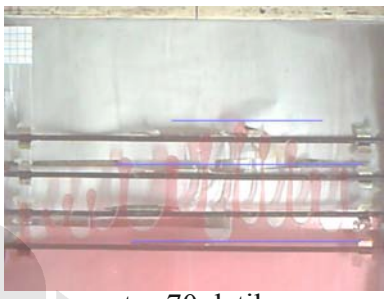

t = 45 detik


t = 55 detik

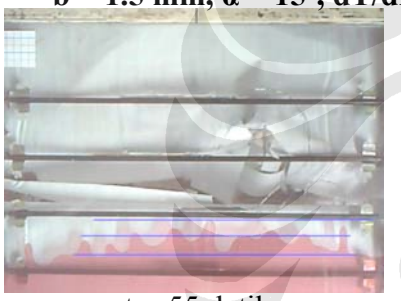
b = 1.5 mm, α = 15^o, dT/dx = 4 ^{o}C/cm

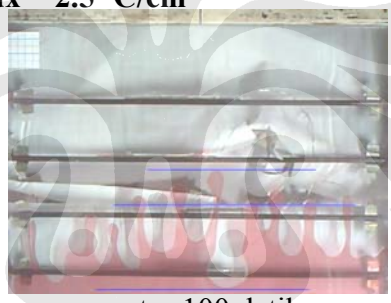

t = 35 detik

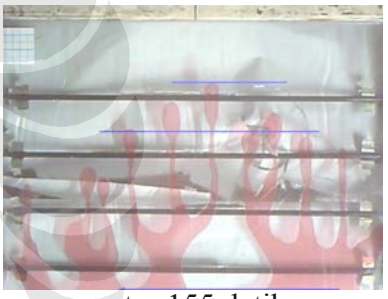

t = 55 detik


t = 70 detik

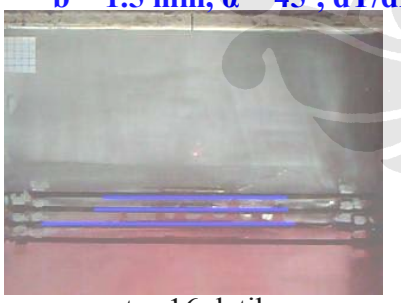
b = 1.5 mm, α = 15^o, dT/dx = 2.5 ^{o}C/cm

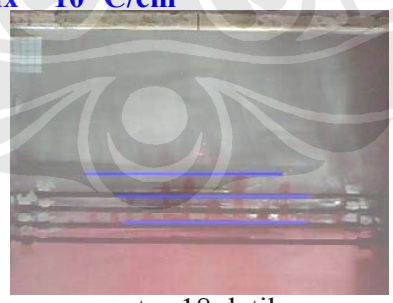

t = 55 detik

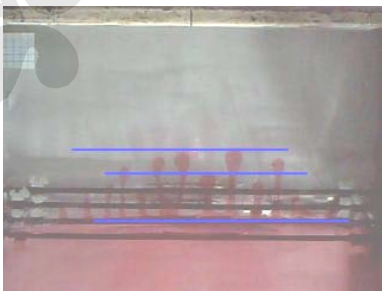

t = 100 detik


t = 155 detik

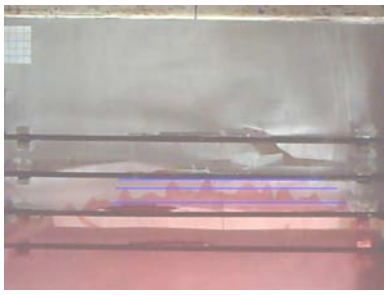
b = 1.5 mm, α = 45^o, dT/dx = 10 ^{o}C/cm

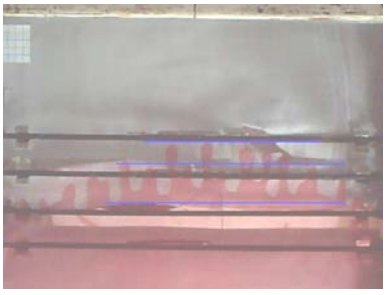

t = 16 detik

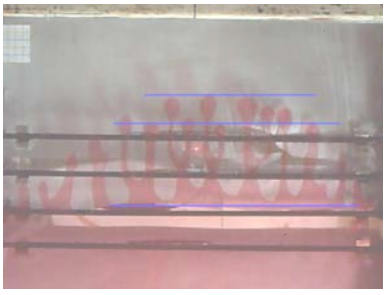

t = 18 detik


t = 20 detik

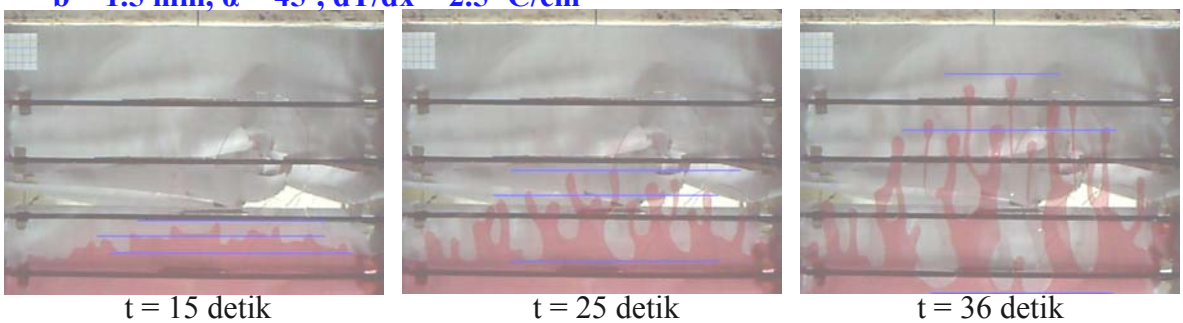
b = 1.5 mm, α = 45^o, dT/dx = 4 ^{o}C/cm


t = 14 detik


t = 18 detik

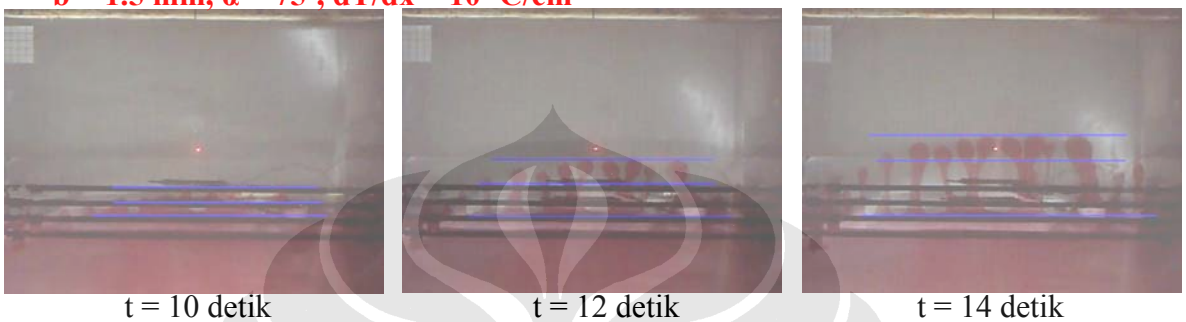

t = 23 detik

b = 1.5 mm, α = 45°, dT/dx = 2.5 °C/cm



t = 15 detik | t = 25 detik | t = 36 detik

b = 1.5 mm, α = 75°, dT/dx = 10 °C/cm



t = 10 detik | t = 12 detik | t = 14 detik

b = 1.5 mm, α = 75°, dT/dx = 4 °C/cm

t = 11 detik | t = 14 detik | t = 18 detik

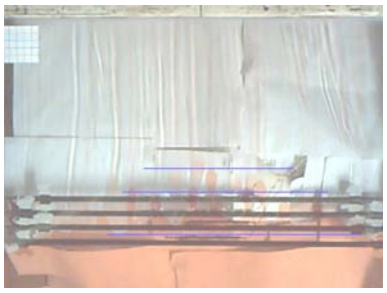
b = 1.5 mm, α = 75°, dT/dx = 2.5 °C/cm

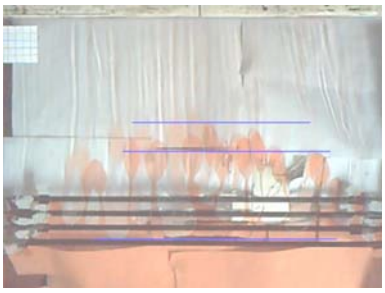
t = 13 detik | t = 19 detik | t = 25 detik

Gambar perkembangan aliran SAE 30 dT/dx ≥ 0

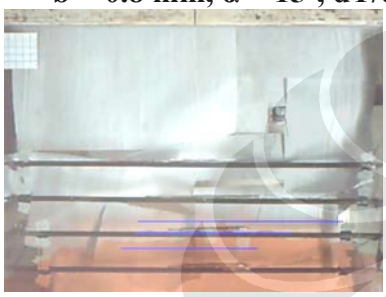
I. b = 0.8 mm, α = 15°, dT/dx = 10 °C/cm


t = 25 detik

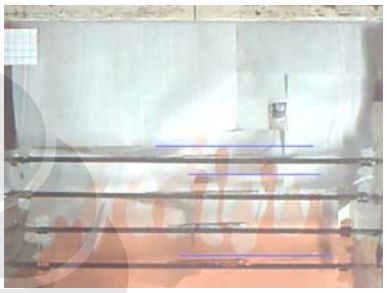

t = 40 detik


t = 80 detik

b = 0.8 mm, α = 15°, dT/dx = 4 °C/cm

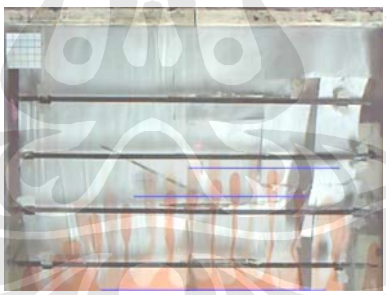

t = 50 detik

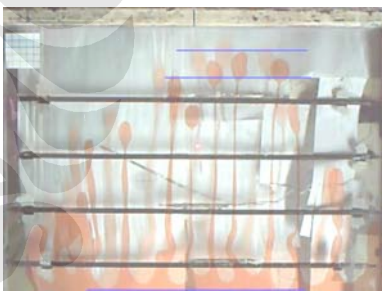

t = 77 detik


t = 100 detik

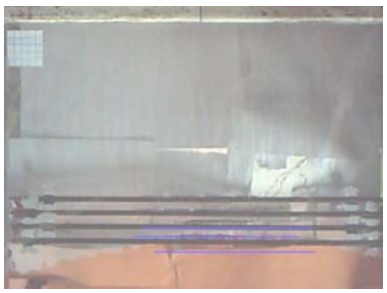
b = 0.8 mm, α = 15°, dT/dx = 2.5 °C/cm

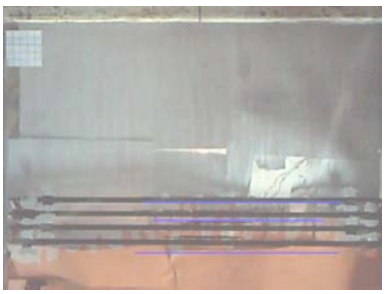

t = 65 detik

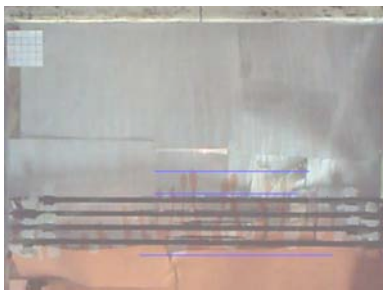

t = 175 detik


t = 255 detik

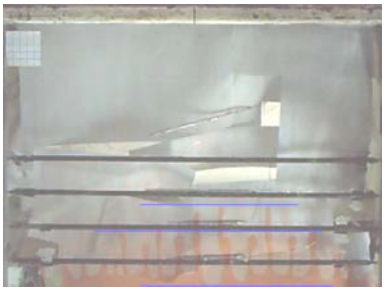
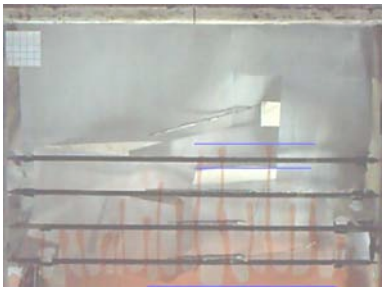
b = 0.8 mm, α = 45°, dT/dx = 10 °C/cm


t = 15 detik


t = 21 detik

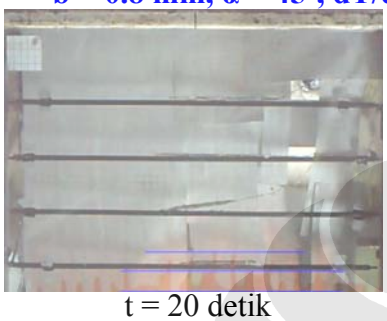
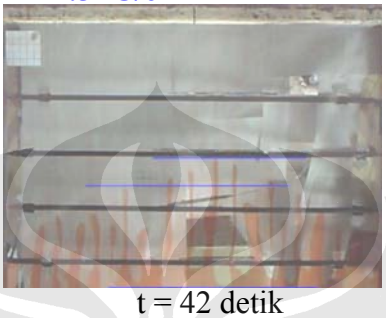
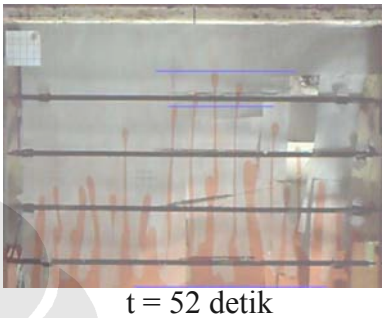

t = 25 detik

b = 0.8 mm, α = 45°, dT/dx = 4 °C/cm

t = 15 detik t = 23 detik t = 30 detik

b = 0.8 mm, α = 45°, dT/dx = 2.5 °C/cm

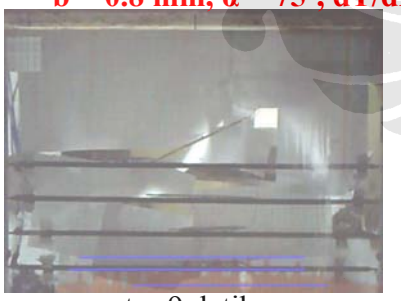
t = 20 detik t = 42 detik t = 52 detik

b = 0.8 mm, α = 75°, dT/dx = 10 °C/cm



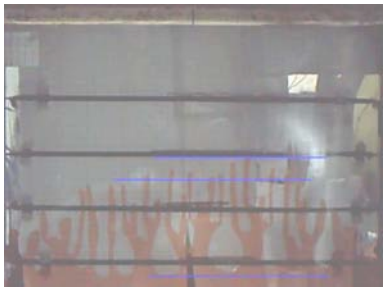
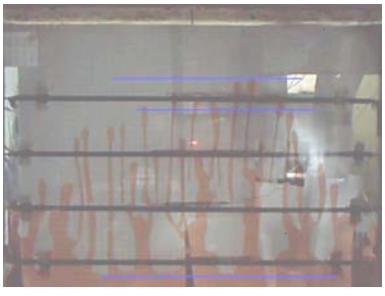
t = 13 detik t = 17 detik t = 20 detik

b = 0.8 mm, α = 75°, dT/dx = 4 °C/cm



t = 9 detik t = 13 detik t = 19 detik

b = 0.8 mm, α = 75°, dT/dx = 2.5 °C/cm

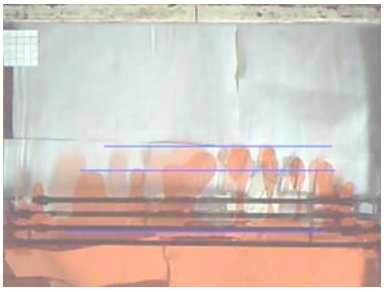




t = 11 detik t = 26 detik t = 33 detik

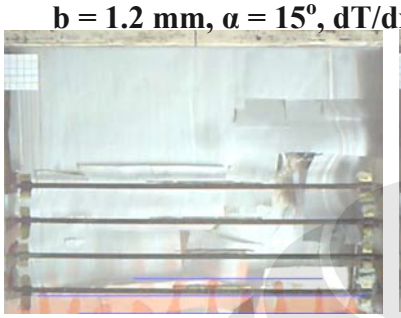
II. b = 1.2 mm, α = 15°, dT/dx = 10 °C/cm


t = 11 detik


t = 20 detik


t = 30 detik

b = 1.2 mm, α = 15°, dT/dx = 4 °C/cm

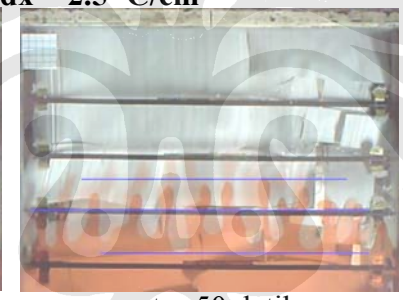

t = 42 detik

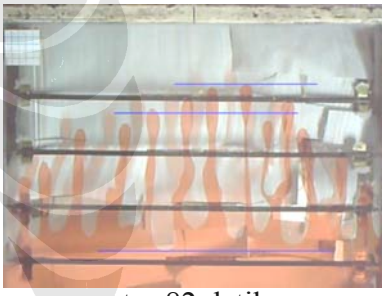

t = 64 detik


t = 92 detik

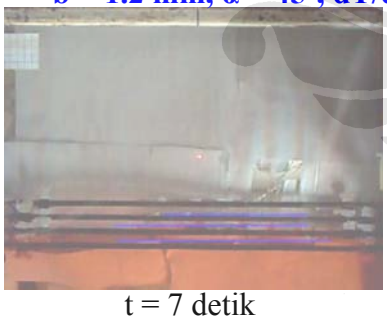
b = 1.2 mm, α = 15°, dT/dx = 2.5 °C/cm

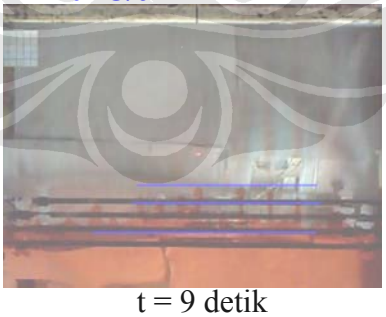

t = 28 detik

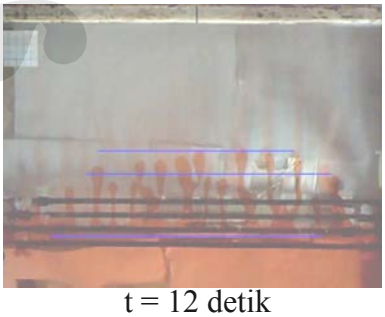

t = 50 detik


t = 82 detik

b = 1.2 mm, α = 45°, dT/dx = 10 °C/cm

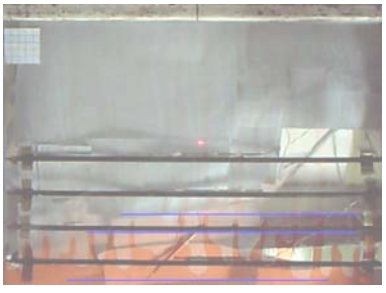

t = 7 detik


t = 9 detik


t = 12 detik

b = 1.2 mm, α = 45°, dT/dx = 4 °C/cm

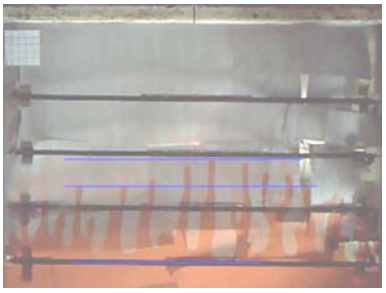

t = 10 detik

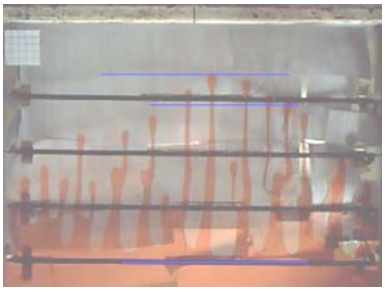

t = 15 detik


t = 21 detik

b = 1.2 mm, α = 45°, dT/dx = 2.5 °C/cm


t = 13 detik

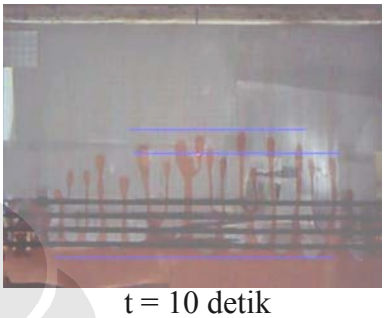

t = 19 detik


t = 25 detik

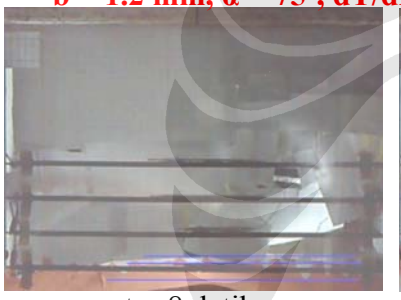
b = 1.2 mm, α = 75°, dT/dx = 10 °C/cm


t = 5 detik


t = 7 detik


t = 10 detik

b = 1.2 mm, α = 75°, dT/dx = 4 °C/cm

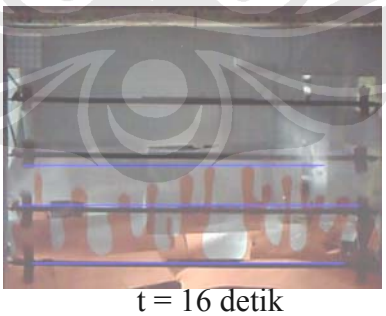

t = 8 detik

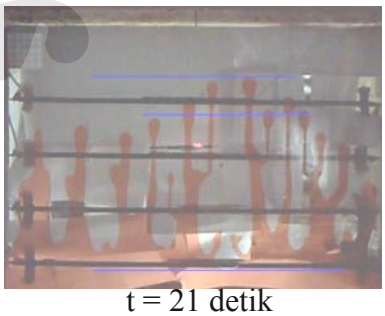

t = 12 detik


t = 16 detik

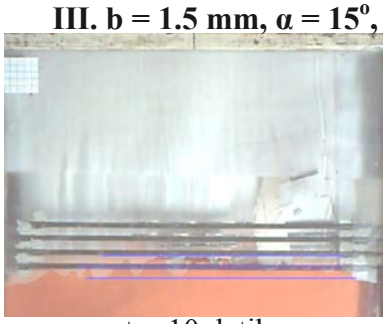
b = 1.2 mm, α = 75°, dT/dx = 2.5 °C/cm

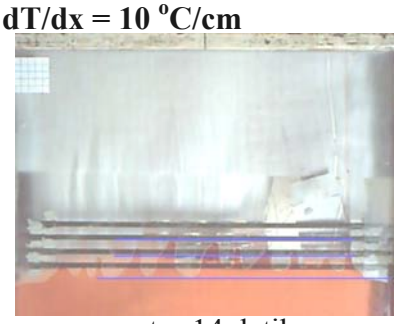

t = 11 detik


t = 16 detik


t = 21 detik

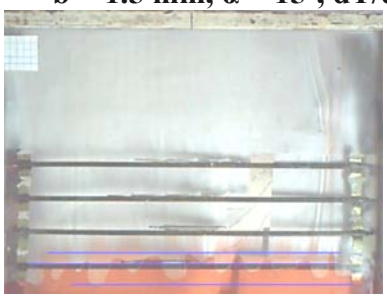
III. b = 1.5 mm, α = 15°, dT/dx = 10 °C/cm


t = 10 detik

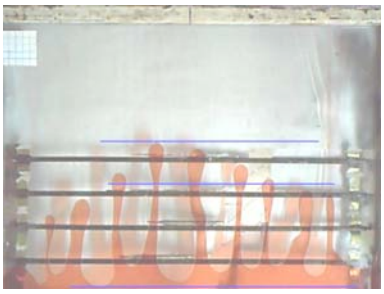

t = 14 detik


t = 19 detik

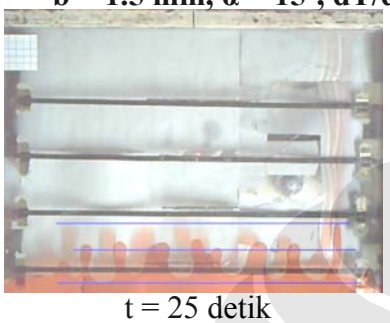
b = 1.5 mm, α = 15°, dT/dx = 4 °C/cm

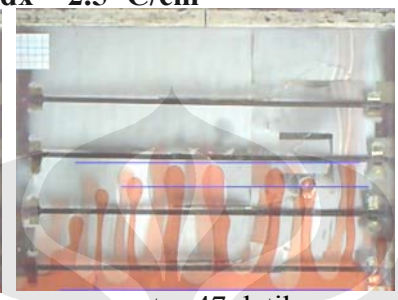

t = 17 detik

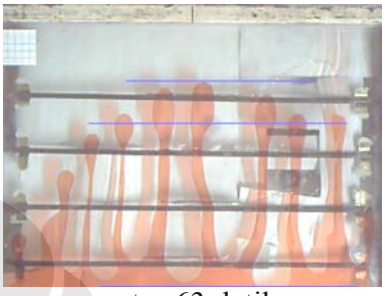

t = 28 detik


t = 41 detik

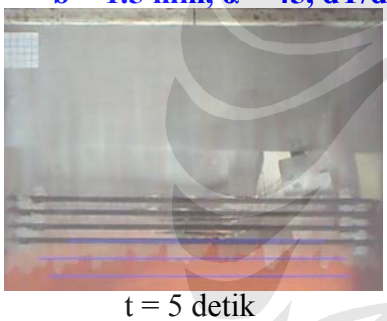
b = 1.5 mm, α = 15°, dT/dx = 2.5 °C/cm


t = 25 detik

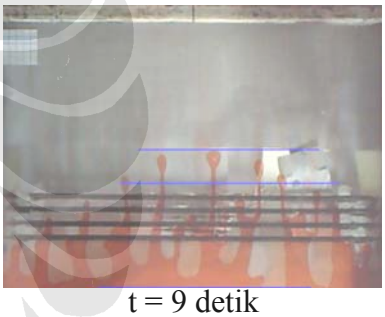

t = 47 detik


t = 63 detik

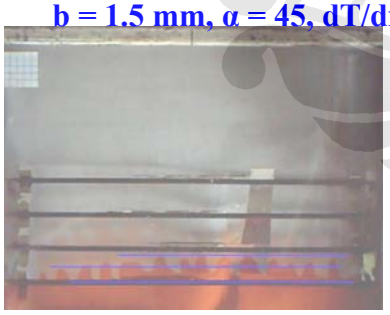
b = 1.5 mm, α = 45, dT/dx = 10 °C/cm

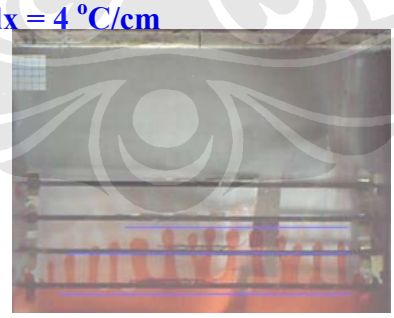

t = 5 detik

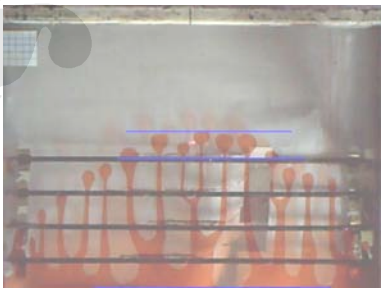

t = 7 detik


t = 9 detik

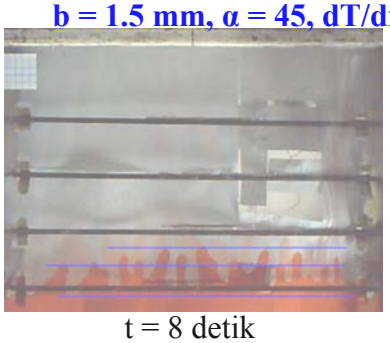
b = 1.5 mm, α = 45, dT/dx = 4 °C/cm


t = 6 detik

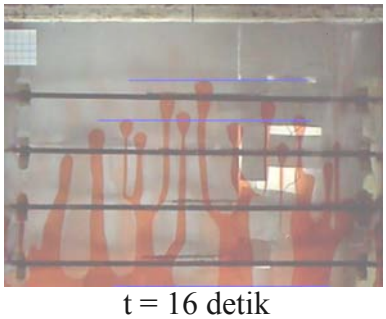

t = 8 detik


t = 11 detik

b = 1.5 mm, α = 45, dT/dx = 2.5 °C/cm

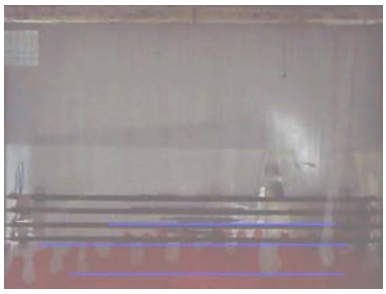

t = 8 detik

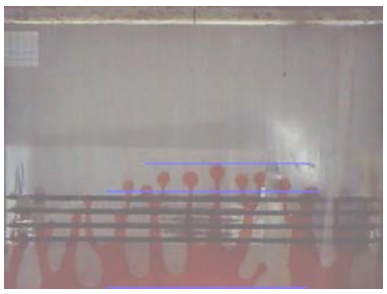

t = 12 detik


t = 16 detik

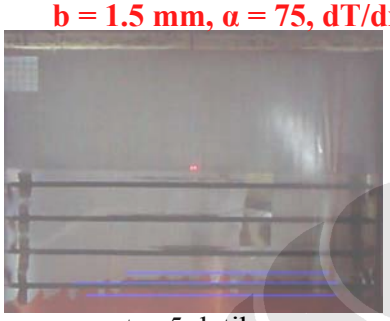
b = 1.5 mm, α = 75, dT/dx = 10 ^{o}C/cm


t = 5 detik

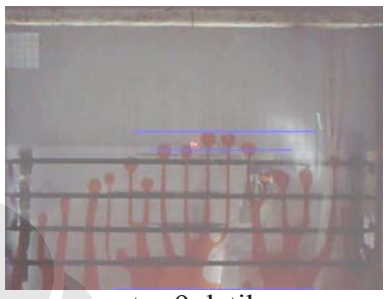

t = 6 detik


t = 8 detik

b = 1.5 mm, α = 75, dT/dx = 4 ^{o}C/cm


t = 5 detik


t = 7 detik


t = 9 detik

b = 1.5 mm, α = 75, dT/dx = 2.5 ^{o}C/cm


t = 6 detik


t = 10 detik


t = 13 detik

LAMPIRAN 3

Tabel data perubahan bentuk tiap satuan waktu $dT/dx \leq 0$

I. Glycerin

Glycerin, b = 0.8mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-10 °C/cm	1.	15	425,59	0,048	0	58,78	0	0	0,035	0,000
	2.	20	425,59	0,048	13,24	58,78	1,67	3,43	0,047	0,715
	3.	25	425,59	0,048	12,6	58,78	2,93	5,05	0,059	1,052
	4.	30	425,59	0,048	19,67	58,78	2,09	6,36	0,070	1,325
	5.	35	425,59	0,048	18,04	58,78	5,35	9,37	0,082	1,952
	6.	45	425,59	0,048	22,86	58,78	5,58	11,22	0,106	2,338
	7.	60	425,59	0,048	25,59	58,78	8,64	14,9	0,141	3,104
	8.	70	425,59	0,048	30,38	58,78	10,87	17,65	0,164	3,677
	9.	85	425,59	0,048	28	58,78	11,32	17,27	0,200	3,598
	10.	95	425,59	0,048	30,84	58,78	13,91	20,35	0,223	4,240
dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-4 °C/cm	1.	14	425,59	0,048	8,24	58,78	1,28	2,64	0,033	0,550
	2.	18	425,59	0,048	8,42	58,78	2,32	4,54	0,042	0,946
	3.	23	425,59	0,048	8,44	58,78	3,49	6,95	0,054	1,448
	4.	30	425,59	0,048	10,45	58,78	4,01	9,89	0,070	2,060
	5.	37	425,59	0,048	10,29	58,78	6,21	13,80	0,087	2,875
	6.	45	425,59	0,048	14,87	58,78	12,42	19,37	0,106	4,035
	7.	55	425,59	0,048	15,46	58,78	9,61	20,27	0,129	4,223
	8.	70	425,59	0,048	23,53	58,78	14,71	25,51	0,164	5,315
	9.	85	425,59	0,048	24,49	58,78	14,51	25,87	0,200	5,390
	10.	95	425,59	0,048	22,69	58,78	13,39	24,22	0,223	5,046
dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-2.5 °C/cm	1.	20	425,59	0,048	15,17	58,78	2,1	4,82	0,047	1,004
	2.	25	425,59	0,048	24,12	58,78	2,41	7,64	0,059	1,592
	3.	35	425,59	0,048	23,20	58,78	3,2	10,15	0,082	2,115
	4.	45	425,59	0,048	18,42	58,78	5,55	13,13	0,106	2,735
	5.	55	425,59	0,048	19,35	58,78	8,14	17,79	0,129	3,706
	6.	65	425,59	0,048	17,57	58,78	10,06	19,73	0,153	4,110
	7.	75	425,59	0,048	21,58	58,78	14,86	25,24	0,176	5,258
	8.	85	425,59	0,048	20,18	58,78	14,71	25,44	0,200	5,300
	9.	105	425,59	0,048	20,97	58,78	18,22	28,89	0,247	6,019
	10.	120	425,59	0,048	18,31	58,78	19,79	29,74	0,282	6,196

Glycerin, b = 0.8mm, α = 45 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-10 °C/cm	1.	7	155,777	0,018	10,94	58,78	1,66	3,08	0,045	1,711
	2.	8	155,777	0,018	12,24	58,78	2,74	5,05	0,051	2,806
	3.	9	155,777	0,018	11,89	58,78	3,79	6,58	0,058	3,656
	4.	10	155,777	0,018	16,67	58,78	5,90	9,05	0,064	5,028
	5.	12	155,777	0,018	20,19	58,78	8,30	12,38	0,077	6,878
	6.	15	155,777	0,018	18,31	58,78	9,48	14,92	0,096	8,289
	7.	20	155,777	0,018	22,25	58,78	11,55	17,06	0,128	9,478
	8.	25	155,777	0,018	29,28	58,78	16,38	22,59	0,160	12,550
	9.	30	155,777	0,018	26,69	58,78	16,74	22,77	0,193	12,650
dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-4 °C/cm	1.	4	155,777	0,018	0	58,78	0	0	0,026	0,000
	2.	6	155,777	0,018	6,29	58,78	2,13	4,02	0,039	2,233
	3.	8	155,777	0,018	11,36	58,78	3,57	7,32	0,051	4,067
	4.	10	155,777	0,018	13,32	58,78	8,28	12,69	0,064	7,050
	5.	13	155,777	0,018	13,75	58,78	13,58	18,77	0,083	10,428
	6.	15	155,777	0,018	16,95	58,78	14,12	19,73	0,096	10,961
	7.	20	155,777	0,018	24,44	58,78	19,37	26,39	0,128	14,661
	8.	25	155,777	0,018	25,78	58,78	24,71	30,99	0,160	17,217
dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-2.5 °C/cm	1.	5	155,777	0,018	0	58,78	0	0	0,032	0,000
	2.	7	155,777	0,018	7,61	58,78	2,61	4,49	0,045	2,494
	3.	9	155,777	0,018	11,35	58,78	5,55	8,56	0,058	4,756
	4.	11	155,777	0,018	17,83	58,78	8,24	26,28	0,071	14,600
	5.	14	155,777	0,018	13,58	58,78	13,27	18,08	0,090	10,044
	6.	16	155,777	0,018	14,13	58,78	14,05	20,29	0,103	11,272
	7.	20	155,777	0,018	15,99	58,78	21,70	27,42	0,128	15,233
	8.	23	155,777	0,018	19,62	58,78	25,18	30,73	0,148	17,072
	9.	26	155,777	0,018	19,41	58,78	26,34	31,11	0,167	17,283

Glycerin, b = 0.8mm, α = 75 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-4 °C/cm	1.	3	114,036	0,013	0	58,78	0	0	0,026	0,000
	2.	5	114,036	0,013	6,36	58,78	3,09	4,19	0,044	3,223
	3.	6	114,036	0,013	9,49	58,78	6,19	8,56	0,053	6,585
	4.	8	114,036	0,013	14,17	58,78	10,57	15,76	0,070	12,123
	5.	10	114,036	0,013	12,55	58,78	18,94	21,71	0,088	16,700
	6.	12	114,036	0,013	15,85	58,78	20,43	24,21	0,105	18,623
	7.	15	114,036	0,013	18,79	58,78	24,64	29,97	0,132	23,054
	8.	18	114,036	0,013	20,06	58,78	26,38	31,98	0,158	24,600
	9.	21	114,036	0,013	27,83	58,78	28,24	36,27	0,184	27,900

Glycerin, b = 1.2mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-4 °C/cm	1.	12	283,727	0,048	2,31	58,78	1,43	2,36	0,042	0,492
	2.	16	283,727	0,048	9,02	58,78	1,94	4,68	0,056	0,975
	3.	22	283,727	0,048	8,29	58,78	3,27	7,15	0,078	1,490
	4.	28	283,727	0,048	8,2	58,78	4,94	11,09	0,099	2,310
	5.	35	283,727	0,048	7,77	58,78	9,61	14,35	0,123	2,990
	6.	43	283,727	0,048	8,67	58,78	13,58	18,88	0,152	3,933
	7.	50	283,727	0,048	11,46	58,78	15,81	20,65	0,176	4,302
	8.	60	283,727	0,048	14,23	58,78	17,79	22,68	0,211	4,725
	9.	75	283,727	0,048	16,98	58,78	20,68	25,48	0,264	5,308

Glycerin, b = 1.5mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-4 °C/cm	1.	12	226,981	0,048	4,49	58,78	1,89	2,87	0,053	0,598
	2.	16	226,981	0,048	5,09	58,78	4,98	7,49	0,070	1,560
	3.	19	226,981	0,048	6,31	58,78	5,17	8,67	0,084	1,806
	4.	23	226,981	0,048	9,75	58,78	9,04	13,62	0,101	2,838
	5.	26	226,981	0,048	11,69	58,78	12,98	18,06	0,115	3,763
	6.	32	226,981	0,048	14,74	58,78	13,58	18,7	0,141	3,896
	7.	40	226,981	0,048	20,65	58,78	17,91	24,22	0,176	5,046
	8.	50	226,981	0,048	21,49	58,78	19,13	24,45	0,220	5,094
	9.	60	226,981	0,048	22,98	58,78	20,27	26,05	0,264	5,427
	10.	75	226,981	0,048	25,11	58,78	25,59	31,63	0,330	6,590

II. CASTOR OIL

castor, 0.8mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-10 °C/cm	1.	30	327,282	0,044	43,33	58,78	1,22	7,28	0,092	1,655
	2.	35	327,282	0,044	36	58,78	1	6,66	0,107	1,514
	3.	40	327,282	0,044	38,89	58,78	1,33	7,7	0,122	1,750
	4.	45	327,282	0,044	39,02	58,78	1,85	8,81	0,137	2,002
	5.	50	327,282	0,044	34,34	58,78	1,84	8,74	0,153	1,986
	6.	60	327,282	0,044	37,36	58,78	3,69	11,31	0,183	2,571
	7.	75	327,282	0,044	36,29	58,78	6,13	13,9	0,229	3,159
	8.	90	327,282	0,044	37,94	58,78	7,73	16,6	0,275	3,773
	9.	105	327,282	0,044	38,57	58,78	9,29	18,66	0,321	4,241
	10.	120	327,282	0,044	41,96	58,78	10,89	21,87	0,367	4,971
	11.	135	327,282	0,044	38,09	58,78	10,53	21,07	0,412	4,789
	12.	150	327,282	0,044	43,52	58,78	13,04	24,71	0,458	5,616

castor, 0.8mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-4 °C/cm	1.	15	327,282	0,044	9,01	58,78	1,36	1,92	0,046	0,436
	2.	25	327,282	0,044	14,25	58,78	1,69	3,84	0,076	0,873
	3.	35	327,282	0,044	17,27	58,78	1,91	4,92	0,107	1,118
	4.	50	327,282	0,044	24,89	58,78	1,54	7,96	0,153	1,809
	5.	60	327,282	0,044	22,54	58,78	3,01	10,02	0,183	2,277
	6.	85	327,282	0,044	21,49	58,78	6,25	16,82	0,260	3,823
	7.	100	327,282	0,044	20,3	58,78	8,32	19,69	0,306	4,475
	8.	115	327,282	0,044	19,1	58,78	8,45	19,18	0,351	4,359
	9.	130	327,282	0,044	21,58	58,78	11.3	23,39	0,397	5,316
	10.	145	327,282	0,044	23,07	58,78	12,72	26,11	0,443	5,934

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-2.5 °C/cm	1.	10	327,282	0,044	0	58,78	0	0	0,031	0,000
	2.	15	327,282	0,044	17,59	58,78	0,3	1,51	0,046	0,343
	3.	25	327,282	0,044	13,81	58,78	1,04	3,09	0,076	0,702
	4.	35	327,282	0,044	14,99	58,78	1,91	5,54	0,107	1,259
	5.	45	327,282	0,044	19,19	58,78	2,62	8,45	0,137	1,921
	6.	70	327,282	0,044	15,37	58,78	2,31	11,54	0,214	2,623
	7.	80	327,282	0,044	13,65	58,78	2,27	12,8	0,244	2,909
	8.	95	327,282	0,044	13,22	58,78	3,77	15,68	0,290	3,564
	9.	110	327,282	0,044	14,2	58,78	2,87	17,29	0,336	3,930
	10.	135	327,282	0,044	15,84	58,78	4,03	17,55	0,412	3,989

castor, 0.8mm, α = 45 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-4 °C/cm	1.	3	119,794	0,026	0	58,78	0	0	0,025	0,000
	2.	6	119,794	0,026	15,65	58,78	1,04	2,64	0,050	1,015
	3.	7	119,794	0,026	19,47	58,78	0,83	2,76	0,058	1,062
	4.	10	119,794	0,026	21,55	58,78	1,59	6,13	0,083	2,358
	5.	11	119,794	0,026	24,59	58,78	2,19	8,06	0,092	3,100
	6.	14	119,794	0,026	20,19	58,78	2,15	9,25	0,117	3,558
	7.	16	119,794	0,026	20,81	58,78	3,48	13,04	0,134	5,015
	8.	22	119,794	0,026	16,3	58,78	4,27	15,53	0,184	5,973
	9.	25	119,794	0,026	16,95	58,78	5,14	18,39	0,209	7,073
	10.	30	119,794	0,026	16,71	58,78	4,25	19,71	0,250	7,581

castor, 0.8mm, α = 75 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-4 $^oC/cm$	1.	4	87,695	0,019	0	58,78	0	0	0,046	0,000
	2.	7	87,695	0,019	13,41	58,78	1,27	2,85	0,080	1,500
	3.	10	87,695	0,019	25,34	58,78	1,84	7,80	0,114	4,105
	4.	13	87,695	0,019	18,81	58,78	2,81	10,90	0,148	5,737
	5.	17	87,695	0,019	18,08	58,78	4,6	17,78	0,194	9,358
	6.	20	87,695	0,019	21,29	58,78	4,58	20,67	0,228	10,879
	7.	25	87,695	0,019	22,25	58,78	6,14	25,89	0,285	13,626
	8.	30	87,695	0,019	15,70	58,78	8,13	26,78	0,342	14,095

castor, b = 1.2mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-4 $^oC/cm$	1.	15	218,188	0,044	19,62	58,78	0,48	1,29	0,069	0,293
	2.	22	218,188	0,044	24,69	58,78	0,87	2,57	0,101	0,584
	3.	29	218,188	0,044	26,9	58,78	1,09	4,55	0,133	1,034
	4.	36	218,188	0,044	23,64	58,78	1,88	6,71	0,165	1,525
	5.	43	218,188	0,044	20,53	58,78	3,06	8,56	0,197	1,945
	6.	50	218,188	0,044	19,37	58,78	3,74	9,84	0,229	2,236
	7.	57	218,188	0,044	17,66	58,78	3,47	11,01	0,261	2,502
	8.	64	218,188	0,044	16,56	58,78	4,29	14,63	0,293	3,325
	9.	71	218,188	0,044	13,46	58,78	4,51	14,81	0,325	3,366
	10.	78	218,188	0,044	13,3	58,78	5,26	16,21	0,357	3,684

castor, b = 1.5mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-4 $^oC/cm$	1.	15	174,55	0,044	8,26	58,78	0,81	1,45	0,086	0,330
	2.	25	174,55	0,044	7,42	58,78	2,76	4,26	0,143	0,968
	3.	35	174,55	0,044	9,91	58,78	5,23	7,98	0,201	1,814
	4.	45	174,55	0,044	12,03	58,78	7	10,34	0,258	2,350
	5.	60	174,55	0,044	14,66	58,78	10,20	14,30	0,344	3,250
	6.	70	174,55	0,044	14,04	58,78	12,67	16,03	0,401	3,643
	7.	85	174,55	0,044	19,81	58,78	15,97	20,91	0,487	4,752
	8.	100	174,55	0,044	15,85	58,78	16,61	21,11	0,573	4,798
	9.	120	174,55	0,044	16,73	58,78	21,07	25,17	0,687	5,720
	10.	140	174,55	0,044	17,65	58,78	23,29	26,98	0,802	6,132

III. SAE 30

SAE 30,0.8mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-10 °C/cm	1.	10	29,902	0,043	0	58,78	0	0	0,334	0,000
	2.	15	29,902	0,043	0	58,78	0	0	0,502	0,000
	3.	21	29,902	0,043	14,82	58,78	2,74	4,73	0,702	1,100
	4.	27	29,902	0,043	15,16	58,78	3,90	6,26	0,903	1,456
	5.	40	29,902	0,043	19,67	58,78	5,82	9,04	1,338	2,102
	6.	50	29,902	0,043	22,26	58,78	7,79	11,01	1,672	2,561
	7.	65	29,902	0,043	23,14	58,78	10,26	13,57	2,174	3,156
	8.	85	29,902	0,043	23,57	58,78	10,86	14,39	2,843	3,347
	9.	110	29,902	0,043	32,38	58,78	14,73	20,67	3,679	4,807

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-4 °C/cm	1.	15	29,902	0,043	0	58,78	0	0	0,502	0,000
	2.	30	29,902	0,043	4,62	58,78	1,53	2,39	1,003	0,556
	3.	40	29,902	0,043	7,44	58,78	3,69	4,93	1,338	1,147
	4.	55	29,902	0,043	10,82	58,78	7,49	10,19	1,839	2,370
	5.	65	29,902	0,043	9,83	58,78	8,41	10,85	2,174	2,523
	6.	85	29,902	0,043	10,03	58,78	10,58	12,93	2,843	3,007
	7.	100	29,902	0,043	10,15	58,78	13,71	16,21	3,344	3,770
	8.	135	29,902	0,043	15,18	58,78	16,47	18,71	4,515	4,351
	9.	150	29,902	0,043	12,49	58,78	18,01	20,54	5,016	4,777
	10.	170	29,902	0,043	16,89	58,78	20,58	23,51	5,685	5,467

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-2.5 °C/cm	1.	25	29,902	0,043	0	58,78	0	0	0,836	0,000
	2.	55	29,902	0,043	2,89	58,78	4,36	5,1	1,839	1,186
	3.	90	29,902	0,043	6,68	58,78	7,77	9,59	3,010	2,230
	4.	105	29,902	0,043	5,47	58,78	9,25	11,78	3,511	2,740
	5.	145	29,902	0,043	6,27	58,78	15,57	18,02	4,849	4,191
	6.	165	29,902	0,043	4,63	58,78	17,26	20,03	5,518	4,658
	7.	210	29,902	0,043	6,95	58,78	22,41	24,78	7,023	5,763
	8.	245	29,902	0,043	10,8	58,78	28,07	31,11	8,193	7,235
	9.	270	29,902	0,043	13,73	58,78	31,97	36,56	9,029	8,502
	10.	300	29,902	0,043	9,87	58,78	32,86	36,74	10,033	8,544

SAE 30, 0.8mm, α = 45 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-4 °C/cm	1.	10	10,945	0,016	0	58,78	0	0	0,914	0,000
	2.	15	10,945	0,016	3,72	58,78	6,24	7,27	1,370	4,544
	3.	20	10,945	0,016	4,44	58,78	11,17	12,34	1,827	7,713
	4.	26	10,945	0,016	6,55	58,78	16,52	17,83	2,376	11,144
	5.	40	10,945	0,016	10,23	58,78	23,44	25,21	3,655	15,756
	6.	50	10,945	0,016	14,34	58,78	27,26	29,92	4,568	18,700
	7.	60	10,945	0,016	13,42	58,78	30,08	32,17	5,482	20,106

SAE 30, b = 0.8mm, α = 75 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-4 °C/cm	1.	4	8,012	0,012	0	58,78	0	0	0,499	0,000
	2.	6	8,012	0,012	16,63	58,78	2,31	3,98	0,749	3,317
	3.	7	8,012	0,012	15,80	58,78	3,68	5,68	0,874	4,733
	4.	9	8,012	0,012	15,36	58,78	5,64	9,09	1,123	7,575
	5.	10	8,012	0,012	16,44	58,78	7,95	11,34	1,248	9,450
	6.	12	8,012	0,012	16,42	58,78	11,09	15,34	1,498	12,783
	7.	13	8,012	0,012	14,11	58,78	13,44	17,01	1,623	14,175
	8.	17	8,012	0,012	18,58	58,78	18,05	21,44	2,122	17,867
	9.	20	8,012	0,012	22,09	58,78	21,09	24,70	2,496	20,583
	10.	25	8,012	0,012	24,88	58,78	22,16	26,27	3,120	21,892

SAE 30, b = 1.2mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-4 °C/cm	1.	4	19,935	0,043	0	58,78	0	0	0,201	0,000
	2.	8	19,935	0,043	0	58,78	0	0	0,401	0,000
	3.	20	19,935	0,043	9,26	58,78	2,78	3,61	1,003	0,840
	4.	30	19,935	0,043	7,73	58,78	3,82	5,33	1,505	1,240
	5.	40	19,935	0,043	9,27	58,78	7,56	9,54	2,007	2,219
	6.	50	19,935	0,043	12,87	58,78	8,23	13,09	2,508	3,044
	7.	56	19,935	0,043	9,12	58,78	12,88	15,85	2,809	3,686
	8.	65	19,935	0,043	9,06	58,78	15,44	19,49	3,261	4,533
	9.	75	19,935	0,043	11,15	58,78	18,81	22,88	3,762	5,321
	10.	90	19,935	0,043	11,82	58,78	19,74	22,33	4,515	5,193

SAE 30, b = 1.5mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
-4 °C/cm	1.	13	15,948	0,043	4,92	58,78	2,03	4,58	0,815	1,065
	2.	18	15,948	0,043	9,94	58,78	3,15	6,75	1,129	1,570
	3.	20	15,948	0,043	10,01	58,78	4,70	8,28	1,254	1,926
	4.	24	15,948	0,043	10,20	58,78	7,20	11,02	1,505	2,563
	5.	26	15,948	0,043	10,72	58,78	9,42	13,23	1,630	3,077
	6.	29	15,948	0,043	16,62	58,78	10,67	15,43	1,818	3,588
	7.	32	15,948	0,043	10,07	58,78	12,95	16,97	2,007	3,947
	8.	37	15,948	0,043	11,06	58,78	15,63	20,23	2,320	4,705
	9.	45	15,948	0,043	13,59	58,78	18,79	23,12	2,822	5,377
	10.	60	15,948	0,043	17,68	58,78	24,69	29,47	3,762	6,853

LAMPIRAN 4

Tabel data perubahan bentuk tiap satuan waktu $dT/dx \geq 0$

I. Glycerin

glycerin, b = 0.8 mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
10 °C/cm	1.	27	425,59	0,048	0	58,78	0	0	0,063	0,000
	2.	33	425,59	0,048	2,51	58,78	1,37	2,60	0,078	0,542
	3.	38	425,59	0,048	3,25	58,78	2,87	4,91	0,089	1,023
	4.	43	425,59	0,048	5,88	58,78	3,65	6,54	0,101	1,363
	5.	53	425,59	0,048	9,45	58,78	5,32	8,37	0,125	1,744
	6.	63	425,59	0,048	11,9	58,78	6,83	9,69	0,148	2,019
	7.	78	425,59	0,048	15,83	58,78	8,64	11,84	0,183	2,467
	8.	93	425,59	0,048	18,84	58,78	9,85	13,99	0,219	2,915
	9.	108	425,59	0,048	24,58	58,78	12,05	17,23	0,254	3,590
	10.	123	425,59	0,048	26,17	58,78	12,54	18,25	0,289	3,802

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
4 °C/cm	1.	32	425,59	0,048	0	58,78	0	0	0,075	0,000
	2.	51	425,59	0,048	2,18	58,78	2,29	3,14	0,120	0,654
	3.	75	425,59	0,048	5,63	58,78	2,86	5,27	0,176	1,098
	4.	91	425,59	0,048	7,25	58,78	3,75	8,35	0,214	1,740
	5.	106	425,59	0,048	6,96	58,78	7,17	13,75	0,249	2,865
	6.	121	425,59	0,048	6,97	58,78	7,07	14,57	0,284	3,035
	7.	140	425,59	0,048	7,79	58,78	8,59	19,28	0,329	4,017
	8.	160	425,59	0,048	7,35	58,78	12,36	22,69	0,376	4,727
	9.	200	425,59	0,048	10,72	58,78	21,16	25,93	0,470	5,402
	10.	220	425,59	0,048	13,33	58,78	22,27	27,94	0,517	5,821

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
2.5 °C/cm	1.	7	425,59	0,048	0	58,78	0	0	0,016	0,000
	2.	16	425,59	0,048	0	58,78	0	0	0,038	0,000
	3.	46	425,59	0,048	1,99	58,78	4,76	5,66	0,108	1,179
	4.	72	425,59	0,048	6,75	58,78	4,86	8,35	0,169	1,740
	5.	115	425,59	0,048	4	58,78	8,94	13,03	0,270	2,715
	6.	133	425,59	0,048	4,09	58,78	12,28	19,4	0,313	4,042
	7.	168	425,59	0,048	3,87	58,78	16,74	26,07	0,395	5,431
	8.	183	425,59	0,048	3,62	58,78	19,01	30,32	0,430	6,317
	9.	200	425,59	0,048	3,87	58,78	23,32	35,70	0,470	7,438
	10.	225	425,59	0,048	4,59	58,78	24,43	36,49	0,529	7,602

glycerin, b = 0.8 mm, α = 45 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
4 ^{o}C/cm	1.	10	155,777	0,018	0	58,78	0	0	0,064	0,000
	2.	15	155,777	0,018	5,47	58,78	1,34	2,54	0,096	1,411
	3.	20	155,777	0,018	4,29	58,78	3,71	5,17	0,128	2,872
	4.	23	155,777	0,018	5,82	58,78	4,41	6,95	0,148	3,861
	5.	26	155,777	0,018	5,41	58,78	6,02	9,66	0,167	5,367
	6.	28	155,777	0,018	6,23	58,78	7,84	12,48	0,180	6,933
	7.	31	155,777	0,018	5,14	58,78	10,22	15,33	0,199	8,517
	8.	35	155,777	0,018	3,93	58,78	13,76	19,14	0,225	10,633
	9.	40	155,777	0,018	9,09	58,78	21,47	26,65	0,257	14,806

glycerin, b = 0.8 mm, α = 75 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
4 ^{o}C/cm	1.	5	114,036	0,013	0	58,78	0	0	0,044	0,000
	2.	10	114,036	0,013	0	58,78	0	0	0,088	0,000
	3.	12	114,036	0,013	0	58,78	0	0	0,105	0,000
	4.	17	114,036	0,013	4,09	58,78	2,83	3,87	0,149	2,977
	5.	19	114,036	0,013	5,35	58,78	3,81	6,15	0,167	4,731
	6.	21	114,036	0,013	7,85	58,78	4,81	8,91	0,184	6,854
	7.	22	114,036	0,013	4,73	58,78	5,72	9,41	0,193	7,238
	8.	24	114,036	0,013	4,32	58,78	10,64	15,52	0,210	11,938
	9.	30	114,036	0,013	7,35	58,78	16,61	21,98	0,263	16,908
	10.	35	114,036	0,013	14,05	58,78	21,15	26,5	0,307	20,385

glycerin, b = 1.2 mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
4 ^{o}C/cm	1.	20	283,727	0,048	8,76	58,78	2,2	3,03	0,070	0,631
	2.	30	283,727	0,048	8,43	58,78	3,52	4,85	0,106	1,010
	3.	45	283,727	0,048	5,69	58,78	4,28	7,03	0,159	1,465
	4.	6	283,727	0,048	6,69	58,78	5.59	9,89	0,021	2,060
	5.	70	283,727	0,048	8,72	58,78	7	13,06	0,247	2,721
	6.	81	283,727	0,048	5,97	58,78	8,32	15,92	0,285	3,317
	7.	91	283,727	0,048	4,09	58,78	10,07	18,16	0,321	3,783
	8.	105	283,727	0,048	5,32	58,78	12,94	22,57	0,370	4,702
	9.	115	283,727	0,048	6,27	58,78	14,99	25,73	0,405	5,360
	10.	130	283,727	0,048	5,47	58,78	18,48	28,24	0,458	5,883

glycerin, b = 1.5 mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
4 °C/cm	1.	4	226,981	0,048	0	58,78	0	0	0,018	0,000
	2.	8	226,981	0,048	0	58,78	0	0	0,035	0,000
	3.	17	226,981	0,048	0	58,78	0	0	0,075	0,000
	4.	26	226,981	0,048	7,06	58,78	2,02	4,57	0,115	0,952
	5.	30	226,981	0,048	5,49	58,78	4,16	7,47	0,132	1,556
	6.	34	226,981	0,048	7,27	58,78	5,11	12,35	0,150	2,573
	7.	38	226,981	0,048	6,27	58,78	5,66	14,58	0,167	3,038
	8.	46	226,981	0,048	6,99	58,78	7,56	21,66	0,203	4,513
	9.	55	226,981	0,048	6,49	58,78	12,45	27,05	0,242	5,635
	10.	65	226,981	0,048	8,44	58,78	17,85	33,53	0,286	6,985

II. Castor oil

Castor oil, 0.8 mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
10 °C/cm	1.	18	327,282	0,044	11,52	58,78	0,83	1,52	0,055	0,346
	2.	25	327,282	0,044	14,57	58,78	1,75	4,35	0,076	0,989
	3.	30	327,282	0,044	14,21	58,78	3,21	6,23	0,092	1,416
	4.	35	327,282	0,044	18,69	58,78	4,11	7,82	0,107	1,777
	5.	40	327,282	0,044	20,72	58,78	5,28	9,26	0,122	2,105
	6.	50	327,282	0,044	56,04	58,78	6,72	10,28	0,153	2,336
	7.	60	327,282	0,044	28,33	58,78	8,10	12,11	0,183	2,752
	8.	70	327,282	0,044	28,20	58,78	8,18	12,72	0,214	2,891
	9.	80	327,282	0,044	32,91	58,78	11,14	16,27	0,244	3,698

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
4 °C/cm	1.	30	327,282	0,044	0	58,78	0	0	0,092	0,000
	2.	35	327,282	0,044	4,76	58,78	1,78	2,50	0,107	0,568
	3.	40	327,282	0,044	10,36	58,78	1,99	3,56	0,122	0,809
	4.	50	327,282	0,044	15,19	58,78	2,21	5,80	0,153	1,318
	5.	60	327,282	0,044	13,67	58,78	4,03	9,41	0,183	2,139
	6.	70	327,282	0,044	9,05	58,78	6,24	12,26	0,214	2,786
	7.	80	327,282	0,044	8,79	58,78	9,30	15,98	0,244	3,632
	8.	90	327,282	0,044	7,87	58,78	13,31	19,32	0,275	4,391
	9.	100	327,282	0,044	10,76	58,78	16,32	21,19	0,306	4,816
	10.	120	327,282	0,044	17,72	58,78	18,56	23,03	0,367	5,234

Castor oil, b = 0.8 mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
2.5 °C/cm	1.	30	327,282	0,044	12,45	58,78	1,19	2,46	0,092	0,559
	2.	45	327,282	0,044	14,04	58,78	2,03	4,26	0,137	0,968
	3.	60	327,282	0,044	17,44	58,78	2,36	6,44	0,183	1,464
	4.	80	327,282	0,044	16,85	58,78	3,01	10,16	0,244	2,309
	5.	100	327,282	0,044	15,54	58,78	6,87	14,26	0,306	3,241
	6.	120	327,282	0,044	16,75	58,78	8,63	19,64	0,367	4,464
	7.	140	327,282	0,044	13,66	58,78	11,52	23,59	0,428	5,361
	8.	160	327,282	0,044	13,75	58,78	13,7	25,79	0,489	5,861
	9.	180	327,282	0,044	13,84	58,78	16,02	28,02	0,550	6,368
	10.	195	327,282	0,044	15,86	58,78	21,06	33,90	0,596	7,705

Castor oil, b = 0.8 mm, α = 45 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
4 °C/cm	1.	10	119,794	0,026	0	58,78	0	0	0,083	0,000
	2.	14	119,794	0,026	4,53	58,78	1,40	2,65	0,117	1,019
	3.	17	119,794	0,026	4,33	58,78	2	4,33	0,142	1,665
	4.	20	119,794	0,026	4,36	58,78	4,14	6,92	0,167	2,662
	5.	25	119,794	0,026	4,61	58,78	7,17	11,5	0,209	4,423
	6.	30	119,794	0,026	6,56	58,78	12,13	17,72	0,250	6,815
	7.	35	119,794	0,026	11,84	58,78	14,95	19,49	0,292	7,496
	8.	40	119,794	0,026	18,21	58,78	17,89	23,03	0,334	8,858

Castor oil, b = 0.8 mm, α = 75 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
4 °C/cm	1.	7	87,695	0,019	0	58,78	0	0	0,080	0,000
	2.	9	87,695	0,019	0	58,78	0	0	0,103	0,000
	3.	12	87,695	0,019	4,42	58,78	2,39	3,55	0,137	1,868
	4.	14	87,695	0,019	5,45	58,78	3,79	5,75	0,160	3,026
	5.	16	87,695	0,019	3,82	58,78	6,29	8,42	0,182	4,432
	6.	18	87,695	0,019	4,83	58,78	10,56	13,95	0,205	7,342
	7.	20	87,695	0,019	4,43	58,78	12,48	15,23	0,228	8,016
	8.	25	87,695	0,019	10,68	58,78	18,15	20,95	0,285	11,026
	9.	30	87,695	0,019	16,8	58,78	20,29	23,5	0,342	12,368

Castor oil, b = 1.2 mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
4 °C/cm	1.	20	218,188	0,044	0	58,78	0	0	0,092	0,000
	2.	45	218,188	0,044	3,14	58,78	2,99	3,57	0,206	0,811
	3.	55	218,188	0,044	10,94	58,78	3,78	5,62	0,252	1,277
	4.	65	218,188	0,044	8,53	58,78	6,24	8,49	0,298	1,930
	5.	75	218,188	0,044	9,77	58,78	8,31	12,33	0,344	2,802
	6.	85	218,188	0,044	7,32	58,78	11,72	14,8	0,390	3,364
	7.	95	218,188	0,044	7,01	58,78	14,48	17,17	0,435	3,902
	8.	115	218,188	0,044	13,41	58,78	19,72	22,59	0,527	5,134
	9.	130	218,188	0,044	15,38	58,78	23,70	25,83	0,596	5,870
	10.	150	218,188	0,044	27	58,78	24,58	27,66	0,687	6,286

Castor oil, b = 1.5 mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
4 °C/cm	1.	35	174,55	0,044	9,84	58,78	2,04	3	0,201	0,682
	2.	45	174,55	0,044	7,52	58,78	3,48	4,97	0,258	1,130
	3.	55	174,55	0,044	10,38	58,78	5,41	8,6	0,315	1,955
	4.	60	174,55	0,044	7,14	58,78	8,16	12,44	0,344	2,827
	5.	63	174,55	0,044	6,73	58,78	8,50	12,66	0,361	2,877
	6.	70	174,55	0,044	5,79	58,78	12,52	16,21	0,401	3,684
	7.	80	174,55	0,044	8,36	58,78	16,93	19,24	0,458	4,373
	8.	100	174,55	0,044	14,35	58,78	20,37	24,10	0,573	5,477
	9.	120	174,55	0,044	20,48	58,78	24,26	27,61	0,687	6,275
	10.	135	174,55	0,044	20,25	58,78	24,19	27,41	0,773	6,230

III. SAE 30

SAE 30, b = 0.8 mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
10 °C/cm	1.	7	29,902	0,043	0	58,78	0	0	0,234	0,000
	2.	13	29,902	0,043	0	58,78	0	0	0,435	0,000
	3.	20	29,902	0,043	2,54	58,78	1,09	2,43	0,669	0,552
	4.	25	29,902	0,043	3,16	58,78	2,11	3,85	0,836	0,875
	5.	31	29,902	0,043	4,08	58,78	2,88	5,82	1,037	1,323
	6.	40	29,902	0,043	9,02	58,78	4,79	9,51	1,338	2,161
	7.	45	29,902	0,043	10,02	58,78	5,59	10,10	1,505	2,296
	8.	60	29,902	0,043	16,20	58,78	8,36	13,41	2,007	3,048
	9.	80	29,902	0,043	19,53	58,78	10,12	24	2,675	5,455
	10.	100	29,902	0,043	22,48	58,78	13,09	18,31	3,344	4,161

SAE 30, b = 0.8 mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
4 °C/cm	1.	5	29,902	0,043	0	58,78	0	0	0,167	0,000
	2.	15	29,902	0,043	0	58,78	0	0	0,502	0,000
	3.	28	29,902	0,043	0	58,78	0	0	0,936	0,000
	4.	50	29,902	0,043	6,77	58,78	2,60	4,34	1,672	0,986
	5.	60	29,902	0,043	6,35	58,78	3,88	6,86	2,007	1,559
	6.	77	29,902	0,043	7,43	58,78	4,89	10,17	2,575	2,311
	7.	85	29,902	0,043	8,09	58,78	5,33	10,99	2,843	2,498
	8.	100	29,902	0,043	6,77	58,78	7,96	15,14	3,344	3,441
	9.	120	29,902	0,043	8,22	58,78	11,08	18,21	4,013	4,139
	10.	140	29,902	0,043	8,94	58,78	14,94	21,34	4,682	4,850

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
2.5 °C/cm	1.	30	29,902	0,043	0	58,78	0	0	1,003	0,000
	2.	65	29,902	0,043	8,61	58,78	3,02	5,97	2,174	1,357
	3.	105	29,902	0,043	12,66	58,78	6,94	10,28	3,511	2,336
	4.	145	29,902	0,043	13,20	58,78	8,49	13,96	4,849	3,173
	5.	175	29,902	0,043	9,98	58,78	10,44	16,49	5,852	3,748
	6.	195	29,902	0,043	9,41	58,78	12,95	20,63	6,521	4,689
	7.	215	29,902	0,043	8,19	58,78	16,10	26,19	7,190	5,952
	8.	230	29,902	0,043	6,84	58,78	22,01	30,15	7,692	6,852
	9.	255	29,902	0,043	6,66	58,78	29,96	33,64	8,528	7,646

SAE 30, b = 0.8 mm, α = 45 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
4 °C/cm	1.	10	10,945	0,016	2,42	58,78	1,45	1,89	0,914	1,181
	2.	15	10,945	0,016	4,29	58,78	2,46	4,59	1,370	2,869
	3.	17	10,945	0,016	4,68	58,78	3,93	6,38	1,553	3,988
	4.	21	10,945	0,016	6,36	58,78	6,25	10,09	1,919	6,306
	5.	23	10,945	0,016	4,72	58,78	7,89	11,38	2,101	7,113
	6.	26	10,945	0,016	7,63	58,78	9,43	15,93	2,376	9,956
	7.	27	10,945	0,016	5,31	58,78	10,88	16,14	2,467	10,088
	8.	30	10,945	0,016	2,60	58,78	13,95	19,59	2,741	12,244
	9.	35	10,945	0,016	3,07	58,78	19,93	23,79	3,198	14,869

SAE 30, b = 0.8 mm, α = 75 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
4 °C/cm	1.	6	8,012	0,012	0	58,78	0	0	0,749	0,000
	2.	9	8,012	0,012	10,23	58,78	3,14	4,63	1,123	3,858
	3.	11	8,012	0,012	6,88	58,78	5,27	7,16	1,373	5,967
	4.	13	8,012	0,012	12,85	58,78	6,83	9,89	1,623	8,242
	5.	15	8,012	0,012	9,54	58,78	8,71	12,90	1,872	10,750
	6.	16	8,012	0,012	13,76	58,78	9,71	14,52	1,997	12,100
	7.	18	8,012	0,012	8,31	58,78	13,62	18,88	2,247	15,733
	8.	19	8,012	0,012	4,96	58,78	17,91	21,17	2,371	17,642
	9.	21	8,012	0,012	5,55	58,78	20,74	23,17	2,621	19,308
	10.	25	8,012	0,012	7,31	58,78	25,95	28,59	3,120	23,825

SAE 30, b = 1.2 mm, α = 15 derajat

dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
4 °C/cm	1.	35	19,935	0,043	10,23	58,78	1,34	2,52	1,756	0,586
	2.	42	19,935	0,043	7,84	58,78	2,09	4,61	2,107	1,072
	3.	50	19,935	0,043	8,48	58,78	5,74	7,62	2,508	1,772
	4.	56	19,935	0,043	7,81	58,78	6,69	9,01	2,809	2,095
	5.	64	19,935	0,043	10,78	58,78	11,06	14,03	3,210	3,263
	6.	72	19,935	0,043	10,93	58,78	12,43	15,38	3,612	3,577
	7.	82	19,935	0,043	11,82	58,78	15,72	18,72	4,113	4,353
	8.	92	19,935	0,043	12,68	58,78	17,06	20,43	4,615	4,751
	9.	100	19,935	0,043	14,14	58,78	19,83	23,38	5,016	5,437
	10.	120	19,935	0,043	16,48	58,78	22,92	27,24	6,020	6,335

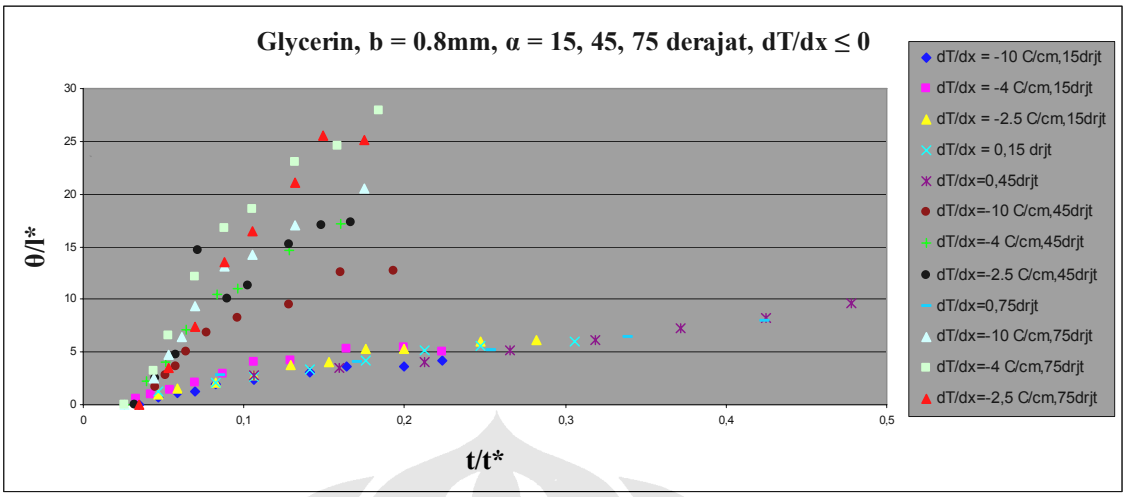
SAE 30, b = 1.5 mm, α = 15 derajat

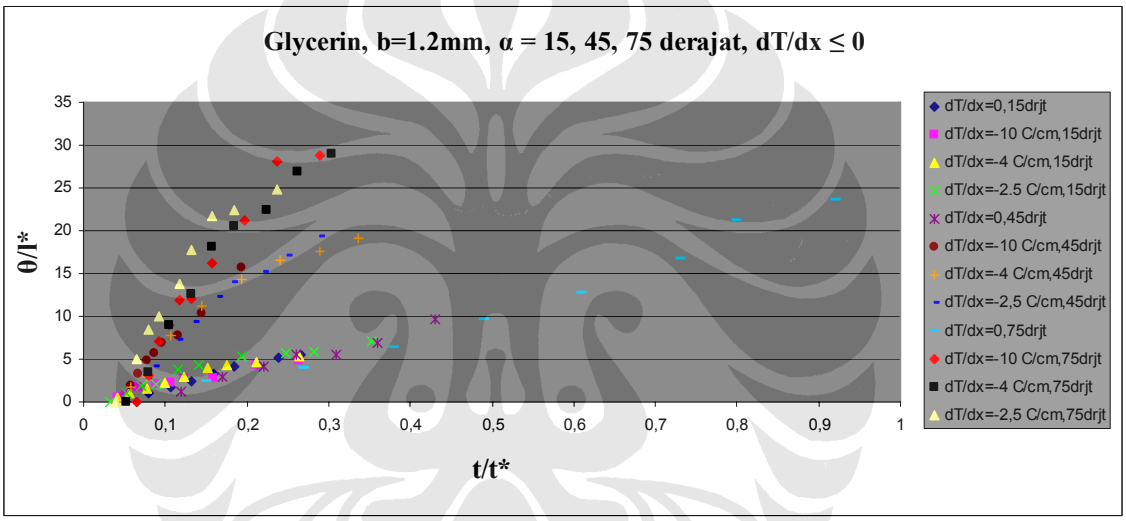
dT/dx	No.	t	t*	ℓ^*	$\sum \ell_i$	W	y	$\hat{\theta}$	t/t*	$\hat{\theta}/\ell^*$
4 °C/cm	1.	17	15,948	0,043	20,71	58,78	3,51	5,37	1,066	1,249
	2.	23	15,948	0,043	17,10	58,78	5,94	8,26	1,442	1,921
	3.	28	15,948	0,043	15,92	58,78	7,83	11,57	1,756	2,691
	4.	31	15,948	0,043	13,39	58,78	8,06	12,56	1,944	2,921
	5.	35	15,948	0,043	13,21	58,78	11,09	16,43	2,195	3,821
	6.	37	15,948	0,043	8,80	58,78	13,09	17,93	2,320	4,170
	7.	41	15,948	0,043	7,29	58,78	16,47	21,64	2,571	5,033
	8.	45	15,948	0,043	6,51	58,78	18,76	23,85	2,822	5,547
	9.	50	15,948	0,043	12,05	58,78	22,96	28,01	3,135	6,514
	10.	60	15,948	0,043	15,51	58,78	25,44	29,57	3,762	6,877

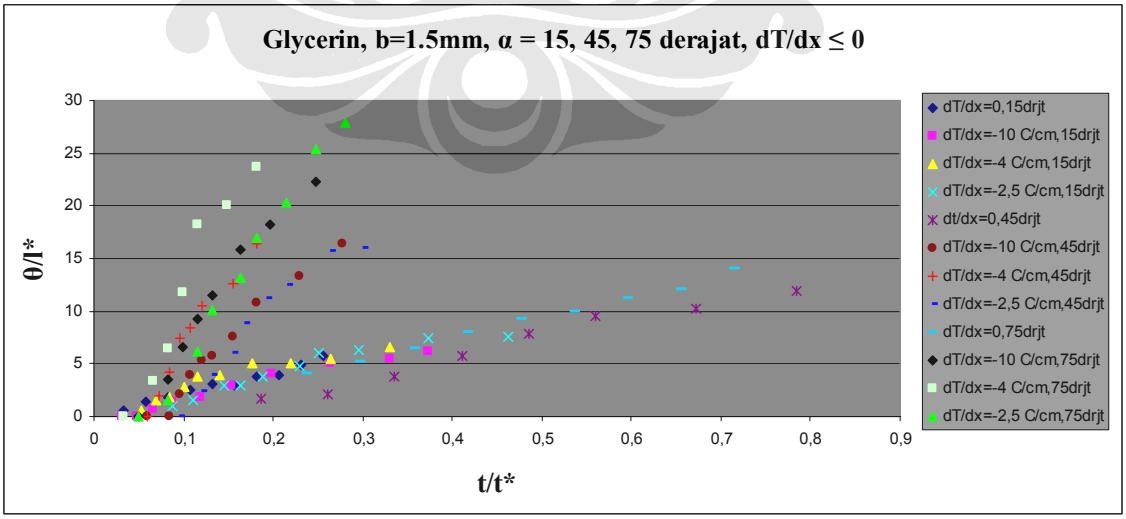
LAMPIRAN 5

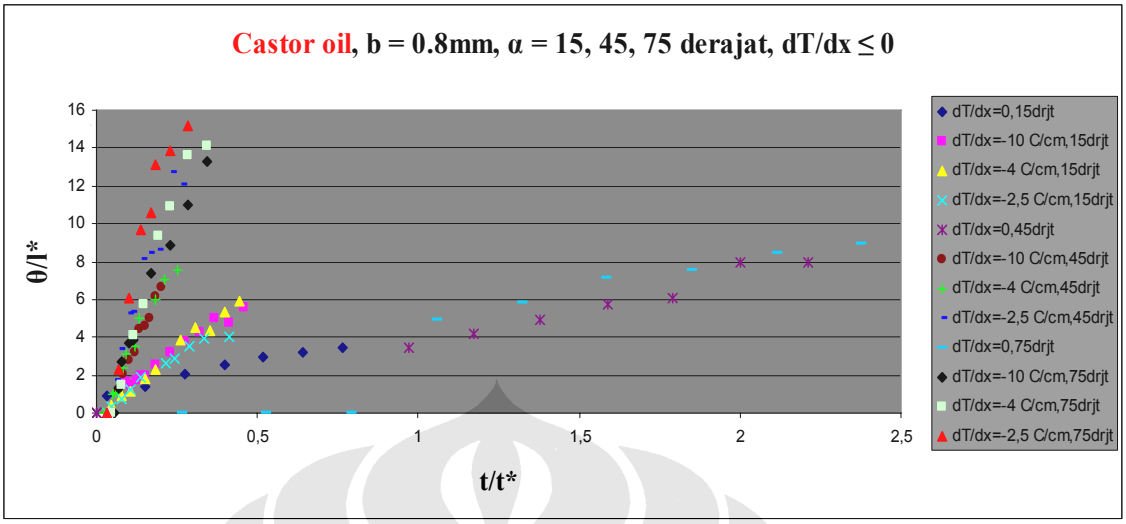
Grafik hubungan antara skala panjang (Ɵ/*l) dan skala waktu (t/*t**)**

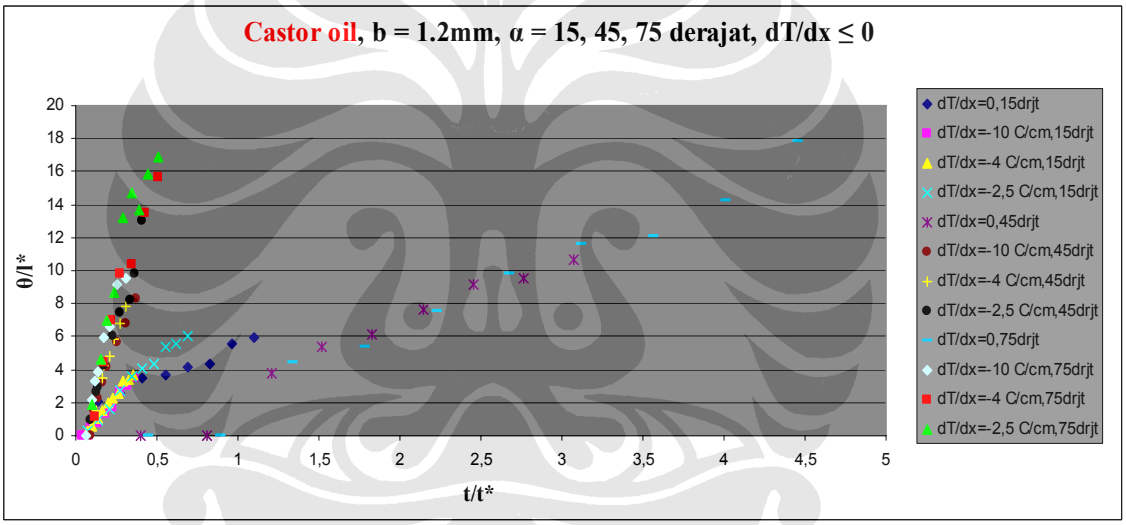
$dT/dx \leq 0$

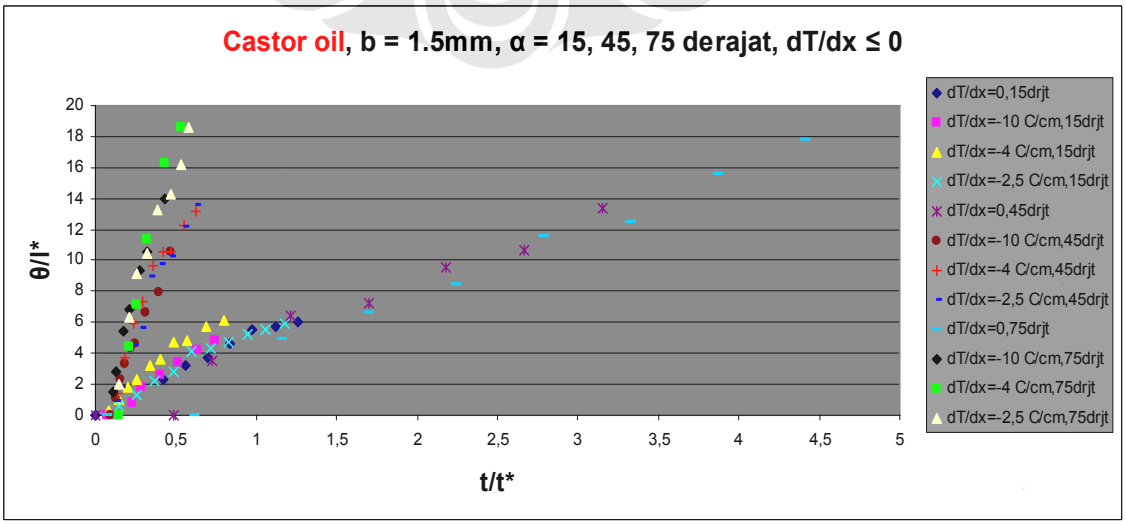

Glycerin, b = 0.8mm, α = 15, 45, 75 derajat, dT/dx ≤ 0
θ/l*
t/t*
dT/dx = -10 C/cm,15drjt
dT/dx = -4 C/cm,15drjt
dT/dx = -2.5 C/cm,15drjt
dT/dx = 0,15 drjt
dT/dx=0,45drjt
dT/dx=-10 C/cm,45drjt
dT/dx=-4 C/cm,45drjt
dT/dx=-2.5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=-10 C/cm,75drjt
dT/dx=-4 C/cm,75drjt
dT/dx=-2,5 C/cm,75drjt

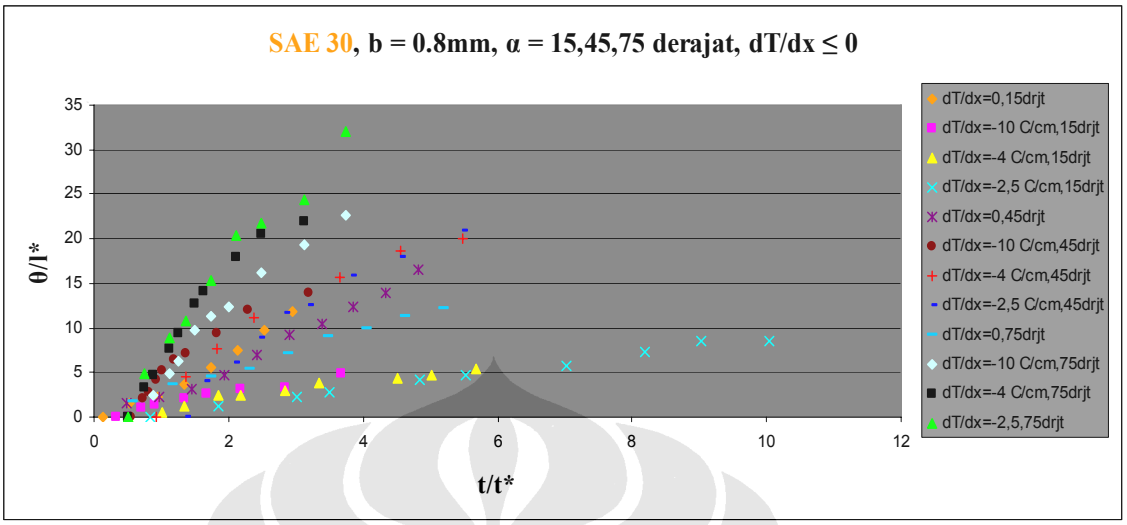

Glycerin, b=1.2mm, α = 15, 45, 75 derajat, dT/dx ≤ 0
θ/l*
t/t*
dT/dx=0,15drjt
dT/dx=-10 C/cm,15drjt
dT/dx=-4 C/cm,15drjt
dT/dx=-2.5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=-10 C/cm,45drjt
dT/dx=-4 C/cm,45drjt
dT/dx=-2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=-10 C/cm,75drjt
dT/dx=-4 C/cm,75drjt
dT/dx=-2,5 C/cm,75drjt

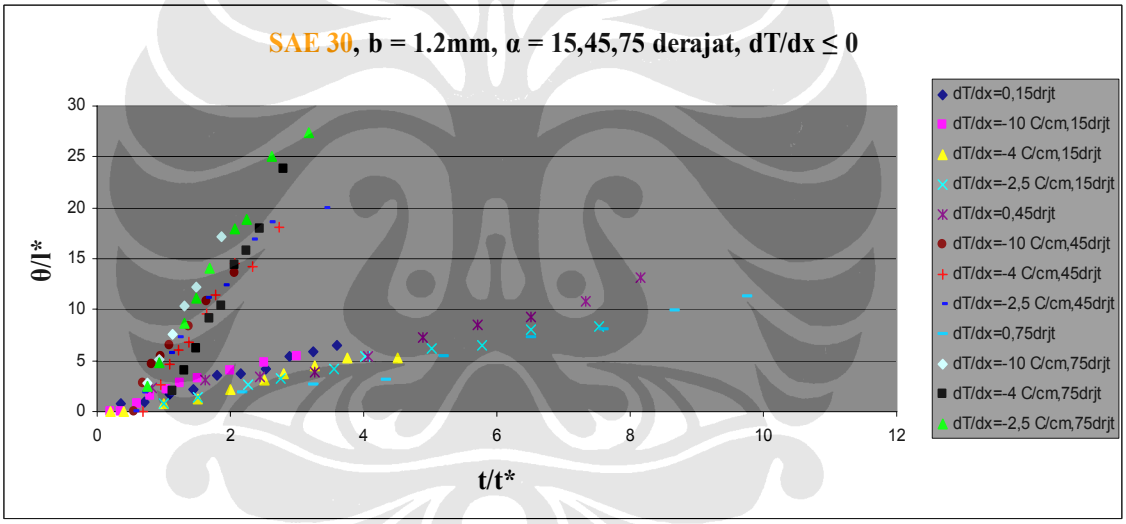

Glycerin, b=1.5mm, α = 15, 45, 75 derajat, dT/dx ≤ 0
θ/l*
t/t*
dT/dx=0,15drjt
dT/dx=-10 C/cm,15drjt
dT/dx=-4 C/cm,15drjt
dT/dx=-2,5 C/cm,15drjt
dt/dx=0,45drjt
dT/dx=-10 C/cm,45drjt
dT/dx=-4 C/cm,45drjt
dT/dx=-2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=-10 C/cm,75drjt
dT/dx=-4 C/cm,75drjt
dT/dx=-2,5 C/cm,75drjt

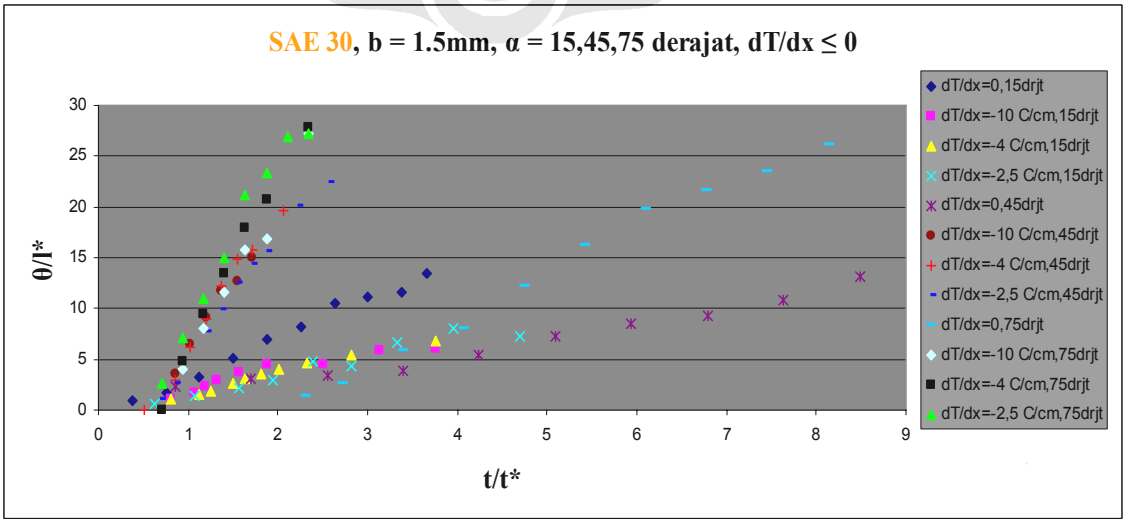

Castor oil, b = 0.8mm, α = 15, 45, 75 derajat, dT/dx ≤ 0
θ/l*
t/t*
dT/dx=0,15drjt
dT/dx=-10 C/cm,15drjt
dT/dx=-4 C/cm,15drjt
dT/dx=-2,5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=-10 C/cm,45drjt
dT/dx=-4 C/cm,45drjt
dT/dx=-2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=-10 C/cm,75drjt
dT/dx=-4 C/cm,75drjt
dT/dx=-2,5 C/cm,75drjt


Castor oil, b = 1.2mm, α = 15, 45, 75 derajat, dT/dx ≤ 0
θ/l*
t/t*
dT/dx=0,15drjt
dT/dx=-10 C/cm,15drjt
dT/dx=-4 C/cm,15drjt
dT/dx=-2,5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=-10 C/cm,45drjt
dT/dx=-4 C/cm,45drjt
dT/dx=-2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=-10 C/cm,75drjt
dT/dx=-4 C/cm,75drjt
dT/dx=-2,5 C/cm,75drjt


Castor oil, b = 1.5mm, α = 15, 45, 75 derajat, dT/dx ≤ 0
θ/l*
t/t*
dT/dx=0,15drjt
dT/dx=-10 C/cm,15drjt
dT/dx=-4 C/cm,15drjt
dT/dx=-2,5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=-10 C/cm,45drjt
dT/dx=-4 C/cm,45drjt
dT/dx=-2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=-10 C/cm,75drjt
dT/dx=-4 C/cm,75drjt
dT/dx=-2,5 C/cm,75drjt


SAE 30, b = 0.8mm, α = 15,45,75 derajat, dT/dx ≤ 0
θ/t*
t/t*
dT/dx=0,15drjt
dT/dx=-10 C/cm,15drjt
dT/dx=-4 C/cm,15drjt
dT/dx=-2,5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=-10 C/cm,45drjt
dT/dx=-4 C/cm,45drjt
dT/dx=-2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=-10 C/cm,75drjt
dT/dx=-4 C/cm,75drjt
dT/dx=-2,5,75drjt

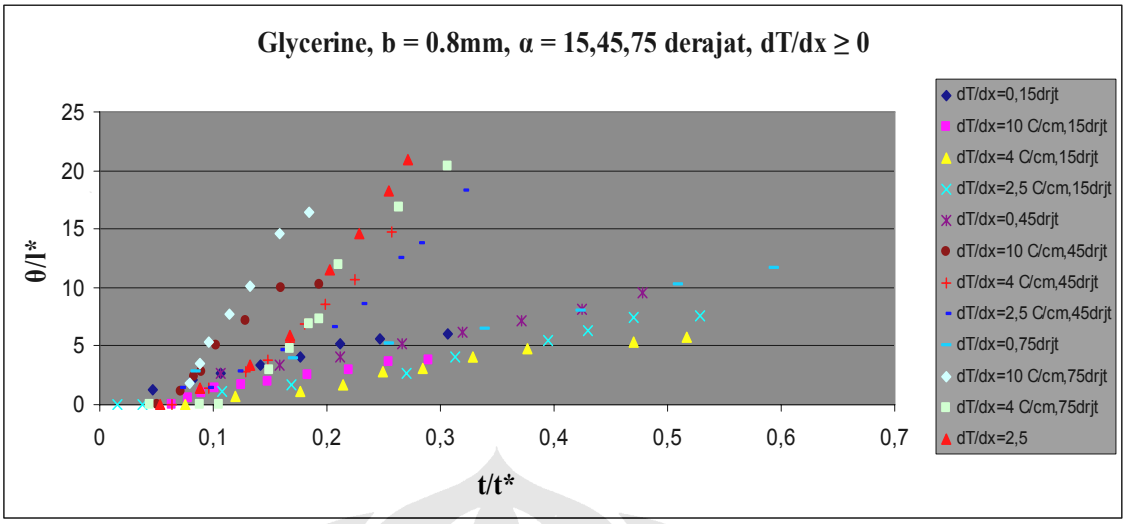

SAE 30, b = 1.2mm, α = 15,45,75 derajat, dT/dx ≤ 0
θ/t*
t/t*
dT/dx=0,15drjt
dT/dx=-10 C/cm,15drjt
dT/dx=-4 C/cm,15drjt
dT/dx=-2,5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=-10 C/cm,45drjt
dT/dx=-4 C/cm,45drjt
dT/dx=-2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=-10 C/cm,75drjt
dT/dx=-4 C/cm,75drjt
dT/dx=-2,5 C/cm,75drjt

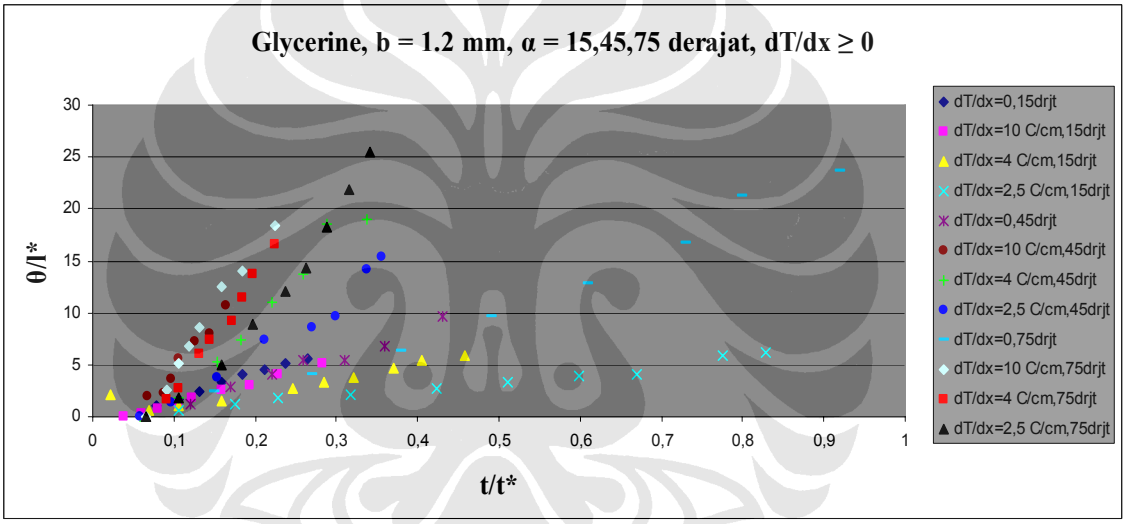

SAE 30, b = 1.5mm, α = 15,45,75 derajat, dT/dx ≤ 0
θ/t*
t/t*
dT/dx=0,15drjt
dT/dx=-10 C/cm,15drjt
dT/dx=-4 C/cm,15drjt
dT/dx=-2,5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=-10 C/cm,45drjt
dT/dx=-4 C/cm,45drjt
dT/dx=-2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=-10 C/cm,75drjt
dT/dx=-4 C/cm,75drjt
dT/dx=-2,5 C/cm,75drjt

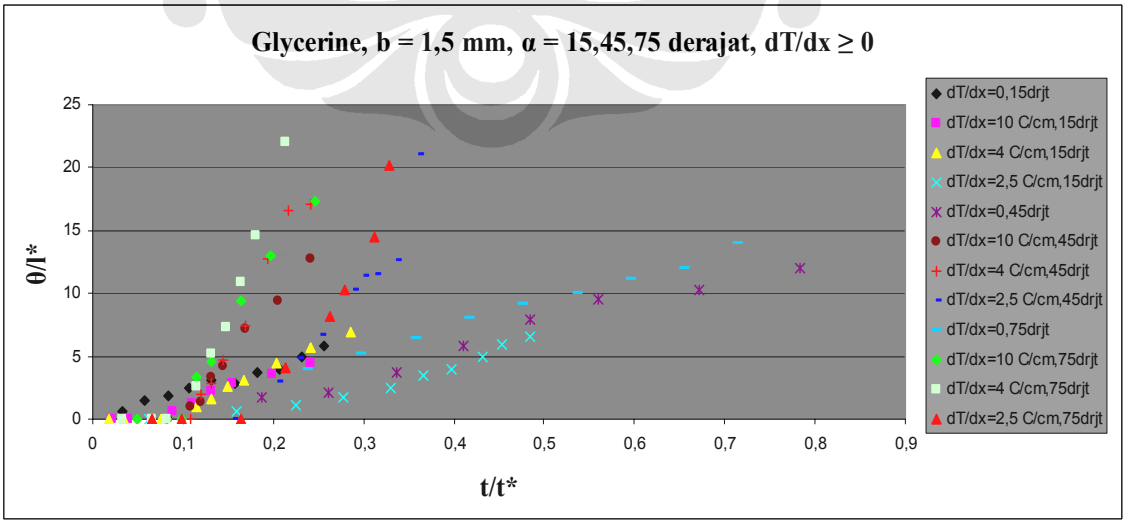
LAMPIRAN 6

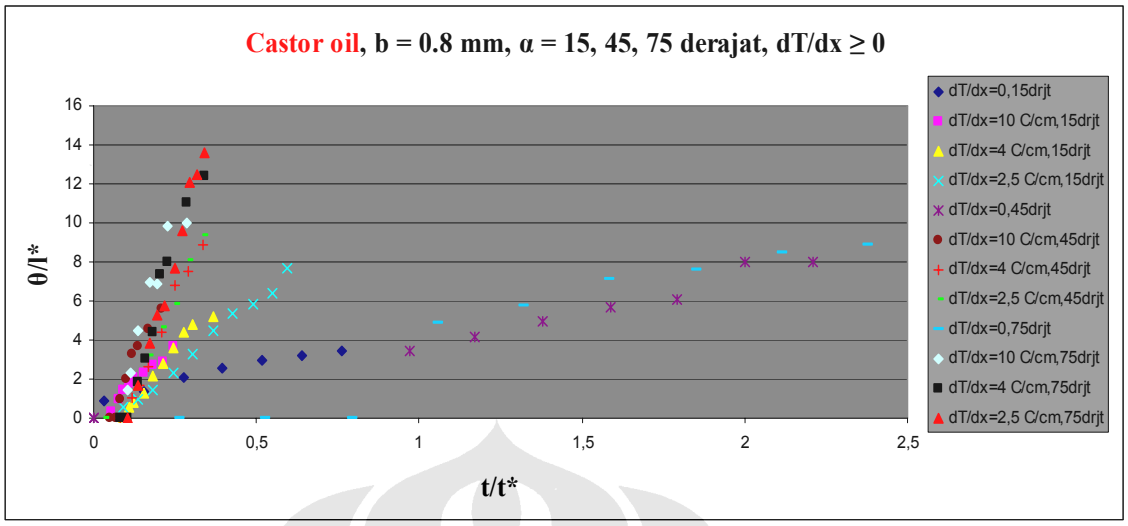
Grafik hubungan antara skala panjang (Θ/l^*) dan skala waktu (t/t^*)

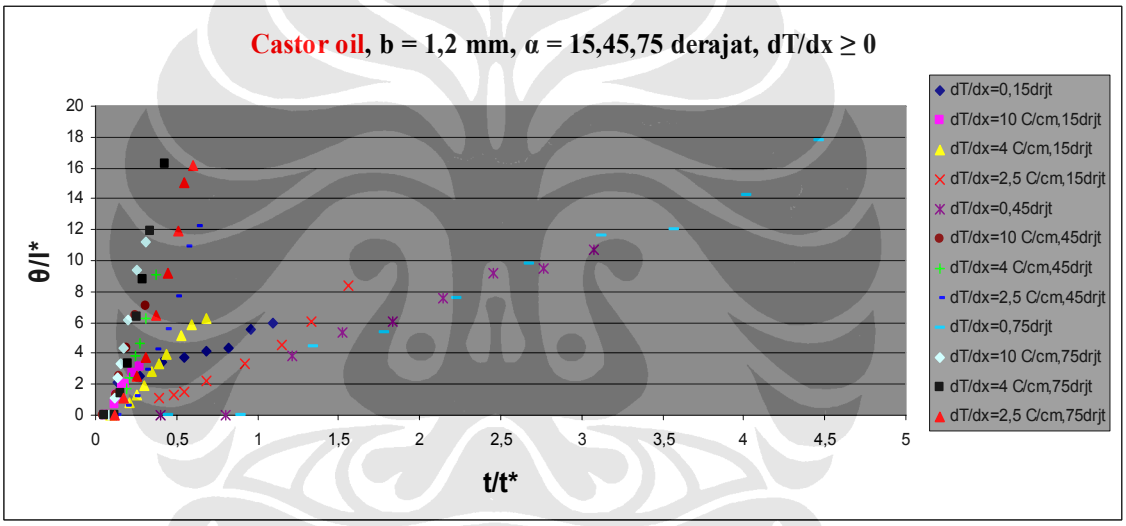
$dT/dx \geq 0$

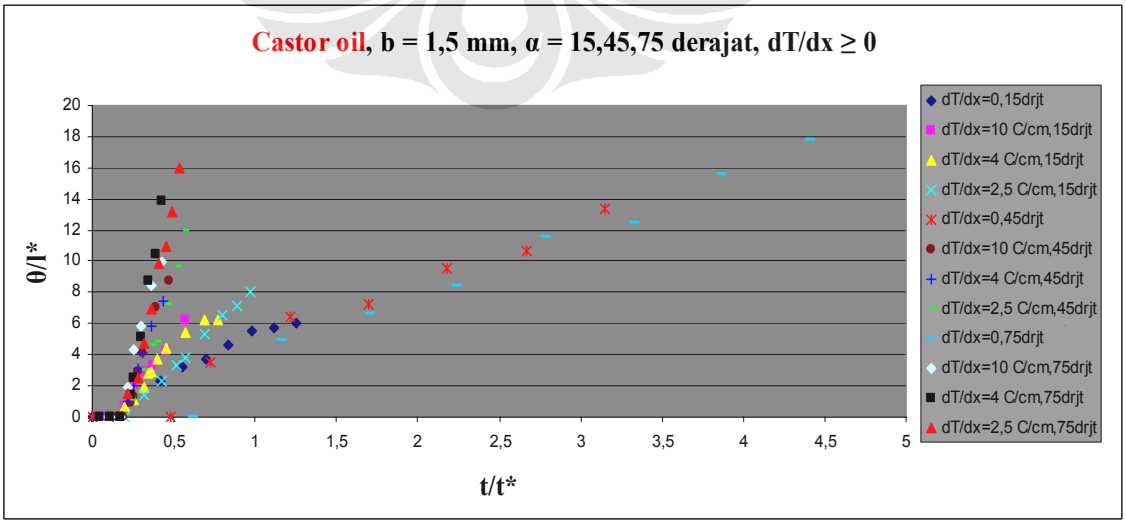

Glycerine, b = 0.8mm, α = 15,45,75 derajat, dT/dx ≥ 0
θ/l*
t/t*
dT/dx=0,15drjt
dT/dx=10 C/cm,15drjt
dT/dx=4 C/cm,15drjt
dT/dx=2,5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=10 C/cm,45drjt
dT/dx=4 C/cm,45drjt
dT/dx=2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=10 C/cm,75drjt
dT/dx=4 C/cm,75drjt
dT/dx=2,5

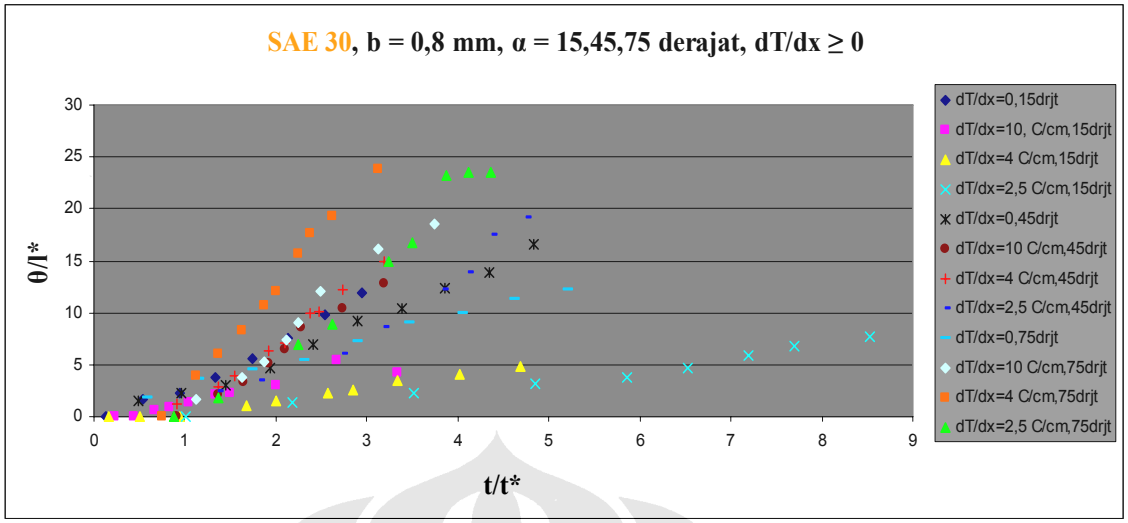

Glycerine, b = 1.2 mm, α = 15,45,75 derajat, dT/dx ≥ 0
θ/l*
t/t*
dT/dx=0,15drjt
dT/dx=10 C/cm,15drjt
dT/dx=4 C/cm,15drjt
dT/dx=2,5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=10 C/cm,45drjt
dT/dx=4 C/cm,45drjt
dT/dx=2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=10 C/cm,75drjt
dT/dx=4 C/cm,75drjt
dT/dx=2,5 C/cm,75drjt

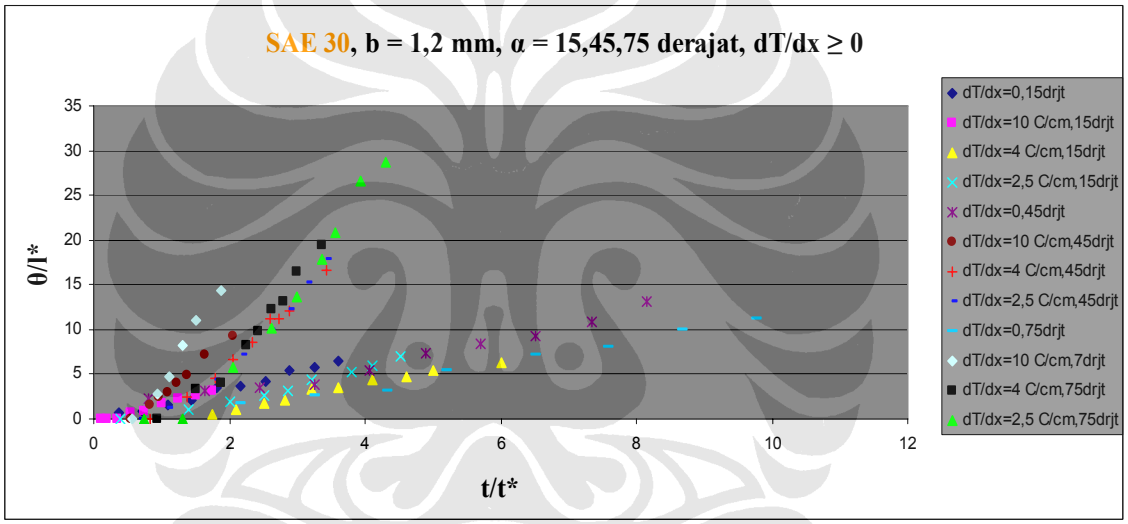

Glycerine, b = 1,5 mm, α = 15,45,75 derajat, dT/dx ≥ 0
θ/l*
t/t*
dT/dx=0,15drjt
dT/dx=10 C/cm,15drjt
dT/dx=4 C/cm,15drjt
dT/dx=2,5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=10 C/cm,45drjt
dT/dx=4 C/cm,45drjt
dT/dx=2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=10 C/cm,75drjt
dT/dx=4 C/cm,75drjt
dT/dx=2,5 C/cm,75drjt

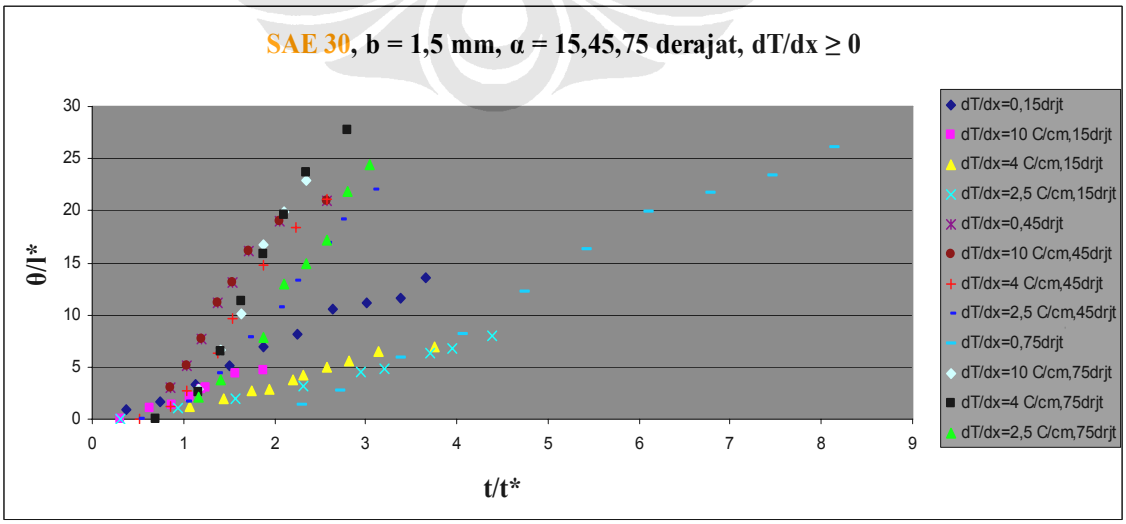

Castor oil, b = 0.8 mm, α = 15, 45, 75 derajat, dT/dx ≥ 0
θ/l*
t/t*
dT/dx=0,15drjt
dT/dx=10 C/cm,15drjt
dT/dx=4 C/cm,15drjt
dT/dx=2,5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=10 C/cm,45drjt
dT/dx=4 C/cm,45drjt
dT/dx=2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=10 C/cm,75drjt
dT/dx=4 C/cm,75drjt
dT/dx=2,5 C/cm,75drjt


Castor oil, b = 1,2 mm, α = 15,45,75 derajat, dT/dx ≥ 0
θ/l*
t/t*
dT/dx=0,15drjt
dT/dx=10 C/cm,15drjt
dT/dx=4 C/cm,15drjt
dT/dx=2,5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=10 C/cm,45drjt
dT/dx=4 C/cm,45drjt
dT/dx=2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=10 C/cm,75drjt
dT/dx=4 C/cm,75drjt
dT/dx=2,5 C/cm,75drjt


Castor oil, b = 1,5 mm, α = 15,45,75 derajat, dT/dx ≥ 0
θ/l*
t/t*
dT/dx=0,15drjt
dT/dx=10 C/cm,15drjt
dT/dx=4 C/cm,15drjt
dT/dx=2,5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=10 C/cm,45drjt
dT/dx=4 C/cm,45drjt
dT/dx=2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=10 C/cm,75drjt
dT/dx=4 C/cm,75drjt
dT/dx=2,5 C/cm,75drjt


SAE 30, b = 0,8 mm, α = 15,45,75 derajat, dT/dx ≥ 0
θ/l*
t/t*
dT/dx=0,15drjt
dT/dx=10, C/cm,15drjt
dT/dx=4 C/cm,15drjt
dT/dx=2,5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=10 C/cm,45drjt
dT/dx=4 C/cm,45drjt
dT/dx=2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=10 C/cm,75drjt
dT/dx=4 C/cm,75drjt
dT/dx=2,5 C/cm,75drjt


SAE 30, b = 1,2 mm, α = 15,45,75 derajat, dT/dx ≥ 0
θ/l*
t/t*
dT/dx=0,15drjt
dT/dx=10 C/cm,15drjt
dT/dx=4 C/cm,15drjt
dT/dx=2,5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=10 C/cm,45drjt
dT/dx=4 C/cm,45drjt
dT/dx=2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=10 C/cm,7drjt
dT/dx=4 C/cm,75drjt
dT/dx=2,5 C/cm,75drjt


SAE 30, b = 1,5 mm, α = 15,45,75 derajat, dT/dx ≥ 0
θ/l*
t/t*
dT/dx=0,15drjt
dT/dx=10 C/cm,15drjt
dT/dx=4 C/cm,15drjt
dT/dx=2,5 C/cm,15drjt
dT/dx=0,45drjt
dT/dx=10 C/cm,45drjt
dT/dx=4 C/cm,45drjt
dT/dx=2,5 C/cm,45drjt
dT/dx=0,75drjt
dT/dx=10 C/cm,75drjt
dT/dx=4 C/cm,75drjt
dT/dx=2,5 C/cm,75drjt