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LAMPIRAN



Lampiran 1. Prosedur Analisis Profil Gelatinisasi Pati Campolay

A. Kadar Air (AOAC, 2005)

Analisis kadar air dilakukan dengan menggunakan metode oven. Cawan porselen yang akan digunakan dioven terlebih dahulu dengan suhu 100°C-105°C selama 30 menit. Cawan yang telah dioven, didinginkan dalam desikator lalu di timbang (A). Sampel ditimbang sebanyak 2 gram didalam cawan yang sudah ditimbang (B). Kemudian dioven selama 6 jam pada suhu 100°C-105°C. Setelah itu, sampel didinginkan didalam desikator selama 30 menit lalu ditimbang (C). Penentuan kadar air dihitung dengan rumus sebagai berikut:

$$\text{Kadar air (\%)} = \frac{A - B}{C} \times 100\%$$

Keterangan : A = Berat cawan + sampel sebelum pengeringan (g)

B = Berat cawan + sampel setelah pengeringan (g)

C = Berat sampel (g)

B. Kadar Pati (SNI 3451:2011)

Sebanyak 5 gram sampel ditimbang dan dimasukkan ke dalam labu erlenmeyer kemudian ditambahkan 200 mL larutan HCl 3% dan didihkan selama 3 jam dengan pendingin tegak. Kemudian didinginkan dan dinetralkan dengan larutan NaOH 30% lalu ditambahkan CH₃COOH 3% agar larutan menjadi asam. Isi dipindahkan ke dalam labu berukuran 500 mL dan tambahkan akuades sampai tanda tera, kemudian disaring. Sebanyak 10mL filtrat di pipet ke dalam erlenmeyer 500 mL, ditambahkan 25 mL larutan Luff Schoorl dan beberapa butir batu didih serta 15 mL air suling. Campuran dipanaskan dengan nyala tetap dan didihkan selama 3 menit. Campuran lalu dididihkan kembali selama 10 menit, kemudian didinginkan dalam bak berisi es. Setelah campuran dingin ditambahkan 15 mL larutan KI 20% dan 25 mL H₂SO₄ 25% dengan perlahan-lahan. Lalu dititrasi secepatnya dengan larutan Na₂S₂O₃ 0,1 N dan tambahkan 2 mL sampai dengan 3mL (V₁); dan lakukan pengerjaan untuk blanko (V₂). Hitung bobot glukosa dengan menggunakan tabel bobot glukosa setara dengan CuSO₄.5 H₂O tereduksi.

$$\text{Kadar Pati (\%)} = 0,90 \times \text{Kadar Glukosa}$$

$$\text{Kadar glukosa (\%)} = \frac{W \times fp \times x}{\square_1} 100\%$$

Keterangan :

W = bobot contoh (mg)

W₁ = bobot glukosa berdasarkan tabel (mg)

fp = faktor pengenceran

Jumlah Na₂S₂O₃ yang diperlukan untuk mencari bobot glukosa dalam tabel adalah pengurangan volume titar blanko (V₂) dengan volume titar contoh (V₁).

C. Amilosa (Apriyantono *et al.*, 1989)

Penentuan kadar amilosa diawali dengan pembuatan kurva standar. Sampel 40 mg amilosa murni dimasukkan ke dalam tabung reaksi dan ditambahkan 1 mL etanol 95% dan 9 mL NaOH 1 N. Lalu dipanaskan dalam air mendidih selama 10 menit dan didinginkan. Larutan dipipet masing-masing sebanyak 1, 2, 3, 4, dan 5 mL ke dalam labu takar 100 mL. Ke dalam masing-masing labu takar ditambahkan asam asetat 1 N masing-masing 0.2, 0.4, 0.6, 0.8, dan 1 mL lalu ditambahkan masing-masing 2 mL larutan iod. Campuran ditepatkan hingga merata dan didiamkan selama 20 menit. Intensitas warna biru yang terbentuk diukur dengan spektrofotometer UV-Vis pada panjang gelombang 625 nm. Kurva standar dibuat dengan memplotkan kadar amilosa pada sumbu X dan absorbansi pada sumbu Y. Kemudian dihitung persamaan linear yang menggambarkan hubungan antar keduanya. Persamaan linear yang diperoleh berupa :

$$Y = a + bX$$

Penetapan sampel dilakukan dengan menimbang 100 mg sampel dan dimasukkan ke dalam tabung reaksi lalu ditambahkan 1 mL etanol 95% dan 9 mL NaOH 1 N. Campuran dipanaskan dalam air mendidih selama 10 menit lalu dipindahkan ke dalam labu takar 100 mL, ditepatkan sampai tanda tera dengan akuades. Larutan dipipet sebanyak 5 mL, dimasukkan ke dalam labu takar 100 mL, ditambahkan 1 mL asam asetat 1 N dan 2 mL larutan iod, ditepatkan sampai tanda tera, lalu didiamkan selama 20 menit. Intensitas warna biru yang terbentuk diukur dengan spektrofotometer pada panjang gelombang 625 nm.

Kadar amilosa dihitung menggunakan persamaan linear yang diperoleh dari kurva standar.

D. Profil Gelatinisasi (Collado *et al.*, 2001)

Rapid Visco Analyzer digunakan untuk menentukan sifat gelatinisasi dari sampel pati. Suspensi 3 g pati dalam 25 g air suling menjalani siklus pemanasan dan pendinginan terkendali dengan pengadukan konstan di mana sampel ditahan pada suhu 50°C selama 1 menit, dipanaskan dari suhu 50 hingga 95°C pada 6°C/menit, kemudian sampel ditahan pada suhu 95°C selama 5 menit, didinginkan hingga 50°C pada 6°C/menit, dan ditahan pada 50°C selama 5 menit. Data berikut dicatat sebagai : parameter waktu *pasting* dari mulai *pasting* ke viskositas puncak (Ptime); suhu di mana viskositas puncak tercapai (Ptemp); viskositas puncak (PV); viskositas pada akhir waktu penahanan pada 95°C atau viskositas pasta panas/viskositas *trough* (HPV); *breakdown*, PV kurang dari HPV; viskositas pada akhir waktu penahanan pada 50°C atau viskositas pasta dingin/viskositas akhir (CPV); dan *setback*. Semua pengujian diulang dua kali.

E. Rendemen (AOAC, 2005)

Rendemen ditentukan dengan menghitung berat tepung yang dihasilkan dengan berat daging utuh. Berikut merupakan rumus penentuan rendemen:

$$\% \text{ Rendemen} = \frac{\text{Berat pati yang dihasilkan (gram)}}{\text{Berat daging utuh (gram)}} \times 100\%$$

F. Analisis Warna Metode Color Hunter (Hutching, 1999)

Sampel (pati campolay) ditempatkan pada wadah yang transparan. Chromameter disiapkan dan dikalibrasi. Lalu sampel disiapkan sebanyak 5 gram. Menentukan panel standar yang akan disinari dengan alat, setelah standar tertera pada layar maka pengujian terhadap sampel dapat dilakukan. Mata cahaya chromameter ditempelkan sedekat mungkin pada sampel dan disinari dengan alat, kemudian nilai akan tertera pada layar. Pengukuran menghasilkan nilai L, a, b. L menyatakan parameter kecerahan, (warna kromatis, 0: hitam sampai 100:putih). Warna kromatik campuran merah hijau ditunjukkan oleh nilai a (a+ = 0-100) untuk warna merah, a- = 0-(80) untuk warna hijau). Warna kromatik campuran biru kuning ditunjukkan oleh nilai b (b+ =0-70), untuk warna kuning, b- = 0-(-70) untuk warna biru).

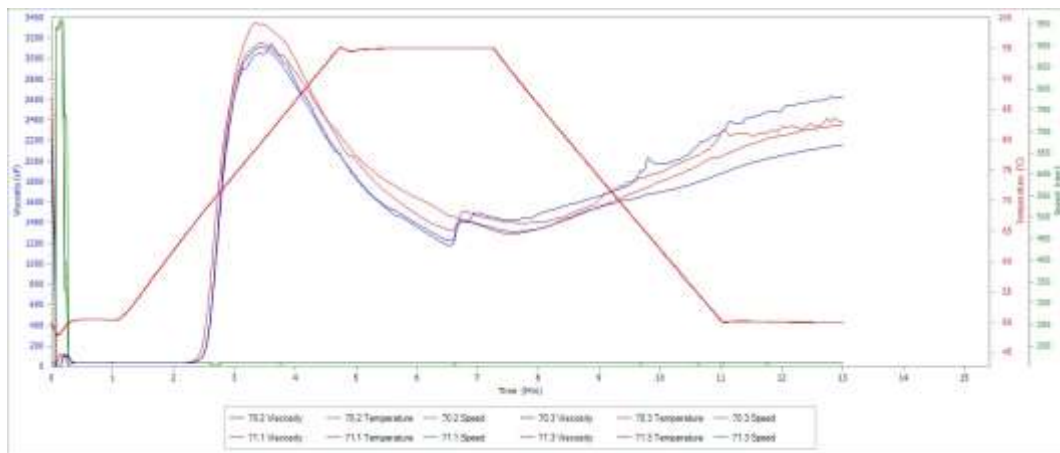
G. Analisis *Scanning Electron Microscope*/SEM (Pukkahuta *et al.*, 2008)

Serbuk pati diletakkan di atas tempat sampel dengan menggunakan isolasi *double-side*. Sampel kemudian dilapisi dengan emas, lalu dimasukkan ke dalam instrumen SEM (SEC, SNE-4500M). Struktur pati diamati di layar monitor dengan menggunakan skala pembesaran 1000 dan 1500 kali dengan tegangan percepatan 10 kV. Hasil pengamatan kemudian difoto dengan menggunakan kamera digital.

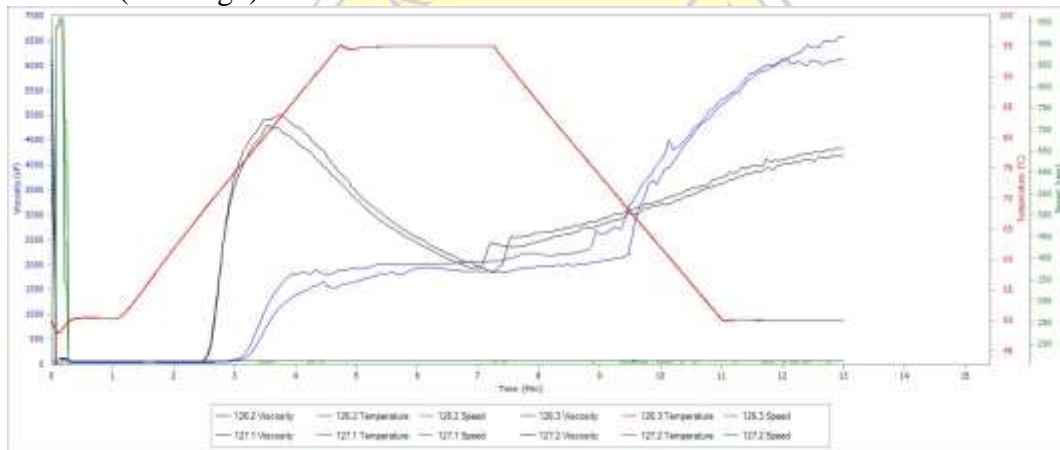


Lampiran 2. Grafik Profil Gelatinisasi

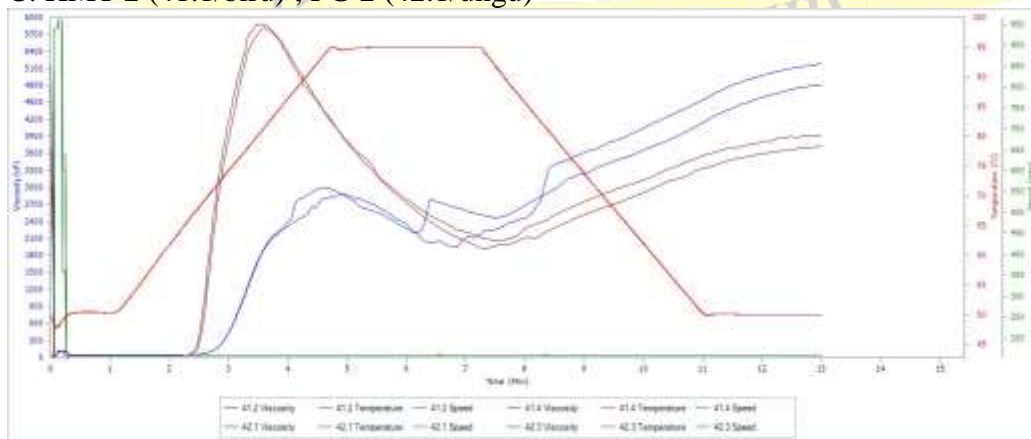
A. Native 1 (70/biru); Native 2 (71/merah)



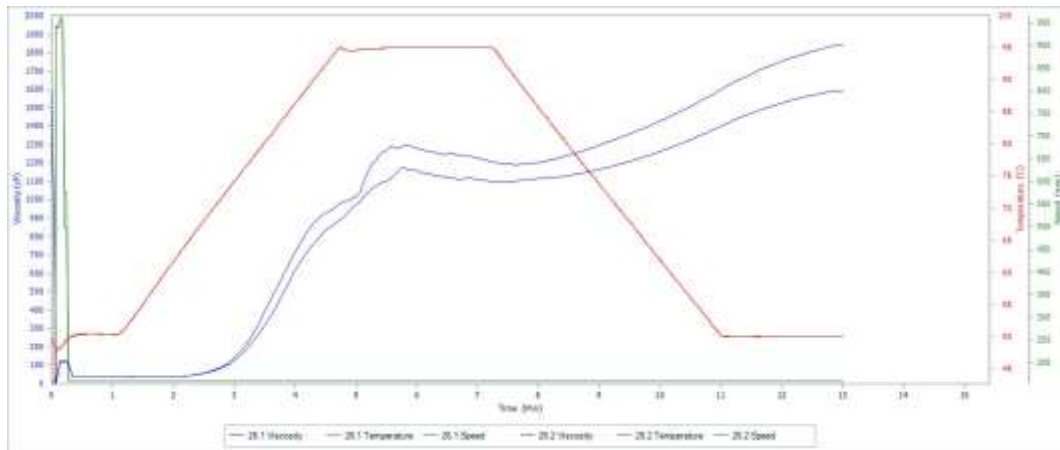
B. PG 1 (127/ungu)



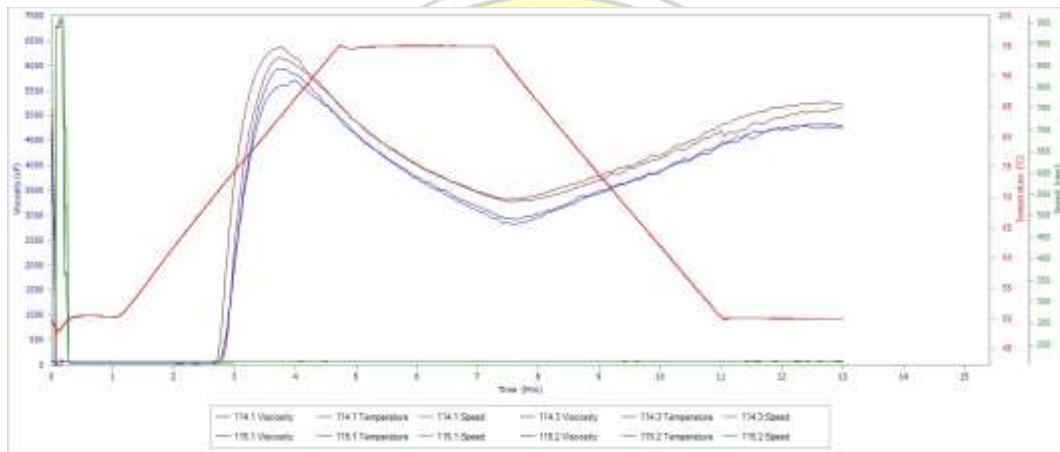
C. HMT 2 (41.1/biru) ; PG 2 (42.1/ungu)



D. HMT 3



E. CL 1 (114/biru), CL 2 (115/ungu)



Keterangan :

N = Native

PG = Pregelatinisasi

HMT = Heat-Moisture Treatment

CL = Cross-linking

Lampiran 3. Rekapitulasi Data Analisis Profil Gelatinisasi Pati Campolay

A. Suhu Awal Gelatinisasi (°C)

Ulangan	N	HMT	PG	CL
1	66.8	68	67.4	70.4
2	66.3	68.4	66.3	70.7
Jumlah	133.1	136.4	133.7	141.1
Rata-rata	66.55	68.2	66.85	70.55

B. Suhu Puncak Gelatinisasi (°C)

Ulangan	N	HMT	PG	CL
1	80,7	94,5	81,9	84,7
2	79,0	95,0	81,1	83,1
Jumlah	159,7	189,5	163	167,8
Rata-rata	79,85	94,75	81,5	83,9

C. Viskositas Puncak (cP)

Ulangan	N	HMT	PG	CL
1	3100	2908	4878	5801
2	3225	1196	5820	6243
Jumlah	6325	4104	10698	12044
Rata-rata	3162.5	2052	5349	6022

D. Waktu Puncak (menit)

Ulangan	N	HMT	PG	CL
1	3,53	4,8	3,63	3,87
2	3,40	5,8	3,57	3,73
Jumlah	6,93	10,6	7,20	7,60
Rata-rata	3,5	5,3	3,6	3,8

E. Viskositas Trough (cP)

Ulangan	N	HMT	PG	CL
1	1168	2038	1863	2848
2	1278	1104	1952	3270
Jumlah	2446	3142	3815	6118
Rata-rata	1223	1571	1907.5	3059

F. Viskositas Akhir (cP)

Ulangan	N	HMT	PG	CL
1	2357	4957	4224	4760
2	2343	1679	3787	5162
Jumlah	4700	6636	8011	9922
Rata-rata	2357	4957	4224	4760

G. Breakdown (cP)

Ulangan	N	HMT	PG	CL
1	1932	870	3016	2953
2	1947	92	3868	2973
Jumlah	3879	962	6884	5926
Rata-rata	1939.5	481	3442	2963

H. *Setback* (cP)

Ulangan	N	HMT	PG	CL
1	1189	2919	2361	1912
2	1065	575	1835	1892
Jumlah	2254	3494	4196	3804
Rata-rata	1127	1747	2098	1902

Keterangan :

N = *Native*

PG = *Pregelatinisasi*

HMT = *Heat-Moisture Treatment*

CL = *Cross-linking*



Lampiran 4. Hasil Uji ANOVA dan Duncan Profil Gelatinisasi Pati Campolay

A. Hasil Uji ANOVA Profil Gelatinisasi Pati Campolay

		ANOVA				
		Sum of Squares	Df	Mean Square	F	Sig.
Suhu Awal Gelatinisasi (C)	Between Groups	19.924	3	6.641	31.070	.003
	Within Groups	.855	4	.214		
	Total	20.779	7			
Waktu Awal Gelatinisasi (s)	Between Groups	472.500	3	157.500	37.059	.002
	Within Groups	17.000	4	4.250		
	Total	489.500	7			
Viskositas Puncak (cP)	Between Groups	20637385.375	3	6879128.458	13.658	.014
	Within Groups	2014648.500	4	503662.125		
	Total	22652033.875	7			
Suhu Puncak Gelatinisasi (C)	Between Groups	270.090	3	90.030	113.603	.000
	Within Groups	3.170	4	.793		
	Total	273.260	7			
Waktu Puncak (s)	Between Groups	15606.000	3	5202.000	11.115	.021
	Within Groups	1872.000	4	468.000		
	Total	17478.000	7			
Viskositas <i>Trough</i> (cP)	Between Groups	3806934.375	3	1268978.125	9.484	.027
	Within Groups	535230.500	4	133807.625		
	Total	4342164.875	7			
Suhu Viskositas <i>Trough</i> (C)	Between Groups	15.295	3	5.098	1.450	.354
	Within Groups	14.060	4	3.515		
	Total	29.355	7			

Cooking Ability (s)	Between Groups	14952.500	3	4984.167	11.451	.020
	Within Groups	1741.000	4	435.250		
	Total	16693.500	7			
Viscosity End Plateau (cP)	Between Groups	3723351.375	3	1241117.125	6.312	.054
	Within Groups	786518.500	4	196629.625		
	Total	4509869.875	7			
Viscosity Beginning Plateau (cP)	Between Groups	13645146.500	3	4548382.167	8.749	.031
	Within Groups	2079535.000	4	519883.750		
	Total	15724681.500	7			
Viskositas Akhir (cP)	Between Groups	7290055.375	3	2430018.458	1.752	.295
	Within Groups	5549026.500	4	1387256.625		
	Total	12839081.875	7			
Breakdown (cP)	Between Groups	10294783.375	3	3431594.458	20.613	.007
	Within Groups	665906.500	4	166476.625		
	Total	10960689.875	7			
Setback (cP)	Between Groups	1056754.000	3	352251.333	0.487	0.710
	Within Groups	2893394.000	4	723348.500		
	Total	3950148.000	7			
Consistency (cP)	Between Groups	1057513.375	3	352504.458	.487	.709
	Within Groups	2893920.500	4	723480.125		
	Total	3951433.875	7			

B. Hasil Uji Lanjut Duncan Profil Gelatinisasi Pati Campolay

1. Suhu Awal Gelatinisasi (C)

Duncan^a

Perlakuan	N	Subset for alpha = 0.05		
		1	2	3
Native	2	66.5500		
Pregelatinisasi	2	66.8500		
Hmt	2		68.2000	
Crosslinking	2			70.5500
Sig.		.552	1.000	1.000

2. Suhu Puncak Gelatinisasi (C)

Duncan^a

Perlakuan	N	Subset for alpha = 0.05		
		1	2	3
native	2	79.850		
pregelatinisasi	2	81.500	81.500	
Crosslinking	2		83.900	
Hmt	2			94.750
Sig.		.137	.054	1.000

3. Viskositas Puncak (cP)

Duncan

Perlakuan	N	Subset for alpha = 0.05	
		1	2
Hmt	2	2052.00	
Native	2	3162.50	
Pregelatinisasi	2		5349.00
Crosslinking	2		6022.00
Sig.		.193	.397

3. Waktu Puncak (s)

Duncan^a

Perlakuan	N	Subset for alpha = 0.05	
		1	2
Native	2	208.00	
Pregelatinisasi	2	216.00	
Crosslinking	2	228.00	
Hmt	2		318.00
Sig.		.413	1.000

4. Viskositas *Trough* (cP)

Duncan^a

Perlakuan	N	Subset for alpha = 0.05	
		1	2
Native	2	1223.00	
Hmt	2	1571.00	
pregelatinisasi	2	1907.50	
Crosslinking	2		3059.00
Sig.		.140	1.000

5. *Breakdown* (cP)

Duncan^a

Perlakuan	N	Subset for alpha = 0.05		
		1	2	3
Hmt	2	481.00		
Native	2		1939.50	
Crosslinking	2		2963.00	2963.00
Pregelatinisasi	2			3442.00
Sig.		1.000	.066	.306

Lampiran 5. Rekapitulasi Data Analisis Kimia Pati Campolay

1. Kadar Air (%)

Ulangan	N	HMT	PG	CL
1	9.38	12.09	12.79	8.22
2	9.49	11.65	13.45	7.94
Jumlah	18.87	23.74	26.24	16.16
Rata-rata	9.435	11.87	13.12	8.08

2. Kadar Pati (%)

Ulangan	N	HMT	PG	CL
1	67.1	71.37	65.95	67.33
2	65.1	67.29	60.62	69.63
Jumlah	132.2	138.66	126.57	136.96
Rata-rata	66.1	69.33	63.285	68.48

3. Kadar Amilosa (%)

Ulangan	N	HMT	PG	CL
1	36.42	31.85	31.71	23.85
2	35.85	27.19	26.47	28.25
Jumlah	72.27	59.04	58.18	52.1
Rata-rata	36.135	29.52	29.09	26.05

Keterangan :

N = *Native*

PG = *Pregelatinisasi*

HMT = *Heat-Moisture Treatment*

CL = *Cross-linking*

Lampiran 6. Hasil Uji ANOVA dan Duncan Analisis Kimia Pati Campolay

A. Hasil Uji ANOVA Analisis Kimia Pati Campolay

		Sum of Squares	Df	Mean Square	F	Sig.
kadar_air	Between Groups	30.891	3	10.297	97.301	0.000
	Within Groups	0.423	4	0.106		
	Total	31.314	7			
kadar_pati	Between Groups	48.489	3	16.163	2.116	0.241
	Within Groups	30.551	4	7.638		
	Total	79.039	7			
kadar_amilosa	Between Groups	108.282	3	36.094	4.193	0.100
	Within Groups	34.429	4	8.607		
	Total	142.711	7			

B. Hasil Uji Lanjut Duncan Analisis Kimia Pati Campolay

1. Kadar Air

Duncan^a

Perlakuan	N	Subset for alpha = 0.05			
		1	2	3	4
crosslinking	2	8.0800			
native	2		9.4350		
hmt	2			11.8700	
pregelatinisasi	2				13.0750
sig.		1.000	1.000	1.000	1.000

Lampiran 7. Rekapitulasi Data Analisis Fisik Pati Campolay

A. Rendemen

	Ulangan	N	HMT	PG	CL
Per Bahan Segar	1	6,24	4,29	5,19	3,18
	2	6,22	4,28	3,85	3,77
Rata-rata		6,23	4,28	4,52	3,47
Per Daging Buah	1	8,44	6,42	7,01	5,30
	2	8,49	6,40	5,77	5,33
Rata-rata		8,47	6,41	6,39	5,31
Per Pati <i>Native</i>	1	100,00	89,00	86,67	83,67
	2	100,00	88,67	83,33	85,67
Rata-rata		100,00	88,83	85,00	84,67

B. Tingkat Kecerahan

Ulangan	N	HMT	PG	CL
1	93.8	83.28	95.19	83.61
2	93.59	80.1	88	82.22
Jumlah	187.39	163.38	183.19	165.83
Rata-rata	93.695	81.69	91.595	82.915

Keterangan :

N = *Native*

PG = Pregelatinisasi

CL = *Cross-linking*

HMT = *Heat-Moisture Treatment*

Lampiran 8. Hasil Uji ANOVA dan Duncan Analisis Fisik Pati Campolay

A. Hasil Uji ANOVA Analisis Fisik Pati Campolay

1. Rendemen

ANOVA						
		Between Groups	8.050	3	2.683	10.012
per_dagingbuah	Within Groups	1.072	4	.268		
	Total	9.122	7			
	Between Groups	10.403	3	3.468	17.998	.009
per_patinative	Within Groups	.771	4	.193		
	Total	11.174	7			
	Between Groups	308.415	3	102.805	53.879	.001
per_buahsegar	Within Groups	7.632	4	1.908		
	Total	316.047	7			
	Between Groups	8.050	3	2.683	10.012	.025

2. Warna

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Nilai_L	Between Groups	219.845	3	73.282	9.191	0.029
	Within Groups	31.892	4	7.973		
	Total	251.738	7			

B. Hasil Uji Lanjut Duncan Analisis Fisik Pati Campolay

1. Rendemen

a. Per Bahan Segar

Duncan^a

Perlakuan	N	Subset for alpha = 0.05	
		1	2
Cross-linking	2	3.4750	
HMT	2	4.2850	
Pregelatinisasi	2	4.5200	
Native	2		6.2300
Sig.		.119	1.000

b. Per Daging Buah

Duncan^a

Perlakuan	N	Subset for alpha = 0.05	
		1	2
Cross-linking	2	5.3150	
Pregelatinisasi	2	6.3900	
HMT	2	6.4100	
Native	2		8.4650
Sig.		.071	1.000

c. Per Pati *Native*

Duncan^a

Perlakuan	N	Subset for alpha = 0.05		
		1	2	3
Cross-linking	2	84.6700		
Pregelatinisasi	2	85.0000	85.0000	
HMT	2		88.8350	
Native	2			100.0000
Sig.		.823	.050	1.000

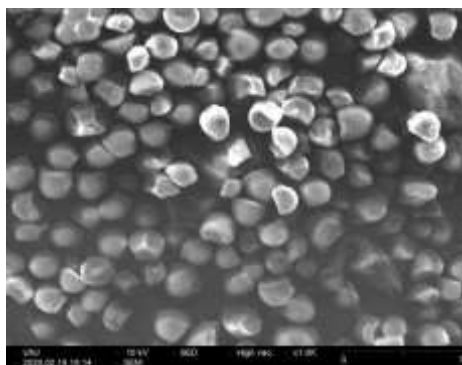
2. Tingkat Kecerahan

Duncan^a

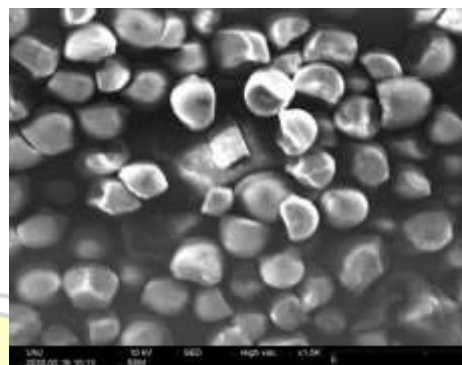
Perlakuan	N	Subset for alpha = 0.05	
		1	2
Hmt	2	81.6900	
Crosslinking	2	82.9150	
pregelatinisasi	2		91.5950
Native	2		93.6950
Sig.		.687	.498

Lampiran 9. Hasil *Scanning Electron Microscope* (SEM)

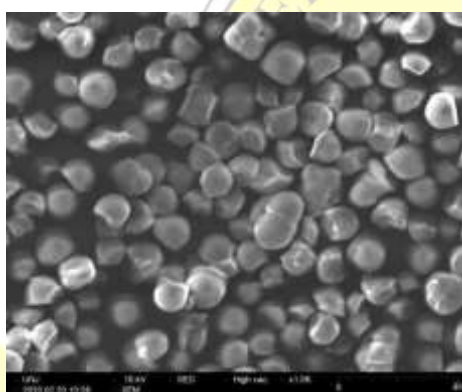
Struktur granula pati campolay *native*, HMT, pregelatinisasi (PG), dan *cross-linking* (CL) masing-masing dua kali ulangan di bawah *Scanning Electron Microscope* (SEM). (a) pembesaran 1000x; (b) pembesaran 1500x.



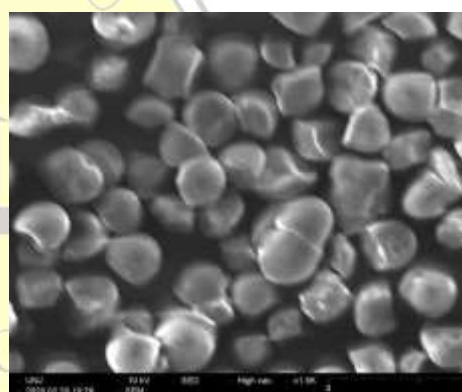
Native 1-a



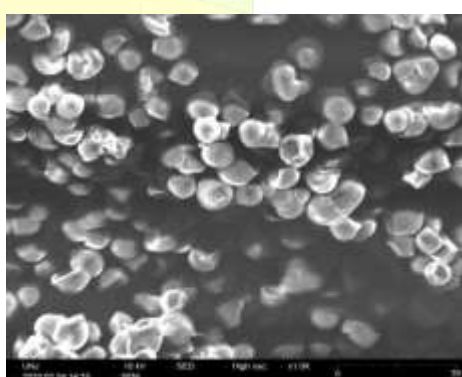
Native 1-b



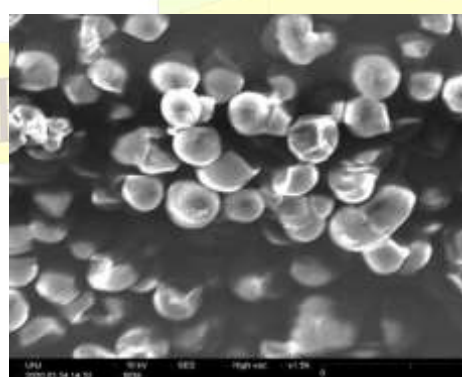
Native 2-a



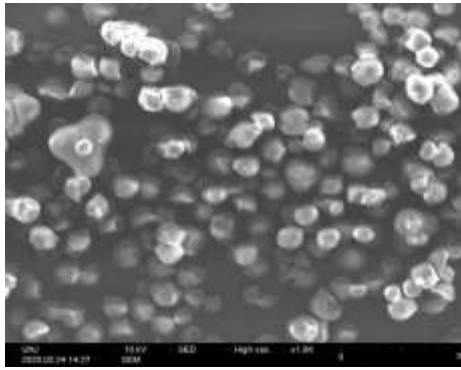
Native 2-b



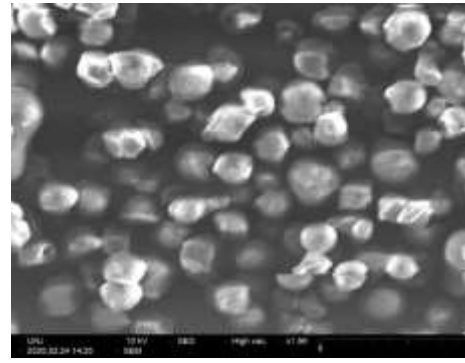
HMT 1-a



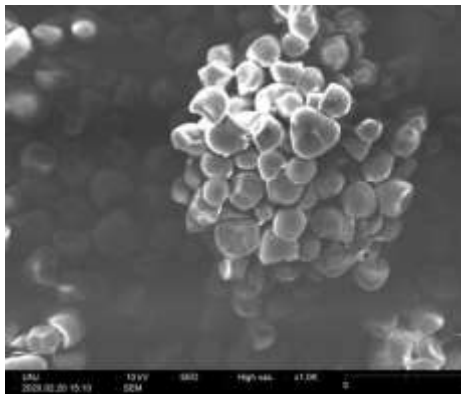
HMT 1-b



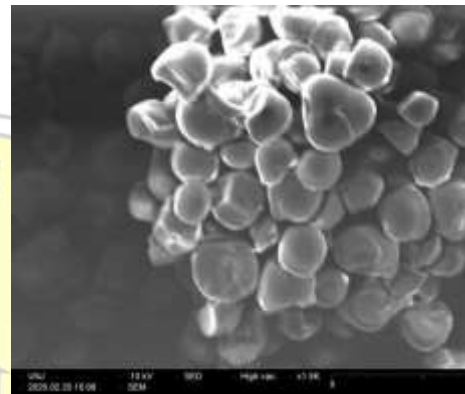
HMT 2-a



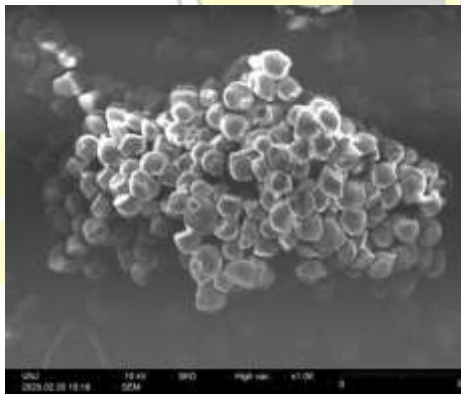
HMT 2-b



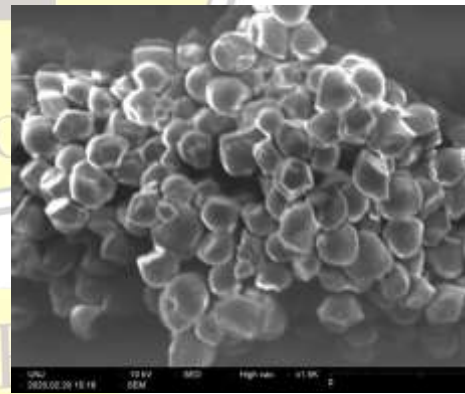
PG 1-a



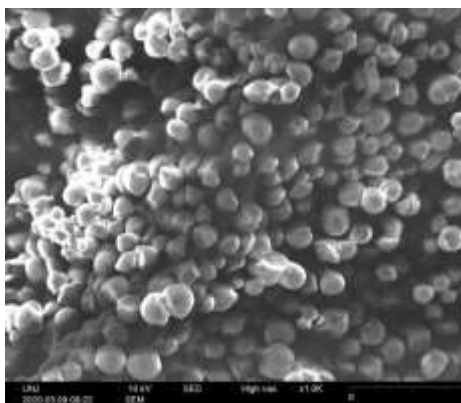
PG 1-b



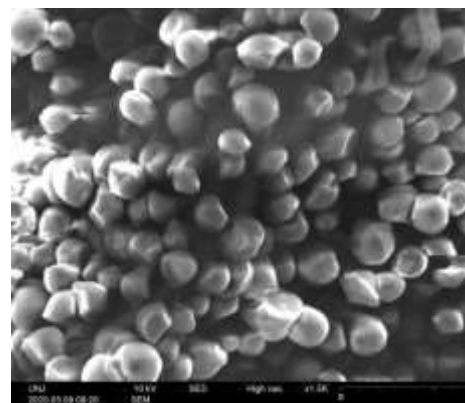
PG 2-a



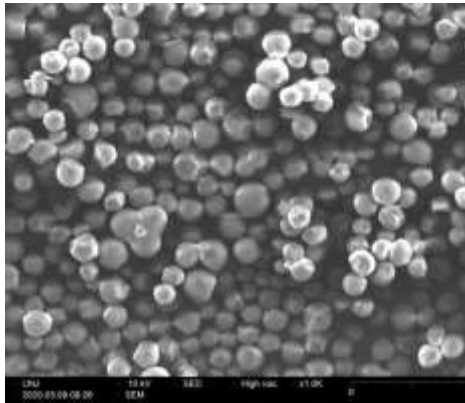
PG 2-b



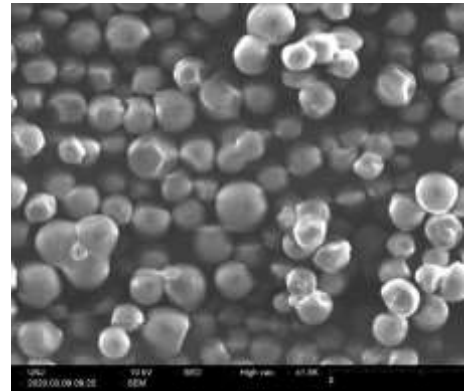
CL 1-a



CL 1-b



CL 2-a



CL 2-b



Lampiran 10. Dokumentasi Penelitian

