Lampiran 1: Perhitungan Nilai Persen *Elongasi* (% ε)

PERSEN *ELONGASI*

a. Persen *Elongasi* Sampel A

$$\% \, \varepsilon = \left(\frac{\Delta l}{l_0}\right) \times 100$$

$$\% \, \varepsilon \, A_1 = \left(\frac{1,82}{15}\right) \times 100$$

$$= 12,14 \, \%$$

$$\% \, \varepsilon \, A_2 = \left(\frac{1,38}{15}\right) \times 100$$

$$= 9,2 \, \%$$

$$\% \, \varepsilon \, A_3 = \left(\frac{1,79}{15}\right) \times 100$$

$$= 11,94 \, \%$$

b. Persen *Elongasi* Sampel B

$$\% \, \varepsilon \, B_1 = \left(\frac{3,07}{15}\right) \times 100$$

$$= 24,4 \, \%$$

$$\% \, \varepsilon \, B_2 = \left(\frac{3,66}{15}\right) \times 100$$

$$= 24,4 \, \%$$

$$\% \ \varepsilon \ B_3 = \left(\frac{3}{15}\right) \times 100$$
$$= 20 \ \%$$

c. Persen *Elongasi* Sampel C

$$\% \ \varepsilon \ C_1 = \left(\frac{4,51}{15}\right) \times 100$$
$$= 30,07 \ \%$$

$$\% \ \varepsilon \ C_2 = \left(\frac{4,28}{15}\right) \times 100$$
$$= 28,54 \ \%$$

$$\% \ \varepsilon \ C_3 = \left(\frac{4,82}{15}\right) \times 100$$
$$= 32,14 \ \%$$

d. Persen *Elongasi* Sampel D

$$\% \ \varepsilon \ D_1 = \left(\frac{2,33}{15}\right) \times 100$$
$$= 15,54 \ \%$$

$$\% \ \varepsilon \ D_2 = \left(\frac{2,46}{15}\right) \times 100$$
$$= 16,4 \ \%$$

$$\% \ \varepsilon \ D_3 = \left(\frac{2,38}{15}\right) \times 100$$

$$= 15,87 \ \%$$

e. Persen *Elongasi* Sampel E

$$\% \ \varepsilon \ E_1 = \left(\frac{1,93}{15}\right) \times 100$$

$$= 13,94 \ \%$$

$$\% \ \varepsilon \ E_2 = \left(\frac{2,09}{15}\right) \times 100$$

$$= 13,94 \ \%$$

$$\% \ \varepsilon \ E_3 = \left(\frac{1,83}{15}\right) \times 100$$

$$= 12,2 \ \%$$

f. Persen *Elongasi* Sampel F

$$\% \ \varepsilon \ F_1 = \left(\frac{1,08}{15}\right) \times 100$$

$$= 7,2 \ \%$$

$$\% \ \varepsilon \ F_2 = \left(\frac{1,04}{15}\right) \times 100$$

$$= 6,94 \ \%$$

$$\% \ \varepsilon \ F_3 = \left(\frac{1,12}{15}\right) \times 100$$

$$= 7,47 \ \%$$

Lampiran 2: Perhitungan Nilai *Modulus Young*

MODULUS YOUNG

a. *Modulus Young* Sampel A

$$EA_1 = \frac{\sigma}{\varepsilon} = \frac{0{,}99}{12{,}14} = 0{,}082 \text{ MPa}$$

$$EA_2 = \frac{0{,}69}{9{,}2} = 0{,}075 \text{ MPa}$$

$$EA_3 = \frac{0{,}82}{11{,}94} = 0{,}069 \text{ Mpa}$$

b. *Modulus Young* Sampel B

$$EB_1 = \frac{1{,}86}{20{,}47} = 0{,}091 \text{ MPa}$$

$$EB_2 = \frac{1{,}69}{24{,}4} = 0{,}069 \text{ MPa}$$

$$EB_3 = \frac{1{,}79}{20} = 0{,}0895 \text{ Mpa}$$

c. *Modulus Young* Sampel C

$$EC_1 = \frac{2{,}06}{30{,}07} = 0{,}069 \text{ MPa}$$

$$EC_2 = \frac{1{,}99}{28{,}54} = 0{,}0697 \text{ MPa}$$

$$EC_3 = \frac{2{,}67}{32{,}14} = 0{,}083 \text{ Mpa}$$

d. *Modulus Young* Sampel D

$$ED_1 = \frac{1,47}{15,54} = 0,095 \text{ MPa}$$

$$ED_2 = \frac{1,67}{16,4} = 0,102 \text{ MPa}$$

$$ED_3 = \frac{1,61}{15,87} = 0,101 \text{ Mpa}$$

e. *Modulus Young* Sampel E

$$EE_1 = \frac{1,22}{12,87} = 0,095 \text{ MPa}$$

$$EE_2 = \frac{1,26}{13,94} = 0,090 \text{ MPa}$$

$$EE_3 = \frac{1,21}{12,2} = 0,099 \text{ Mpa}$$

f. *Modulus Young* Sampel F

$$EF_1 = \frac{0,58}{7,2} = 0,081 \text{ MPa}$$

$$EF_2 = \frac{0,48}{6,94} = 0,069 \text{ MPa}$$

$$EF_3 = \frac{0,64}{7,47} = 0,086 \text{ Mpa}$$

Lampiran 3: Perhitungan Teori Ralat Data Uji Tarik

KUAT TARIK

1) Sampel A

Tabel 1. Ralat Kuat Tarik Sampel A

Pengukuran ke-	Kuat tarik (σ_i) MPa	Deviasi ($\delta\sigma_i$)	Kuadrat deviasi $(\delta\sigma_i)^2$
1	0,99	0,05	0,0025
2	0,69	-0,15	0,0225
3	0,82	0,02	0,0004
Jumlah	2,5		0,0254

a) Nilai besaran yang diamati:

$$\bar{\sigma} = \frac{1}{k}\sum_{i=1}^{k} \sigma i$$

$$\bar{\sigma} = \frac{1}{3}\ x\ 2{,}5 = 0{,}84\ MPa$$

b) Standar deviasi

$$s_{\bar{\sigma}} = \sqrt{\frac{\sum_{i=1}^{k}(\delta\sigma_i)^2}{k(k-1)}}$$

$$s_{\bar{\sigma}} = \sqrt{\frac{0{,}0254}{3(3-1)}} = 0{,}092\ Mpa$$

c) Nilai besaran terbaik yang teramati

$$\sigma = \bar{\sigma} \pm s_{\bar{\sigma}}$$

$$\sigma = (0{,}84 \pm 0{,}092)\ MPa$$

d) Ketelitian

$$= 100\% - \left(\frac{s_{\bar{\sigma}}}{\bar{\sigma}}\right) x\ 100\%$$

$$= 100\% - \left(\frac{0,092}{0,84}\right) x\ 100\%$$

$$= 89,05\%$$

2) Sampel B

Dengan menggunakan perhitungan yang sama pada sampel A, nilai-nilai besaran yang terukur sebagai berikut:

Tabel 4. Ralat Kuat Tarik Sampel B

Pengukuran ke-	Kuat tarik (σ_i) MPa	Deviasi ($\delta\sigma_i$)	Kuadrat deviasi $(\delta\sigma_i)^2$
1	1,86	0,08	0,0064
2	1,69	-0,09	0,0081
3	1,79	0,01	0,0001
Jumlah	5,34		0,0146

a) Nilai besaran yang diamati

$$\bar{\sigma} = 1,78\ MPa$$

b) Standar deviasi

$$s_{\bar{\sigma}} = 0,05\ Mpa$$

c) Nilai besaran terbaik yang teramati

$$\sigma = (1,78 \pm 0,05)\ MPa$$

d) Ketelitian

$$= 97,19\%$$

3) Sampel C

Dengan menggunakan perhitungan yang sama pada sampel A, maka diperoleh nilai-nilai besaran terukur sebagai berikut:

Tabel 3. Ralat Kuat Tarik Sampel C

Pengukuran ke-	Kuat tarik (σ_i) MPa	Deviasi ($\delta\sigma_i$)	Kuadrat deviasi $(\delta\sigma_i)^2$
1	2,06	-0,18	0,0324
2	1,99	-0,25	0,0625
3	2,67	0,43	0,1849
Jumlah	6,72		0,2798

a) Nilai besaran yang diamati

$\bar{\sigma} = 2{,}24\ MPa$

b) Standar deviasi

$s_{\bar{\sigma}} = 0{,}22\ Mpa$

c) Nilai besaran terbalik yang teramati

$\sigma = (2{,}24 \pm 0{,}22)\ MPa$

d) Ketelitian

$= 90{,}17\%$

4) Sampel D

Dengan menggunakan perhitungan yang sama pada sampel A, maka diperoleh nilai-nilai besaran terukur sebagai berikut:

Tabel 2. Ralat Kuat Tarik Sampel D

Pengukuran ke-	Kuat tarik (σ_i) Mpa	Deviasi ($\delta\sigma_i$)	Kuadrat deviasi$(\delta\sigma_i)^2$
1	1,47	-0,11	0,0121
2	1,67	0,09	0,0081
3	1,61	0,03	0,0009
Jumlah	4,75		0,0211

a) Nilai besaran yang diamati

$\bar{\sigma} = 1{,}58\ MPa$

b) Standar deviasi

$s_{\bar{\sigma}} = 0{,}06\ Mpa$

c) Nilai besaran terbaik yang teramati

$\sigma = (1{,}58 \pm 0{,}06)\ MPa$

d) Ketelitian

$= 96{,}20\%$

5) Sampel E

Dengan menggunakan perhitungan yang sama pada sampel A, nilai-nilai besaran yang terukur sebagai berikut:

Tabel 4. Ralat Kuat Tarik Sampel E

Pengukuran ke-	Kuat tarik (σ_i) MPa	Deviasi ($\delta\sigma_i$)	Kuadrat deviasi $(\delta\sigma_i)^2$
1	1,22	-0,01	0,0001
2	1,26	0,03	0,0009
3	1,21	-0,02	0,0004
Jumlah	3,69		0,0014

a) Nilai besaran yang diamati

$\bar{\sigma} = 1{,}23\ MPa$

b) Standar deviasi

$s_{\bar{\sigma}} = 0{,}015\ Mpa$

c) Nilai besaran terbaik yang teramati

$\sigma = (1{,}23 \pm 0{,}015)\ MPa$

d) Ketelitian

$= 98{,}78\%$

6) Sampel F

Dengan menggunakan perhitungan yang sama pada sampel A, nilai-nilai besaran yang terukur sebagai berikut:

Tabel 4. Ralat Kuat Tarik Sampel F

Pengukuran ke-	Kuat tarik (σ_i) MPa	Deviasi ($\delta\sigma_i$)	Kuadrat deviasi $(\delta\sigma_i)^2$
1	0,58	0,01	0,0001
2	0,48	-0,09	0,0081
3	0,64	0,07	0,0049
Jumlah	1,70		0,0131

a) Nilai besaran yang diamati

$\bar{\sigma} = 0{,}57\ MPa$

b) Standar deviasi

$s_{\bar{\sigma}} = 0{,}047\ Mpa$

c) Nilai besaran terbaik yang teramati

$\sigma = (0{,}57 \pm 0{,}047)\ MPa$

d) Ketelitian

$= 91{,}75\%$

Lampiran 4: Perhitungan Teori Ralat Data Panjang Awal (l_o)

PANJANG AWAL

a) Ketidakpastian

$$\Delta \text{lo} = \frac{1}{2}\ x\ NST\ mistar = \frac{1}{2}\ x\ 0{,}1 = 0{,}05\ cm$$

b) Nilai besaran terbaik yang teramati

$\text{lo} = lo \pm \Delta lo$

$\text{lo}_{A1} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{A2} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{A3} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{B1} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{B2} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{B3} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{C1} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{C2} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{C3} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{D1} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{D2} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{D3} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{E1} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{E2} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{E3} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{F1} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{F2} = (15 \pm 0{,}05)\ cm$

$\text{lo}_{F3} = (15 \pm 0{,}05)\ cm$

Lampiran 5: Perhitungan Teori Ralat Data Pertambahan Panjang (*Δl)*

PERTAMBAHAN PANJANG

1) Sampel A

Tabel 1. Ralat Pertambahan Panjang Sampel A

Pengukuran ke-	Pertambahan Panjang (Δl_i) cm	Deviasi ($\delta\Delta l_i$)	Kuadrat deviasi $(\delta\Delta l_i)^2$
1	1,82	1,16	1,3456
2	1,38	-0,28	0,0784
3	1,79	0,13	0,0169
Jumlah	4,99		1,4409

a) Nilai besaran yang diamati:

$$\overline{\Delta l} = \frac{1}{k}\sum_{i=1}^{k} \Delta li$$

$$\overline{\Delta l} = \frac{1}{3}\ x\ 4{,}99 = 1{,}66 \text{ cm}$$

b) Standar deviasi

$$s_{\overline{\Delta l}} = \sqrt{\frac{\sum_{i=1}^{k}(\delta\Delta l_i)^2}{k(k-1)}}$$

$$s_{\overline{\Delta l}} = \sqrt{\frac{1{,}4409}{3(3-1)}} = 0{,}49 \text{ cm}$$

c) Nilai besaran terbaik yang teramati

$$\Delta l = \overline{\Delta l} \pm s_{\overline{\Delta l}}$$

$$\Delta l = (1{,}66 \pm 0{,}49) \text{ cm}$$

d) Ketelitian

$= 100\% - \left(\frac{s_{\overline{\Delta l}}}{\overline{\Delta l}}\right) x\ 100\%$

$= 100\% - \left(\frac{0,49}{1,66}\right) x\ 100\%$

$= 70,48\%$

2) Sampel B

Dengan menggunakan perhitungan yang sama pada sampel A, maka diperoleh nilai-nilai besaran terukur sebagai berikut:

Tabel 2. Ralat Pertambahan Panjang Sampel B

Pengukuran ke-	Pertambahan Panjang (Δl_i) cm	Deviasi ($\delta\Delta l_i$)	Kuadrat deviasi $(\delta\Delta l_i)^2$
1	3,07	-0,17	0,0289
2	3,66	0,42	0,1764
3	3	-0,24	0,0576
Jumlah	9,73		0,2629

a) Nilai besaran yang diamati

$\overline{\Delta l} = 3,24$ cm

b) Standar deviasi

$s_{\overline{\Delta l}} = 0,21$ cm

c) Nilai besaran terbaik yang teramati

$\Delta l = (3,24 \pm 0,21)$ cm

d) Ketelitian

$= 93,52\%$

3) Sampel C

Dengan menggunakan perhitungan yang sama pada sampel A, maka diperoleh nilai-nilai besaran terukur sebagai berikut:

Tabel 3. Ralat Pertambahan Panjang Sampel C

Pengukuran ke-	Pertambahan Panjang (Δl_i) cm	Deviasi ($\delta \Delta l_i$)	Kuadrat deviasi $(\delta \Delta l_i)^2$
1	4,51	-0,03	0,0009
2	4,28	-0,26	0,0676
3	4,82	0,28	0,0784
Jumlah	13,61		0,1469

a) Nilai besaran yang diamati

$\overline{\Delta l} = 4{,}54$ cm

b) Standar deviasi

$s_{\overline{\Delta l}} = 0{,}16\ cm$

c) Nilai besaran terbaik yang teramati

$\Delta l = (4{,}54 \pm 0{,}16)$ cm

d) Ketelitian

$= 96{,}48\%$

4) Sampel D

Dengan menggunakan perhitungan yang sama pada sampel A, nilai-nilai besaran yang terukur sebagai berikut:

Tabel 4. Ralat Pertambahan Panjang Sampel D

Pengukuran ke-	Pertambahan Panjang (Δl_i) cm	Deviasi ($\delta\Delta l_i$)	Kuadrat deviasi $(\delta\Delta l_i)^2$
1	2,33	-0,06	0,0036
2	2,46	0,07	0,0049
3	2,38	-0,01	0,0001
Jumlah	7,17		0,0086

a) Nilai besaran yang diamati

$\overline{\Delta l} = 2{,}39 \text{ cm}$

b) Standar deviasi

$s_{\overline{\Delta l}} = 0{,}04 \text{ cm}$

c) Nilai besaran terbaik yang teramati

$\Delta l = (2{,}39 \pm 0{,}04) \text{ cm}$

d) Ketelitian

$= 98{,}33\%$

5) Sampel E

Dengan menggunakan perhitungan yang sama pada sampel A, nilai-nilai besaran yang terukur sebagai berikut:

Tabel 4. Ralat Pertambahan Panjang Sampel E

Pengukuran ke-	Pertambahan Panjang (Δl_i) cm	Deviasi ($\delta\Delta l_i$)	Kuadrat deviasi $(\delta\Delta l_i)^2$
1	1,93	-0,02	0,0004
2	2,09	0,14	0,0196
3	1,83	-0,12	0,0144
Jumlah	5,85		0,0344

e) Nilai besaran yang diamati

$\overline{\Delta l} = 1{,}95 \text{ cm}$

f) Standar deviasi

$s_{\overline{\Delta l}} = 0{,}08 \text{ cm}$

g) Nilai besaran terbaik yang teramati

$\Delta l = (1{,}95 \pm 0{,}08) \text{ cm}$

h) Ketelitian

$= 95{,}9\%$

6) Sampel F

Dengan menggunakan perhitungan yang sama pada sampel A, nilai-nilai besaran yang terukur sebagai berikut:

Tabel 4. Ralat Pertambahan Panjang Sampel F

Pengukuran ke-	Pertambahan Panjang (Δl_i) cm	Deviasi ($\delta\Delta l_i$)	Kuadrat deviasi $(\delta\Delta l_i)^2$
1	1,08	0	0
2	1,04	-0,04	0,0016
3	1,12	0,04	0,0016
Jumlah	3,24		0,0032

i) Nilai besaran yang diamati

$\overline{\Delta l} = 1{,}08$ cm

j) Standar deviasi

$s_{\overline{\Delta l}} = 0{,}02$ cm

k) Nilai besaran terbaik yang teramati

$\Delta l = (1{,}08 \pm 0{,}02)$ cm

l) Ketelitian

$= 98{,}15\%$

Lampiran 6: Perhitungan Teori Ralat Data *Elongasi* (ε)

PERSEN *ELONGASI*

1) Sampel A

a) Nilai besaran yang diamati:

$$\bar{\varepsilon} = \frac{1}{k}\sum_{i=1}^{k} \varepsilon i$$

$$\bar{\varepsilon} = \frac{1}{3}\ x\ 33{,}28 = 11{,}09$$

b) Ketidakpastian

$$\Delta\varepsilon = \sqrt{\left(\frac{\partial\varepsilon(l_0,\Delta l)}{\partial\Delta l}\right)^2 \Delta\Delta l^2 + \left(\frac{\partial\varepsilon(l_0,\Delta l)}{\partial l_0}\right)^2 \Delta {l_0}^2}$$

$$\Delta\varepsilon = \sqrt{\left(\frac{1}{l_0}\right)^2 \Delta\Delta l^2 + \left(-\frac{\Delta l}{{l_0}^2}\right)^2 \Delta {l_0}^2}$$

$$\Delta\varepsilon = \sqrt{\left(\frac{1}{15}\right)^2 (0{,}49)^2 + \left(-\frac{1{,}66}{(15)^2}\right)^2 (0{,}05)^2}$$

$$\Delta\varepsilon = \sqrt{(0{,}07)^2(0{,}24) + (-0{,}007)^2(0{,}0025)}$$

$$\Delta\varepsilon = \sqrt{(0{,}0012) + (12{,}2\ x\ 10^{-8})}$$

$$\Delta\varepsilon = \sqrt{0{,}0012} = 0{,}035$$

c) Nilai besaran terbaik yang teramati

$$\varepsilon = \bar{\varepsilon} \pm \Delta\varepsilon$$

$$\varepsilon = 11{,}09 \pm 0{,}035$$

d) Ketelitian

$= 100\% - \left(\frac{\Delta\varepsilon}{\bar{\varepsilon}}\right) x\ 100\%$

$= 100\% - \left(\frac{0,035}{11,09}\right) x\ 100\%$

$= 99,68\%$

2) Sampel B

Dengan menggunakan perhitungan yang sama pada sampel A, maka diperoleh nilai-nilai besaran terukur sebagai berikut:

a) Nilai besaran yang diamati

$\bar{\varepsilon} = 21,62$

b) Ketidakpastian

$$\Delta\varepsilon = \sqrt{\left(\frac{1}{l_0}\right)^2 \Delta\Delta l^2 + \left(-\frac{\Delta l}{{l_0}^2}\right)^2 \Delta {l_0}^2}$$

$$\Delta\varepsilon = \sqrt{\left(\frac{1}{15}\right)^2 (0,21)^2 + \left(-\frac{3,24}{(15)^2}\right)^2 (0,05)^2}$$

$$\Delta\varepsilon = \sqrt{(0,07)^2(0,04) + (-0,014)^2(0,0025)}$$

$$\Delta\varepsilon = \sqrt{(0,000196) + (49\ x\ 10^{-8})}$$

$$\Delta\varepsilon = \sqrt{0,00019649} = 0,014$$

c) Nilai besaran terbaik yang teramati

$\varepsilon = 21,62 \pm 0,014$

d) Ketelitian

$= 99,94\%$

3) Sampel C

Dengan menggunakan perhitungan yang sama pada sampel A, maka diperoleh nilai-nilai besaran terukur sebagai berikut:

a) Nilai besaran yang diamati

$\bar{\varepsilon} = 30{,}25$

b) Ketidakpastian

$$\Delta\varepsilon = \sqrt{\left(\frac{1}{l_0}\right)^2 \Delta\Delta l^2 + \left(-\frac{\Delta l}{{l_0}^2}\right)^2 \Delta {l_0}^2}$$

$$\Delta\varepsilon = \sqrt{\left(\frac{1}{15}\right)^2 (0{,}16)^2 + \left(-\frac{4{,}54}{(15)^2}\right)^2 (0{,}05)^2}$$

$$\Delta\varepsilon = \sqrt{(0{,}07)^2(0{,}03) + (-0{,}02)^2(0{,}0025)}$$

$$\Delta\varepsilon = \sqrt{(0{,}000147) + (1\ x\ 10^{-6})}$$

$$\Delta\varepsilon = \sqrt{0{,}000148} = 0{,}0122$$

c) Nilai besaran terbaik yang teramati

$\varepsilon = 30{,}25 \pm 0{,}012$

d) Ketelitian

$= 99{,}96\%$

4) Sampel D

Dengan menggunakan perhitungan yang sama pada sampel A, nilai-nilai besaran yang terukur sebagai berikut:

a) Nilai besaran yang diamati

$\bar{\varepsilon} = 15{,}94$

b) Ketidakpastian

$$\Delta\varepsilon = \sqrt{\left(\frac{1}{l_0}\right)^2 \Delta\Delta l^2 + \left(-\frac{\Delta l}{{l_0}^2}\right)^2 \Delta {l_0}^2}$$

$$\Delta\varepsilon = \sqrt{\left(\frac{1}{15}\right)^2 (0{,}04)^2 + \left(-\frac{2{,}39}{(15)^2}\right)^2 (0{,}05)^2}$$

$$\Delta\varepsilon = \sqrt{(0{,}07)^2(0{,}0016) + (-0{,}011)^2(0{,}0025)}$$

$$\Delta\varepsilon = \sqrt{(7{,}84\ x\ 10^{-6}) + (3{,}02\ x\ 10^{-7})}$$

$$\Delta\varepsilon = \sqrt{8{,}14\ x\ 10^{-6}} = 0{,}003$$

c) Nilai besaran terbaik yang teramati

$\varepsilon = 15{,}94 \pm 0{,}003$

d) Ketelitian

$= 99{,}98\%$

5) Sampel E

Dengan menggunakan perhitungan yang sama pada sampel A, nilai-nilai besaran yang terukur sebagai berikut:

a) Nilai besaran yang diamati

$\bar{\varepsilon} = 13$

b) Ketidakpastian

$$\Delta\varepsilon = \sqrt{\left(\frac{1}{l_0}\right)^2 \Delta\Delta l^2 + \left(-\frac{\Delta l}{{l_0}^2}\right)^2 \Delta {l_0}^2}$$

$$\Delta\varepsilon = \sqrt{\left(\frac{1}{15}\right)^2 (0{,}08)^2 + \left(-\frac{1{,}95}{(15)^2}\right)^2 (0{,}05)^2}$$

$$\Delta\varepsilon = \sqrt{(0{,}07)^2(0{,}0064) + (-0{,}0087)^2(0{,}0025)}$$

$$\Delta\varepsilon = \sqrt{(0{,}00003136) + (18{,}7\ x\ 10^{-8})}$$

$$\Delta\varepsilon = \sqrt{0{,}00003155} = 0{,}0056$$

c) Nilai besaran terbaik yang teramati

$\varepsilon = 13 \pm 0,0056$

d) Ketelitian

$= 99,96\%$

e) Sampel F

Dengan menggunakan perhitungan yang sama pada sampel A, nilai-nilai besaran yang terukur sebagai berikut:

a) Nilai besaran yang diamati

$\bar{\varepsilon} = 7,2$

b) Ketidakpastian

$$\Delta\varepsilon = \sqrt{\left(\frac{1}{l_0}\right)^2 \Delta\Delta l^2 + \left(-\frac{\Delta l}{{l_0}^2}\right)^2 \Delta {l_0}^2}$$

$$\Delta\varepsilon = \sqrt{\left(\frac{1}{15}\right)^2 (0,02)^2 + \left(-\frac{1,08}{(15)^2}\right)^2 (0,05)^2}$$

$$\Delta\varepsilon = \sqrt{(0,07)^2(0,0004) + (-0,0048)^2(0,0025)}$$

$$\Delta\varepsilon = \sqrt{(19,6 \; x \; 10^{-7}) + (57 \; x \; 10^{-9})}$$

$$\Delta\varepsilon = \sqrt{2,02 \; x \; 10^{-6}} = 0,0014$$

c) Nilai besaran terbaik yang teramati

$\varepsilon = 7,2 \pm 0,0014$

d) Ketelitian

$= 99,98\%$

Lampiran 7: Perhitungan Teori Ralat Data *Modulus Young* (E)

MODULUS YOUNG

1) Sampel A

a) Nilai besaran yang diamati:

$$\bar{\mathrm{E}} = \frac{1}{k}\sum_{i=1}^{k} \mathrm{E}i$$

$$\bar{\mathrm{E}} = \frac{1}{3}\ x\ 0{,}226 = 0{,}075\ MPa$$

b) Ketidakpastian

$$\Delta \mathrm{E} = \sqrt{\left(\frac{\partial E(\varepsilon.\sigma)}{\partial \sigma}\right)^2 \Delta\sigma^2 + \left(\frac{\partial E(\varepsilon.\sigma)}{\partial \varepsilon}\right)^2 \Delta\varepsilon^2}$$

$$\Delta \mathrm{E} = \sqrt{\left(\frac{1}{\varepsilon}\right)^2 \Delta\sigma^2 + \left(-\frac{\sigma}{\varepsilon^2}\right)^2 \Delta\varepsilon^2}$$

$$\Delta \mathrm{E} = \sqrt{\left(\frac{1}{11{,}09}\right)^2 (0{,}092)^2 + \left(-\frac{0{,}84}{(11{,}09)^2}\right)^2 (0{,}035)^2}$$

$$\Delta \mathrm{E} = \sqrt{(0{,}09)^2(0{,}0085) + (-0{,}0068)^2(0{,}001225)}$$

$$\Delta \mathrm{E} = \sqrt{0{,}000069 + 0{,}000000056}$$

$$\Delta \mathrm{E} = \sqrt{0{,}000069056} = 0{,}0083\ MPa$$

c) Nilai besaran terbaik yang teramati

$$\mathrm{E} = \bar{\mathrm{E}} \pm \Delta \mathrm{E}$$

$$\mathrm{E} = (0{,}075 \pm 0{,}0083)\ MPa$$

d) Ketelitian

$$= 100\% - \left(\frac{\Delta E}{E}\right) x\ 100\%$$

$$= 100\% - \left(\frac{0,0083}{0,075}\right) x\ 100\%$$

$$= 88,92\%$$

2) Sampel B

Dengan menggunakan perhitungan yang sama pada sampel A, maka diperoleh nilai-nilai besaran terukur sebagai berikut:

a) Nilai besaran yang diamati

$$\overline{E} = 0,084\ MPa$$

b) Ketidakpastian

$$\Delta E = \sqrt{\left(\frac{1}{\varepsilon}\right)^2 \Delta\sigma^2 + \left(-\frac{\sigma}{\varepsilon^2}\right)^2 \Delta\varepsilon^2}$$

$$\Delta E = \sqrt{\left(\frac{1}{21,62}\right)^2 (0,05)^2 + \left(-\frac{1,78}{(21,62)^2}\right)^2 (0,014)^2}$$

$$\Delta E = \sqrt{(0,046)^2(0,0025) + (-0,0038)^2(0,000196)}$$

$$\Delta E = \sqrt{0,00000529 + 0,000000002}$$

$$\Delta E = \sqrt{0,000005292} = 0,0023\ MPa$$

c) Nilai besaran terbaik yang teramati

$$E = (0,084 \pm 0,0023)\ MPa$$

d) Ketelitian

$$= 97,26\%$$`

3) Sampel C

Dengan menggunakan perhitungan yang sama pada sampel A, maka diperoleh nilai-nilai besaran terukur sebagai berikut:

a) Nilai besaran yang diamati

$$\overline{\mathrm{E}} = 0{,}074\ MPa$$

b) Ketidakpastian

$$\Delta \mathrm{E} = \sqrt{\left(\frac{1}{\varepsilon}\right)^2 \Delta\sigma^2 + \left(-\frac{\sigma}{\varepsilon^2}\right)^2 \Delta\varepsilon^2}$$

$$\Delta \mathrm{E} = \sqrt{\left(\frac{1}{30{,}25}\right)^2 (0{,}22)^2 + \left(-\frac{2{,}24}{(30{,}25)^2}\right)^2 (0{,}012)^2}$$

$$\Delta \mathrm{E} = \sqrt{(0{,}03)^2(0{,}0484) + (-0{,}0025)^2(0{,}000144)}$$

$$\Delta \mathrm{E} = \sqrt{0{,}00004356 + 9\ x\ 10^{-10}}$$

$$\Delta \mathrm{E} = \sqrt{0{,}00004356} = 0{,}0066\ MPa$$

c) Nilai besaran terbaik yang teramati

$$\mathrm{E} = (0{,}074 \pm 0{,}0066)\ MPa$$

d) Ketelitian

$$= 91{,}08\%$$

4) Sampel D

Dengan menggunakan perhitungan yang sama pada sampel A, nilai-nilai besaran yang terukur sebagai berikut:

a) Nilai besaran yang diamati

$$\overline{\mathrm{E}} = 0{,}099\ MPa$$

b) Ketidakpastian

$$\Delta \mathrm{E} = \sqrt{\left(\frac{1}{\varepsilon}\right)^2 \Delta\sigma^2 + \left(-\frac{\sigma}{\varepsilon^2}\right)^2 \Delta\varepsilon^2}$$

$$\Delta \mathrm{E} = \sqrt{\left(\frac{1}{15{,}94}\right)^2 (0{,}06)^2 + \left(-\frac{1{,}58}{(15{,}94)^2}\right)^2 (0{,}003)^2}$$

$$\Delta \mathrm{E} = \sqrt{(0{,}063)^2(0{,}0036) + (-0{,}0062)^2(0{,}000009)}$$

$$\Delta \mathrm{E} = \sqrt{0{,}0000143 + 3{,}46\ x\ 10^{-10}}$$

$$\Delta \mathrm{E} = \sqrt{0{,}0000143} = 0{,}0038\ MPa$$

c) Nilai besaran terbaik yang teramati

$\mathrm{E} = (0{,}099 \pm 0{,}0038)\ MPa$

d) Ketelitian

$= 96{,}16\%$

5) Sampel E

Dengan menggunakan perhitungan yang sama pada sampel A, nilai-nilai besaran yang terukur sebagai berikut:

a) Nilai besaran yang diamati

$\overline{\mathrm{E}} = 0{,}095\ MPa$

b) Ketidakpastian

$$\Delta \mathrm{E} = \sqrt{\left(\frac{1}{\varepsilon}\right)^2 \Delta\sigma^2 + \left(-\frac{\sigma}{\varepsilon^2}\right)^2 \Delta\varepsilon^2}$$

$$\Delta \mathrm{E} = \sqrt{\left(\frac{1}{13}\right)^2 (0{,}015)^2 + \left(-\frac{1{,}23}{(13)^2}\right)^2 (0{,}0056)^2}$$

$$\Delta \mathrm{E} = \sqrt{(0{,}08)^2(0{,}000225) + (-0{,}0073)^2(0{,}00003136)}$$

$$\Delta \mathrm{E} = \sqrt{1{,}44\ x\ 10^{-6} + 1\ x\ 10^{-9}}$$

$$\Delta \mathrm{E} = \sqrt{0{,}000001441} = 0{,}0012\ MPa$$

c) Nilai besaran terbaik yang teramati

$\mathrm{E} = (0{,}095 \pm 0{,}0012)\ MPa$

d) Ketelitian

$= 98{,}74\%$

6) Sampel F

Dengan menggunakan perhitungan yang sama pada sampel A, nilai-nilai besaran yang terukur sebagai berikut:

a) Nilai besaran yang diamati

$\overline{\mathrm{E}} = 0{,}079\ MPa$

b) Ketidakpastian

$$\Delta \mathrm{E} = \sqrt{\left(\frac{1}{\varepsilon}\right)^2 \Delta\sigma^2 + \left(-\frac{\sigma}{\varepsilon^2}\right)^2 \Delta\varepsilon^2}$$

$$\Delta \mathrm{E} = \sqrt{\left(\frac{1}{7{,}2}\right)^2 (0{,}047)^2 + \left(-\frac{0{,}57}{(7{,}2)^2}\right)^2 (0{,}0014)^2}$$

$$\Delta \mathrm{E} = \sqrt{(0{,}138)^2(0{,}0022) + (-0{,}011)^2(0{,}00000196)}$$

$$\Delta \mathrm{E} = \sqrt{0{,}000042 + 2{,}37\ x\ 10^{-10}}$$

$$\Delta \mathrm{E} = \sqrt{0{,}000042} = 0{,}0065\ MPa$$

c) Nilai besaran terbaik yang teramati

$\mathrm{E} = (0{,}079 \pm 0{,}0065)\ MPa$

d) Ketelitian

$= 91{,}77\%$

Lampiran 8: Perhitungan Teori Ralat Data Massa Sampel Uji Biodegradasi

MASSA SAMPEL UJI BIODEGRADASI

1) Sampel A

a) Ketidakpastian

$$\Delta \mathrm{m} = \frac{1}{2}\, x\, NST\ neraca\ digital = \frac{1}{2}\, x\ 0{,}01 = 0{,}005\ gr$$

b) Nilai besaran terbaik yang teramati

$$\mathrm{m} = m \pm \Delta m$$

$$m_1 = (0{,}50 \pm 0{,}005)\ gr$$

$$m_2 = (0{,}46 \pm 0{,}005)\ gr$$

$$m_3 = (0{,}37 \pm 0{,}005)\ gr$$

$$m_4 = (0{,}30 \pm 0{,}005)\ gr$$

$$m_5 = (0{,}24 \pm 0{,}005)\ gr$$

$$m_6 = (0{,}19 \pm 0{,}005)\ gr$$

$$m_7 = (0{,}12 \pm 0{,}005)\ gr$$

$$m_8 = (0{,}05 \pm 0{,}005)\ gr$$

$$m_9 = (0{,}01 \pm 0{,}005)\ gr$$

2) Sampel B

Dengan menggunakan perhitungan yang sama pada sampel A, maka diperoleh nilai-nilai besaran terukur sebagai berikut:

a) Ketelitian

$$\Delta \text{m} = \frac{1}{2}\, x\ NST\ neraca\ digital = \frac{1}{2}\, x\ 0{,}01 = 0{,}005\ gr$$

b) Nilai besaran terbaik yang teramati

$\text{m} = m \pm \Delta m$

$m_1 = (0{,}50 \pm 0{,}005)\ gr$

$m_2 = (0{,}48 \pm 0{,}005)\ gr$

$m_3 = (0{,}42 \pm 0{,}005)\ gr$

$m_4 = (0{,}36 \pm 0{,}005)\ gr$

$m_5 = (0{,}31 \pm 0{,}005)\ gr$

$m_6 = (0{,}25 \pm 0{,}005)\ gr$

$m_7 = (0{,}20 \pm 0{,}005)\ gr$

$m_8 = (0{,}15 \pm 0{,}005)\ gr$

$m_9 = (0{,}11 \pm 0{,}005)\ gr$

$m_{10} = (0{,}06 \pm 0{,}005)\ gr$

$m_{11} = (0{,}02 \pm 0{,}005)\ gr$

3) Sampel C

Dengan menggunakan perhitungan yang sama pada sampel A, maka diperoleh nilai-nilai besaran terukur sebagai berikut:

a) Ketelitian

$$\Delta \text{m} = \frac{1}{2}\, x\ NST\ neraca\ digital = \frac{1}{2}\, x\ 0{,}01 = 0{,}005\ gr$$

b) Nilai besaran terbaik yang teramati

$\mathrm{m} = m \pm \Delta m$

$m_1 = (0{,}50 \pm 0{,}005)\ gr$

$m_2 = (0{,}47 \pm 0{,}005)\ gr$

$m_3 = (0{,}41 \pm 0{,}005)\ gr$

$m_4 = (0{,}38 \pm 0{,}005)\ gr$

$m_5 = (0{,}33 \pm 0{,}005)\ gr$

$m_6 = (0{,}27 \pm 0{,}005)\ gr$

$m_7 = (0{,}22 \pm 0{,}005)\ gr$

$m_8 = (0{,}18 \pm 0{,}005)\ gr$

$m_9 = (0{,}13 \pm 0{,}005)\ gr$

$m_{10} = (0{,}10 \pm 0{,}005)\ gr$

$m_{11} = (0{,}06 \pm 0{,}005)\ gr$

$m_{12} = (0{,}02 \pm 0{,}005)\ gr$

4) Sampel D

Dengan menggunakan perhitungan yang sama pada sampel A, nilai-nilai besaran yang terukur sebagai berikut:

a) Ketelitian

$$\Delta \mathrm{m} = \frac{1}{2}\ x\ NST\ neraca\ digital = \frac{1}{2}\ x\ 0{,}01 = 0{,}005\ gr$$

b) Nilai besaran terbaik yang teramati

$\mathrm{m} = m \pm \Delta m$

$m_1 = (0{,}50 \pm 0{,}005)\ gr$

$m_2 = (0,49 \pm 0,005)\ gr$

$m_3 = (0,45 \pm 0,005)\ gr$

$m_4 = (0,41 \pm 0,005)\ gr$

$m_5 = (0,37 \pm 0,005)\ gr$

$m_6 = (0,31 \pm 0,005)\ gr$

$m_7 = (0,29 \pm 0,005)\ gr$

$m_8 = (0,24 \pm 0,005)\ gr$

$m_9 = (0,19 \pm 0,005)\ gr$

$m_{10} = (0,13 \pm 0,005)\ gr$

$m_{11} = (0,09 \pm 0,005)\ gr$

$m_{12} = (0,04 \pm 0,005)\ gr$

$m_{13} = (0,01 \pm 0,005)\ gr$

5) Sampel E

Dengan menggunakan perhitungan yang sama pada sampel A, nilai-nilai besaran yang terukur sebagai berikut:

a) Ketelitian

$$\Delta \mathrm{m} = \frac{1}{2}\ x\ NST\ neraca\ digital = \frac{1}{2}\ x\ 0,01 = 0,005\ gr$$

b) Nilai besaran terbaik yang teramati

$\mathrm{m} = m \pm \Delta m$

$m_1 = (0,50 \pm 0,005)\ gr$

$m_2 = (0,47 \pm 0,005)\ gr$

$m_3 = (0,43 \pm 0,005)\ gr$

$m_4 = (0{,}38 \pm 0{,}005)\ gr$

$m_5 = (0{,}35 \pm 0{,}005)\ gr$

$m_6 = (0{,}31 \pm 0{,}005)\ gr$

$m_7 = (0{,}27 \pm 0{,}005)\ gr$

$m_8 = (0{,}24 \pm 0{,}005)\ gr$

$m_9 = (0{,}18 \pm 0{,}005)\ gr$

$m_{10} = (0{,}14 \pm 0{,}005)\ gr$

$m_{11} = (0{,}10 \pm 0{,}005)\ gr$

$m_{12} = (0{,}04 \pm 0{,}005)\ gr$

$m_{13} = (0{,}02 \pm 0{,}005)\ gr$

6) Sampel F

Dengan menggunakan perhitungan yang sama pada sampel A, nilai-nilai besaran yang terukur sebagai berikut:

a) Ketelitian

$$\Delta \mathrm{m} = \frac{1}{2}\ x\ NST\ neraca\ digital = \frac{1}{2}\ x\ 0{,}01 = 0{,}005\ gr$$

b) Nilai besaran terbaik yang teramati

$\mathrm{m} = m \pm \Delta m$

$m_1 = (0{,}50 \pm 0{,}005)\ gr$

$m_2 = (0{,}48 \pm 0{,}005)\ gr$

$m_3 = (0{,}44 \pm 0{,}005)\ gr$

$m_4 = (0{,}40 \pm 0{,}005)\ gr$

$m_5 = (0{,}37 \pm 0{,}005)\ gr$

$$m_6 = (0{,}31 \pm 0{,}005)\ gr$$

$$m_7 = (0{,}27 \pm 0{,}005)\ gr$$

$$m_8 = (0{,}24 \pm 0{,}005)\ gr$$

$$m_9 = (0{,}19 \pm 0{,}005)\ gr$$

$$m_{10} = (0{,}16 \pm 0{,}005)\ gr$$

$$m_{11} = (0{,}12 \pm 0{,}005)\ gr$$

$$m_{12} = (0{,}08 \pm 0{,}005)\ gr$$

$$m_{13} = (0{,}05 \pm 0{,}005)\ gr$$

$$m_{14} = (0{,}03 \pm 0{,}005)\ gr$$

$$m_{15} = (0{,}01 \pm 0{,}005)\ gr$$

Lampiran 9: Perhitungan Presentase Biodegradasi Plastik

PRESENTASE BIODEGRADASI PLASTIK

$$\% \text{ kehilangan massa} = \frac{W_i - W_f}{W_i} \text{ x } 100\%$$

Hari ke-28

% kehilangan massa sampel A

$$= \frac{0{,}50 - 0{,}50}{0{,}50}\ x\ 100\%$$

$$= 100\%$$

% kehilangan massa sampel B

$$= \frac{0{,}50 - 0{,}06}{0{,}50}\ x\ 100\%$$

$$= 88\%$$

% kehilangan massa sampel C

$$= \frac{0{,}50 - 0{,}10}{0{,}50}\ x\ 100\%$$

$$= 80\%$$

% kehilangan massa sampel D

$$= \frac{0{,}50 - 0{,}13}{0{,}50}\ x\ 100\%$$

$$= 74\%$$

% kehilangan massa sampel E

$$= \frac{0{,}50 - 0{,}14}{0{,}50}\ x\ 100\%$$

$$= 72\%$$

% kehilangan massa sampel F

$$= \frac{0{,}50 - 0{,}16}{0{,}50}\ x\ 100\%$$

$$= 68\%$$

Hari ke- 34

% kehilangan massa sampel B

$$= \frac{0,50 - 0,50}{0,50}\ x\ 100\%$$

$$= 100\%$$

% kehilangan massa sampel C

$$= \frac{0,50 - 0,02}{0,50}\ x\ 100\%$$

$$= 96\%$$

% kehilangan massa sampel D

$$= \frac{0,50 - 0,04}{0,50}\ x\ 100\%$$

$$= 92\%$$

% kehilangan massa sampel E

$$= \frac{0,50 - 0,04}{0,50}\ x\ 100\%$$

$$= 92\%$$

% kehilangan massa sampel F

$$= \frac{0,50 - 0,08}{0,50}\ x\ 100\%$$

$$= 84\%$$

Hari ke-37

% kehilangan massa sampel C

$$= \frac{0,50 - 0,50}{0,50}\ x\ 100\%$$

$$= 100\%$$

% kehilangan massa sampel D

$$= \frac{0,50 - 0,01}{0,50}\ x\ 100\%$$

$$= 98\%$$

% kehilangan massa sampel E

$$= \frac{0{,}50 - 0{,}02}{0{,}50}\ x\ 100\%$$

$$= 96\%$$

% kehilangan massa sampel F

$$= \frac{0{,}50 - 0{,}05}{0{,}50}\ x\ 100\%$$

$$= 90\%$$

Hari ke-40

% kehilangan massa sampel D

$$= \frac{0{,}50 - 0{,}50}{0{,}50}\ x\ 100\%$$

$$= 100\%$$

% kehilangan massa sampel E

$$= \frac{0{,}50 - 0{,}50}{0{,}50}\ x\ 100\%$$

$$= 100\%$$

% kehilangan massa sampel F

$$= \frac{0{,}50 - 0{,}03}{0{,}50}\ x\ 100\%$$

$$= 94\%$$

Hari ke-46

% kehilangan massa sampel F

$$= \frac{1{,}00 - 1{,}00}{1{,}00}\ x\ 100\%$$

$$= 100\%$$

Lampiran 10: Annual Book Of ASTM Standard

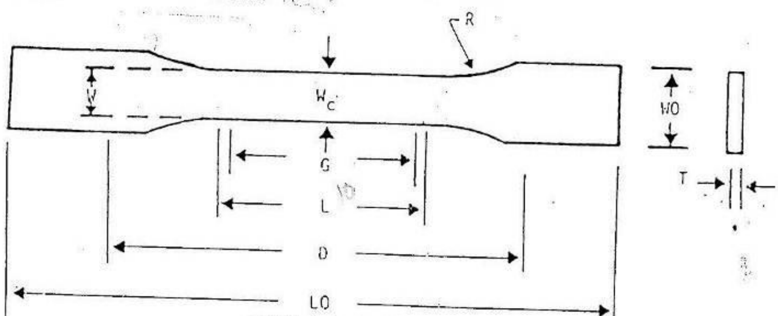
Designation for Speed of Testing[A]

Classification[B]	Specimen Type	Speed of Testing, mm/min	Nominal Strain[C] Rate at Start of Test, mm/mm·min
Rigid and semirigid	M-I	5 ± 25 %	0.1
		50 ± 10 %	1
		500 ± 10 %	10
	M-II	5 ± 25 %	0.15
		50 ± 10 %	1.5
		500 ± 10 %	15
	M-III	1 ± 25 %	0.1
		10 ± 25 %	1
		100 ± 25 %	10
Nonrigid	M-II	50 ± 10 %	1.5
		500 ± 10 %	15

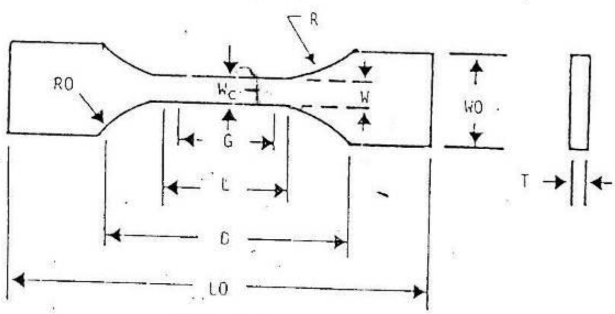
[A] Select the lowest speed that produces rupture in ½ to 5 min for the specimen geometry being used (see 9.2).

[B] See Definitions D 883 for definitions.

[C] The initial rate of straining cannot be calculated exactly for dumbbell-shaped specimens because of extension, both in the reduced section outside the gage length and in the fillets. This initial strain rate can be measured from the initial slope of the tensile strain-versus-time diagram.



TYPES M-I, M-III

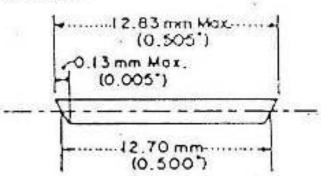


TYPE M-II

Dimensions (see drawings)	Specimen Dimensions for Thickness, T, mm[D]: 10 or Under	4 or Under		Tolerances
	Type M-I	Type M-II	Type M-III	
W—Width of narrow section[A,B]	10	6	2.5	±0.5[H]
L—Length of narrow section	60	33	10	±0.5
WO—Width of overall, min[F]	20	25	10	±0.5
LO—Length overall, min[G]	150	115	60	no max
G—Gage length[C]	50	—	7.5	±0.25
G—Gage length[C]	—	25	—	±0.5
D—Distance between grips	115	80	25	±5
R—Radius of fillet	60	14	15	±1
RO—Outer radius (Type II)	—	25	—	±1

[A] The width at the center W_c shall be plus 0.00 mm, minus 0.10 mm compared with width W at other parts of the reduced section. Any reduction in W at the center shall be gradual, equally on each side so that no abrupt changes in dimension result.

[B] For molded specimens, a draft of not over 0.15 mm may be allowed for Type M-I, 3 mm in thickness, and this should be taken into account when calculating width of the specimen. Thus a typical section of a molded Type M-I specimen, having the maximum allowable draft, could be as follows:



[C] Test marks or initial extensometer span.

[D] Thickness, T, shall be 3 ± 0.4 mm for all types of molded specimens where possible. If specimens are machined from sheets or plates, thickness, T, may be the thickness of the sheet or plate provided this does not exceed the range stated for the intended specimen type. For sheets of nominal thickness greater than 10 mm, the specimens shall be machined to 10 ± 0.4 mm in thickness, for use with the Type M-I specimen. For sheets of nominal thickness between 10 and 50 mm approximately equal amounts shall be machined from each surface. For thicker sheets both surfaces of the specimen shall be machined and the location of the specimen with reference to the original thickness of the sheet, shall be noted. Tolerances on thickness less than 10 mm shall be those standard for the grade of material tested.

[E] A Type M-I specimen, having an overall width of 20 mm and an overall length of 215 mm is the preferred specimen and shall be used whenever possible.

[F] Overall widths greater than the minimum indicated may be desirable for some materials in order to avoid breaking in the grips.

[G] Overall lengths greater than the minimum indicated may be desirable either to avoid breaking in the grips or to satisfy special test requirements.

[H] The Type M-II specimen is intended for nonrigid plastics but may be used for rigid types where desirable.

FIG. 1—*Continued.*

ANNEX

(Mandatory Information)

A1. DEFINITIONS OF TERMS AND SYMBOLS RELATING TO TENSION TESTING OF PLASTICS

A1.1 *tensile stress (nominal)*—the tensile load per unit area of minimum original cross section, within the gage boundaries, carried by the test specimen at any given moment. It is expressed in force per unit area, usually megapascals.

NOTE A1.1—The expression of tensile properties in terms of the minimum original cross-section is almost universally used in practice. In the case of or both (A1.11) nominal stress calculations may not be meaningful beyond the yield point (A1.10) due to the extensive reduction in cross-sectional area that ensues. Under some circumstances it may be desirable to express the tensile properties per unit of minimum prevailing cross section. These properties are called "true" tensile properties (that is, true tensile stress, etc.).

Lampiran 11: Dokumentasi Penelitian

1. Pembuatan Tepung Ampas Ubi Kayu


Gambar 1. Pencucian Ubi Kayu


Gambar 2. Pemarutan Ubi Kayu


Gambar 3. Hasil Pemarutan


Gambar 4. Pemerasan


Gambar 5. Pengeringan


Gambar 6. Tepung Ampas Ubi Kayu

2. Pembuatan Plastik *Biodegradable*

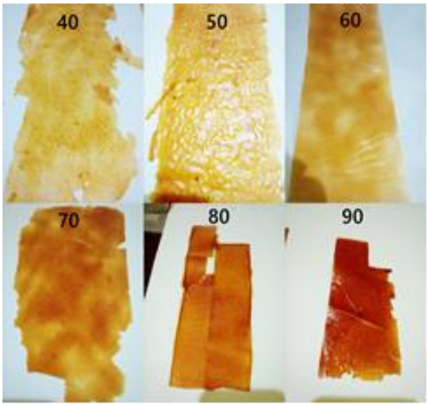
Gambar 24. Bahan Pembuatan

Gambar 25. Alat Pembuatan

Gambar 26. Pemanasan Larutan

Gambar 27. Pencetakan Plastik

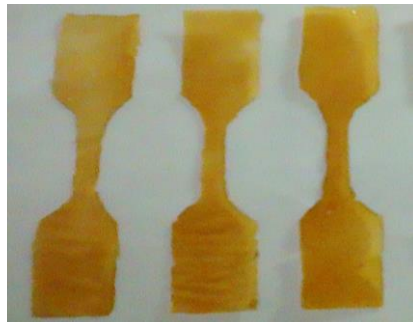
Gambar 28. Pengeringan Plastik



Gambar 29. Plastik *Biodegradable*

3. Pengujian Sampel Plastik *Biodegradable*

Gambar 30. Uji Sifat Mekanik Plastik



Gambar 31. Sampel Plastik *Biodegradable*

Gambar 32. Uji Biodegradasi Plastik

Gambar 33. Plastik *Biodegradable* yang terdegradasi