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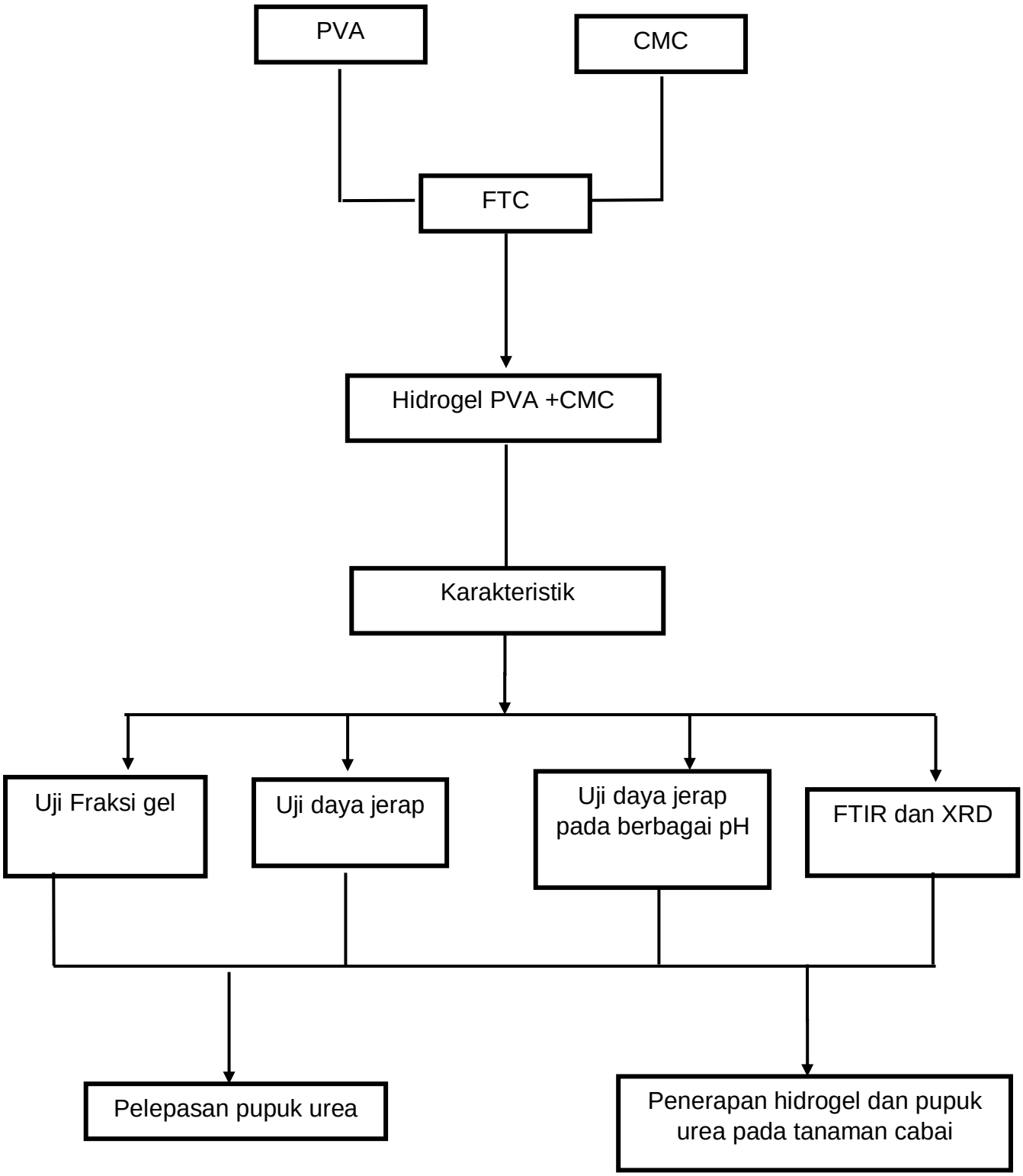
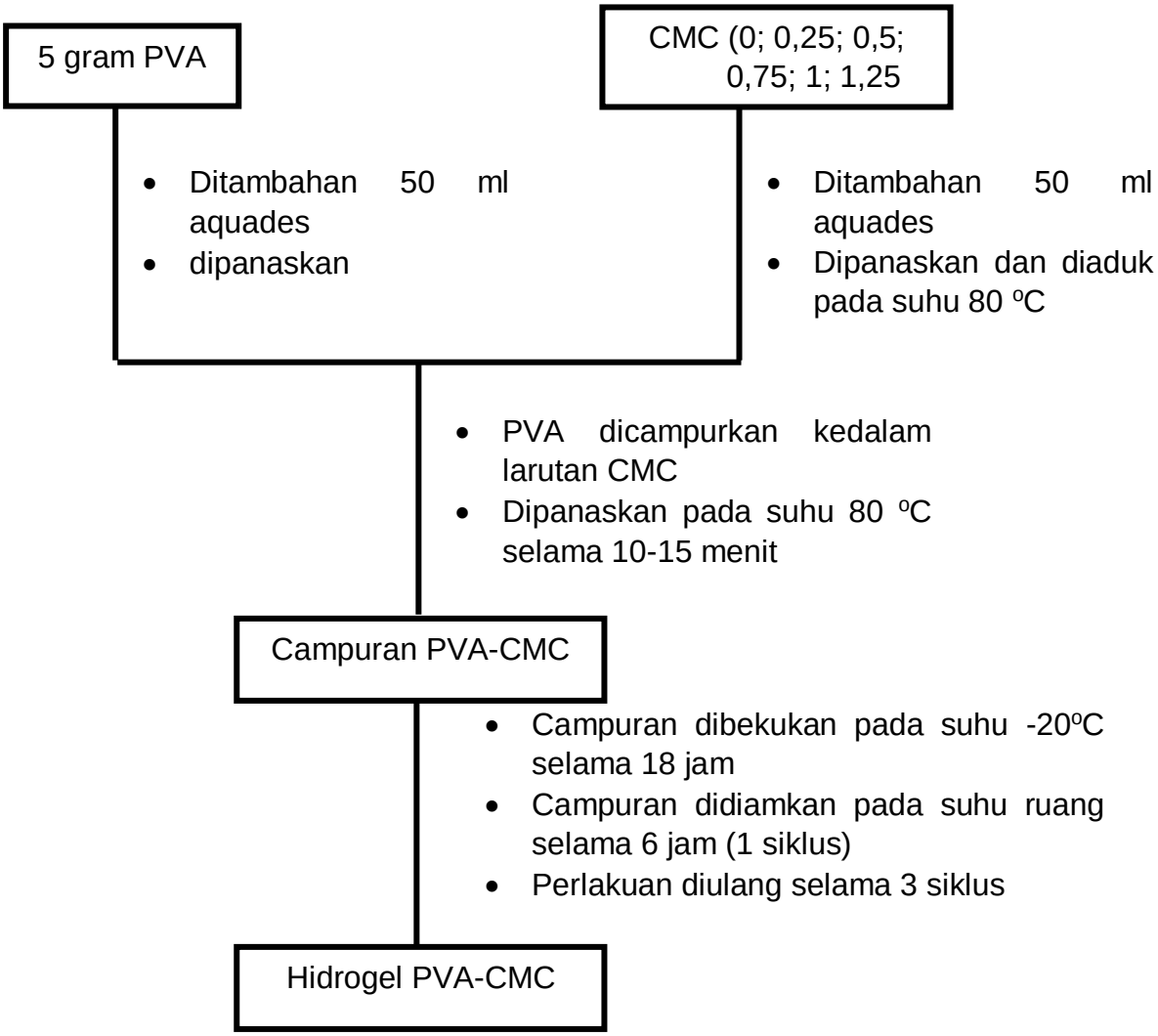
Lampiran 1. Skema Penelitian

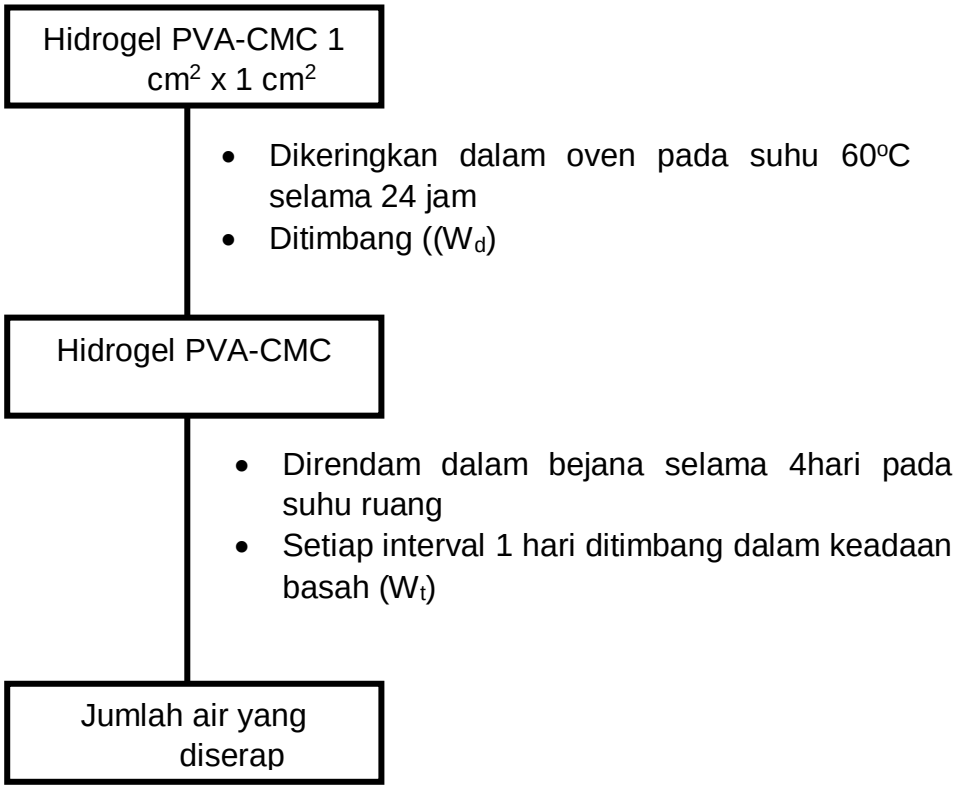


Lampiran 2. Skema Kerja Pembuatan Hidrogel dari PVA-CMC

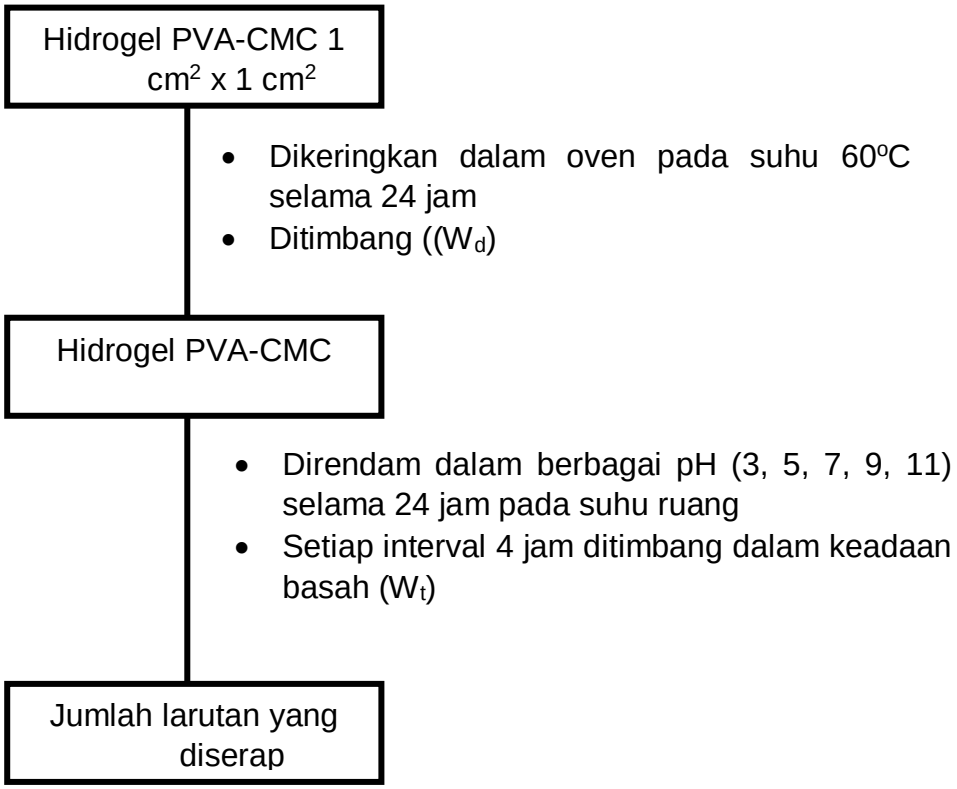


Lampiran 3. Skema Kerja Karakterisasi Hidrogel dari PVA-CMC

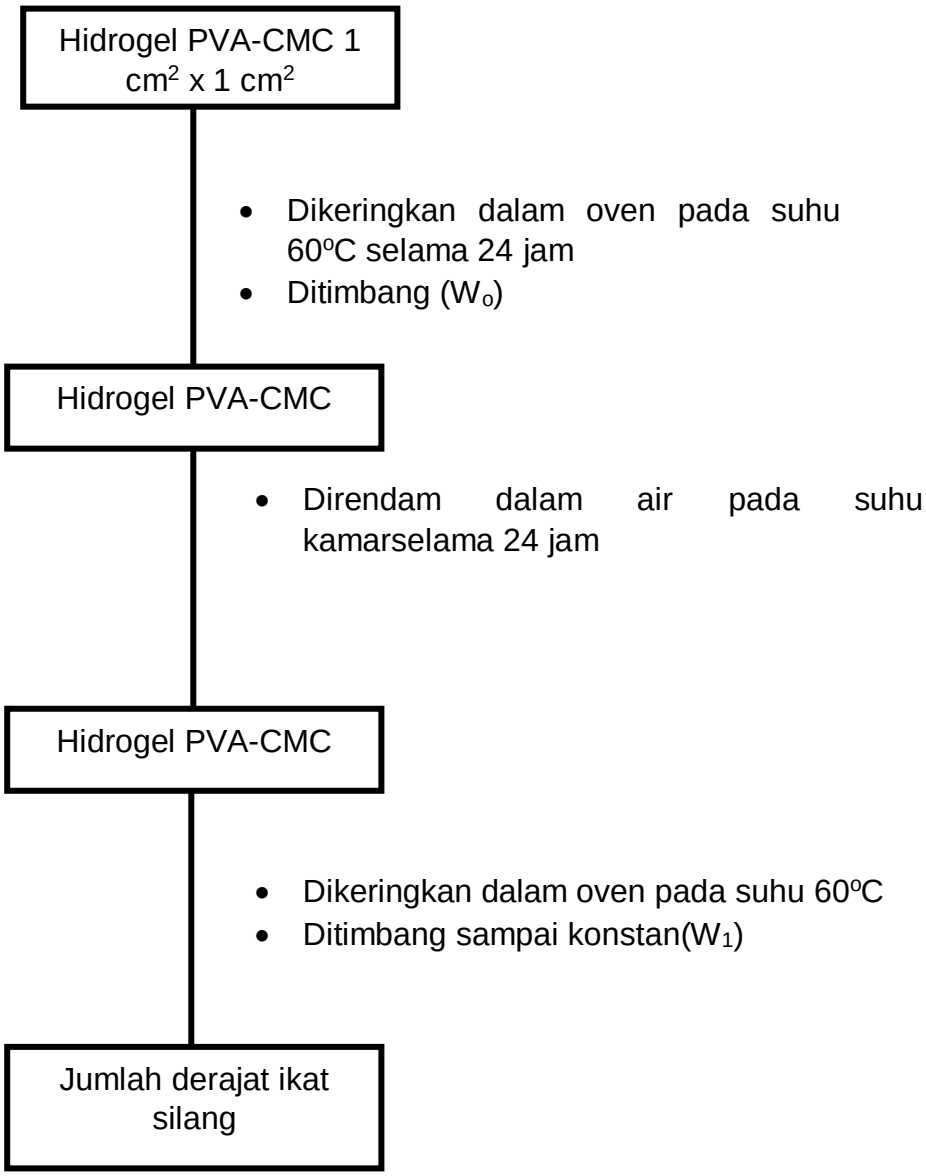
1. Uji daya jerap air



2. Uji daya jerap pada berbagai pH

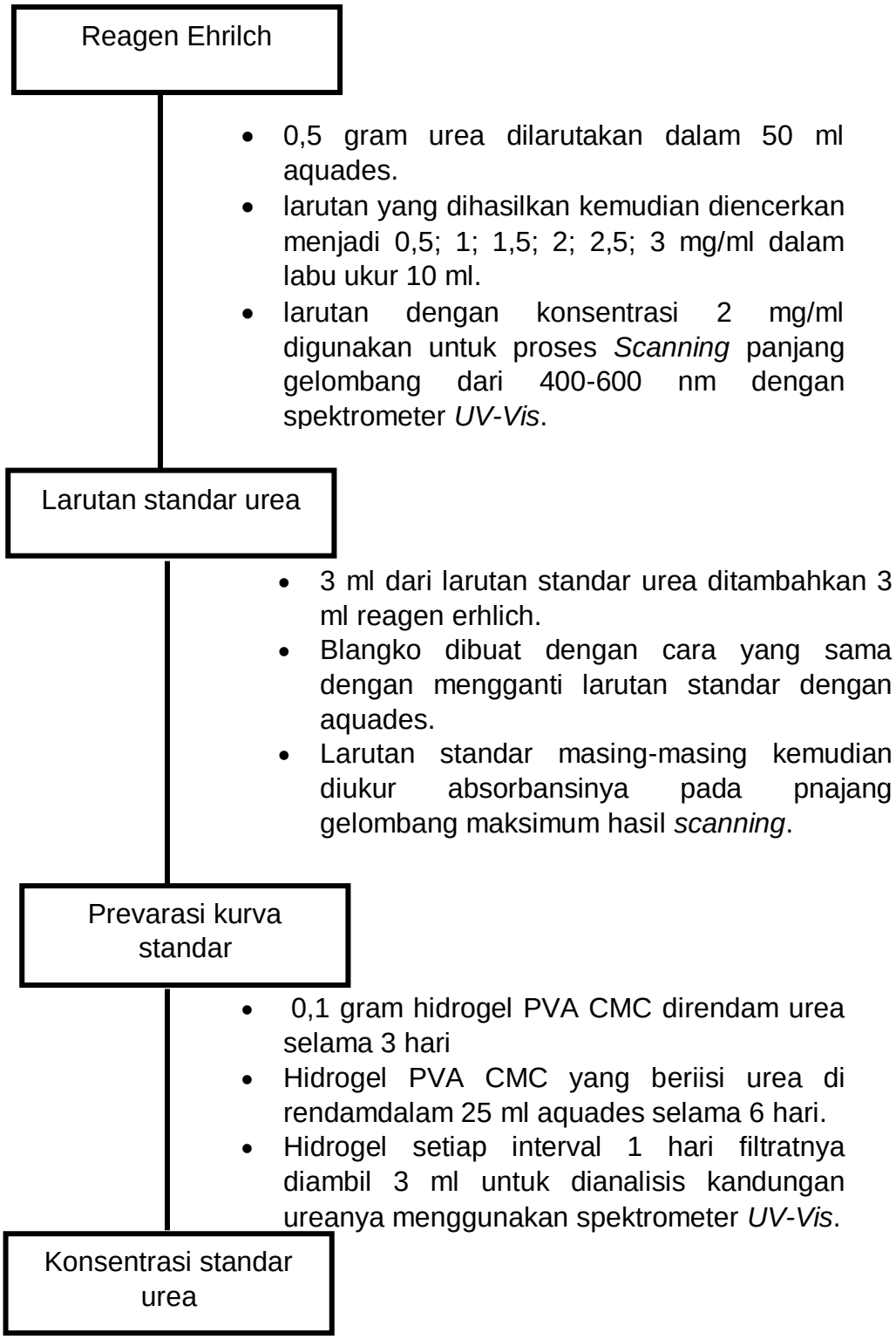


3. Uji fraksi gel

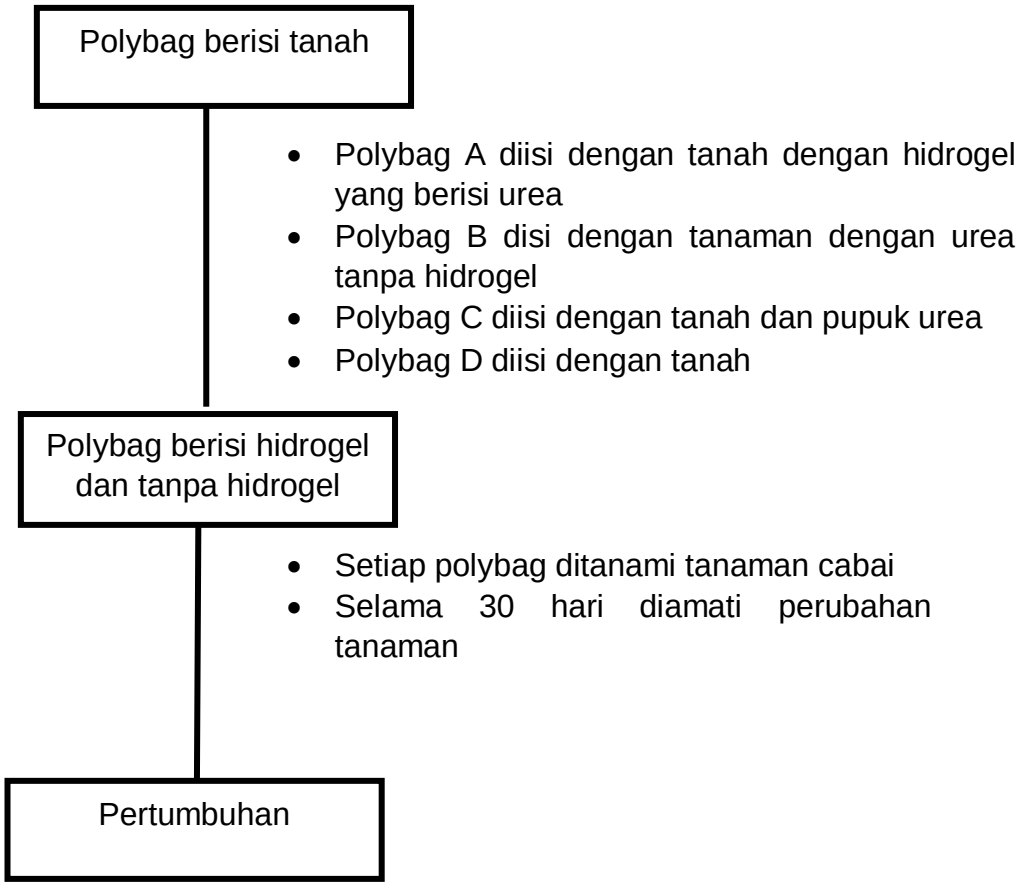


Lampiran 4. Skema Kerja Aplikasi Hidrogel dari PVA-CMC sebagai pelepasan pupuk urea

1. Uji Pelepasan urea



2. Penerapan hidrogel dan urea pada tanaman cabai



Lampiran 5. Hasil uji daya jerap air

Nama sample	Massa awal (W_d) gram	Massa dalam keadaan basah gram (W_t)	Rasio Daya jerap (%)
H0	0,18	0,472	162
H1	0,17	0,532	213
H2	0,19	0,604	218
H3	0,18	0,676	276
H4	0,17	0,892	425
H5	0,17	0,898	428

Lampiran 6. Hasil uji daya jerap diberbagai pH

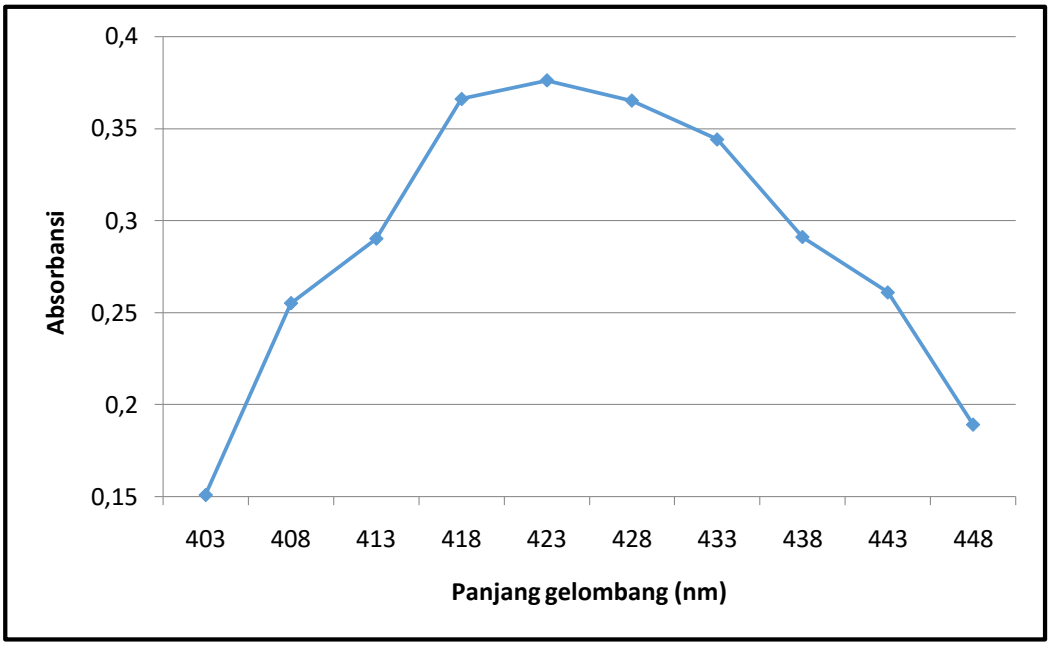
pH	Massa awal (W_d) gram	Massa dalam keadaan basah gram (W_t)	Rasio Daya jerap (%)
pH 3	0,07	0,69	288
pH 5	0,07	1,14	503
pH 7	0,07	1,41	683
pH 9	0,07	1,24	593
pH 11	0,07	0,69	267

Lampiran 7. Hasil uji fraksi gel

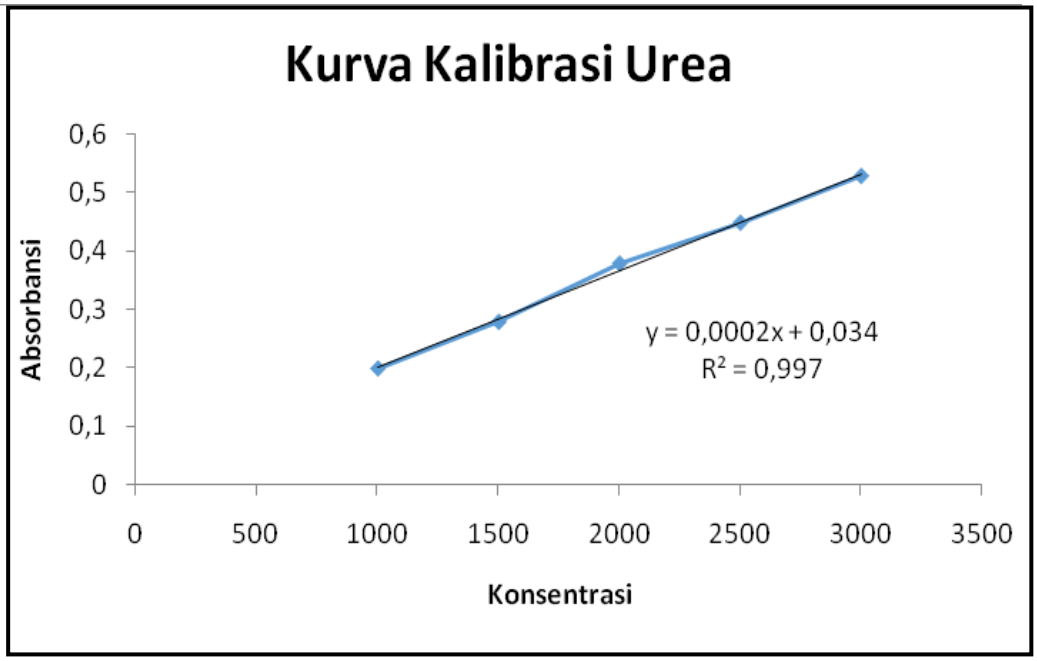
Nama sample	Massa gel sample (W_0) gram	Massa gel sisa (W_1) gram	Rasio Fraksi gel (%)
H0	0,19	0,54	285
H1	0,21	0,46	220
H2	0,18	0,38	215
H3	0,19	0,33	178
H4	0,19	0,32	168
H5	0,21	0,3	149

Lampiran 8. Penentuan konsentrasi urea

1. Penentuan Absorbansi Maksimum



2. Penentuan konsentrasi urea

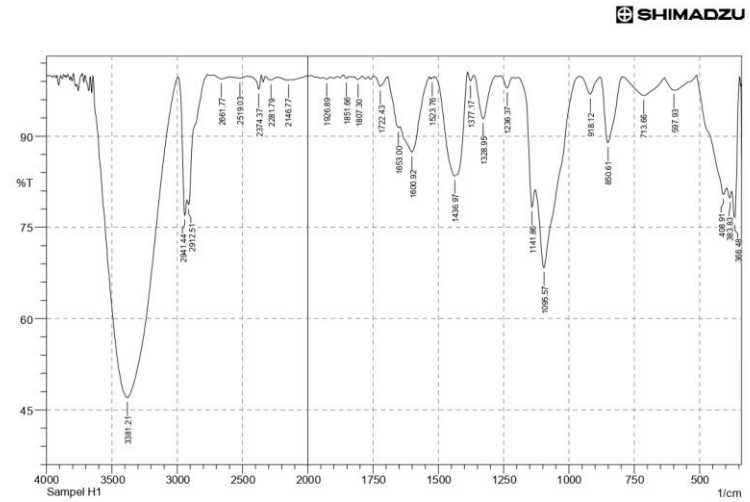


3. Analisis pelepasan urea

Hari	Konsentrasi urea terabsopsi (ml/L)	Konsentrasi urea yang terdesorpsi (ml/L	Rasio konsentrasi urea (%)
1 hari	60	5	8
2 hari	60	20	33
3 hari	60	30	50
4 hari	60	35	58
5 hari	60	45	75
6 hari	60	40	67
7 hari	60	35	58

Lampiran 8. Hasil uji FTIR

1. Hidrogel PVA-CMC (H_1)

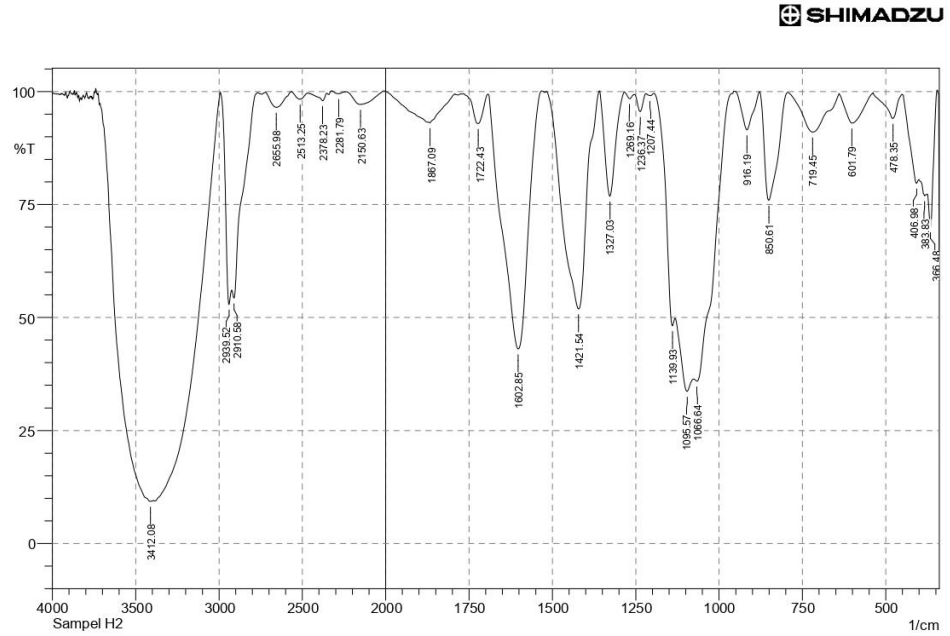


	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	366.48	76.151	10.969	376.12	347.19	2.079	0.82
2	383.83	79.857	1.217	395.41	378.05	1.642	0.065
3	408.91	80.429	2.928	511.14	397.34	6.061	0.917
4	597.93	97.584	2.144	634.58	511.14	0.809	0.709
5	713.66	96.67	2.993	794.67	636.51	1.391	1.16
6	850.61	88.909	10.843	881.47	796.6	2.157	2.068
7	918.12	96.906	2.874	958.62	881.47	0.482	0.409
8	1095.57	68.351	16.442	1128.36	960.55	13.292	5.836
9	1141.86	78.327	6.21	1193.94	1130.29	2.798	0.438
10	1236.37	97.9	1.887	1261.45	1215.15	0.21	0.169
11	1328.95	92.873	7.113	1363.67	1282.66	1.232	1.223
12	1377.17	99.106	1.175	1388.75	1363.67	0.036	0.065
13	1436.97	83.475	16.668	1508.33	1388.75	5.527	5.56
14	1523.76	99.542	0.107	1527.62	1516.05	0.018	0.002
15	1600.92	87.386	7.574	1647.21	1535.34	4.122	1.961
16	1653	91.429	1.158	1693.5	1647.21	1.075	0.166
17	1722.43	98.204	1.626	1745.58	1693.5	0.218	0.178
18	1807.3	99.31	0.507	1822.73	1791.87	0.061	0.037
19	1851.66	99.467	0.479	1863.24	1840.09	0.03	0.024
20	1926.89	99.401	0.261	1940.39	1911.46	0.057	0.015
21	2146.77	99.241	0.046	2156.42	2034.9	0.317	0.048
22	2281.79	99.237	0.533	2326.15	2235.5	0.208	0.117
23	2374.37	97.729	2.23	2426.45	2355.08	0.309	0.279
24	2519.03	99.504	0.247	2565.33	2466.96	0.156	0.052
25	2661.77	99.426	0.492	2725.42	2596.19	0.195	0.148
26	2912.51	78.752	2.08	2922.16	2779.42	5.473	0.178
27	2941.44	76.972	7.705	2991.59	2924.09	4.124	0.893
28	3381.21	46.999	52.747	3643.53	2993.52	110.595	109.863

Comment;
Sampel H1

Date/Time; 10/22/2021 3:00:29 PM
No. of Scans;
Resolution;
Apodization;

2. Hidrogel PVA-CMC (H_2)



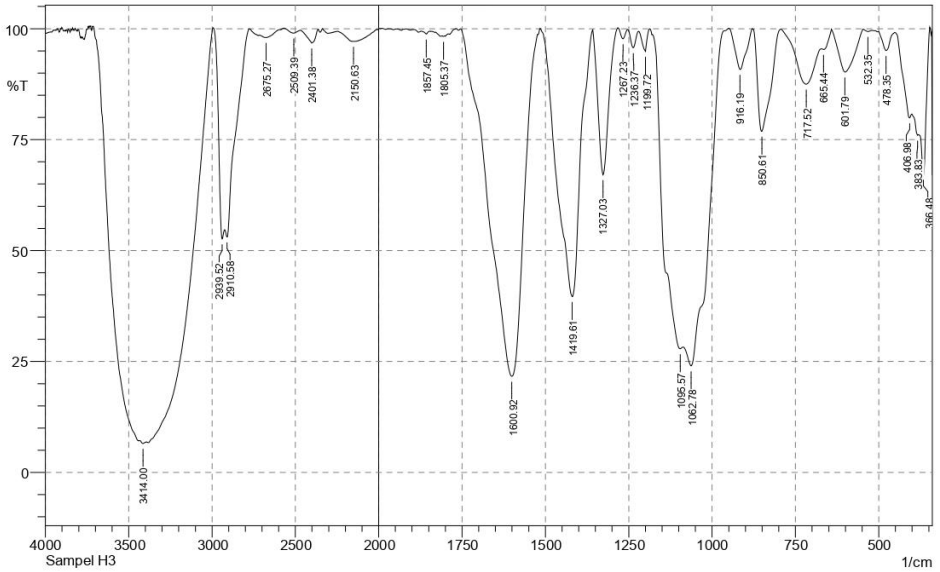
No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	366.48	70.065	13.651	374.19	347.19	2.394	0.994
2	383.83	76.951	1.373	399.26	376.12	2.474	0.072
3	406.98	79.709	3.043	449.41	401.19	2.821	0.402
4	478.35	94.052	5.428	538.14	451.34	1.137	0.963
5	601.79	93.007	6.404	638.44	540.07	1.814	1.575
6	719.45	91.009	8.649	792.74	640.37	3.341	3.109
7	850.61	75.941	23.919	877.61	794.67	5.086	5.031
8	916.19	91.524	8.5	954.76	879.54	1.365	1.373
9	1066.64	35.916	5.828	1076.28	962.48	24.863	1.806
10	1095.57	33.678	7.103	1130.29	1078.21	21.67	2.175
11	1139.93	48.182	7.862	1193.94	1132.21	8.553	0.761
12	1207.44	99.079	0.483	1219.01	1195.87	0.073	0.029
13	1236.37	95.564	3.909	1253.73	1219.01	0.375	0.295
14	1269.16	98.423	1.237	1284.59	1253.73	0.128	0.082
15	1327.03	76.852	23.202	1357.89	1284.59	3.911	3.922
16	1421.54	51.888	48.143	1516.05	1359.82	20.418	20.43
17	1602.85	43.034	56.739	1691.57	1533.41	26.944	26.76
18	1722.43	92.922	5.959	1747.51	1693.5	1.053	0.802
19	1867.09	93.061	6.586	2007.9	1793.8	3.454	3.231
20	2150.63	97.147	2.875	2235.5	2009.83	1.574	1.619
21	2281.79	99.517	0.543	2322.29	2235.5	0.094	0.115
22	2378.23	97.963	1.647	2466.96	2353.16	0.527	0.339
23	2513.25	98.31	1.498	2567.25	2466.96	0.436	0.358
24	2655.98	96.518	3.38	2719.63	2567.25	1.359	1.302
25	2910.58	54.291	4.991	2922.16	2769.78	15.876	0.566
26	2939.52	52.947	13.072	2991.59	2924.09	10.098	2.009
27	3412.08	9.318	5.442	3714.9	3392.79	185.405	21.425

Comment;
Sampel H2

Date/Time; 10/22/2021 2:55:43 PM
No. of Scans;
Resolution;
Apodization;

3. Hidrogel PVA-CMC (H_3)

SHIMADZU



No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	366.48	67.19	18.88	379.98	347.19	3.324	1.52
2	383.83	75.989	0.608	401.19	381.91	2.028	-0.009
3	406.98	79.918	2.16	451.34	403.12	2.52	0.201
4	478.35	95.084	4.145	501.49	451.34	0.601	0.431
5	532.35	99.344	0.383	547.78	518.85	0.055	0.022
6	601.79	90.242	9.475	640.37	547.78	2.336	2.233
7	665.44	95.337	1.221	673.16	642.3	0.466	0.146
8	717.52	87.495	9.598	792.74	673.16	3.814	2.554
9	850.61	76.894	23.087	879.54	794.67	4.705	4.689
10	916.19	90.83	9.128	948.98	881.47	1.458	1.443
11	1062.78	24.034	17.784	1085.92	964.41	41.191	9.04
12	1095.57	27.854	6.016	1186.22	1087.85	30.16	4.067
13	1199.72	94.893	4.883	1220.94	1186.22	0.369	0.326
14	1236.37	95.729	3.881	1253.73	1220.94	0.33	0.276
15	1267.23	97.739	2.261	1282.66	1253.73	0.143	0.145
16	1327.03	67.099	32.834	1357.89	1282.66	5.715	5.709
17	1419.61	39.633	60.016	1514.12	1359.82	26.195	25.99
18	1600.92	21.671	78.327	1753.29	1516.05	58.54	58.516
19	1805.37	98.238	0.145	1809.23	1801.51	0.057	0.002
20	1857.45	98.765	0.667	1872.88	1845.88	0.094	0.027
21	2150.63	97.127	2.453	2245.14	2009.83	1.864	1.475
22	2401.38	96.745	3.068	2468.88	2362.8	0.827	0.725
23	2509.39	99.013	0.827	2569.18	2468.88	0.24	0.19
24	2675.27	97.991	0.962	2715.77	2592.33	0.727	0.279
25	2910.58	53.05	5.277	2922.16	2779.42	16.451	0.67
26	2939.52	52.65	12.457	2991.59	2924.09	9.979	1.752
27	3414	6.526	0.49	3433.29	3394.72	45.172	0.635

Comment;
Sampel H3

Date/Time; 10/22/2021 3:04:13 PM
No. of Scans;
Resolution;
Apodization;

4. Hidrogel PVA-CMC (H_4)

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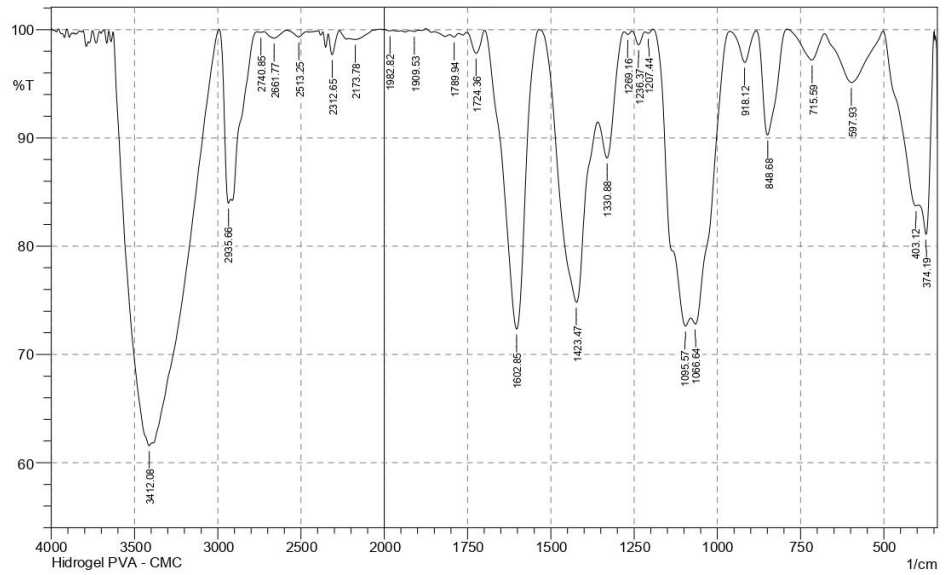

No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	374.19	81.102	10.186	395.41	351.04	2.943	1.26
2	403.12	83.739	0.935	501.49	397.34	4.347	0.268
3	597.93	95.118	4.605	677.01	503.42	2.06	1.859
4	715.59	97.193	2.57	790.81	678.94	0.681	0.601
5	848.68	90.264	9.7	883.4	790.81	1.971	1.965
6	918.12	96.983	2.903	962.48	883.4	0.468	0.427
7	1066.64	72.811	3.185	1078.21	962.48	8.435	1.049
8	1095.57	72.62	4.42	1192.01	1080.14	9.26	1.856
9	1207.44	99.657	0.238	1217.08	1192.01	0.021	0.013
10	1236.37	98.599	1.237	1255.66	1217.08	0.128	0.101
11	1269.16	99.546	0.284	1278.81	1255.66	0.031	0.014
12	1330.88	88.145	6.229	1357.89	1280.73	2.513	1.028
13	1423.47	74.823	19.774	1533.41	1359.82	11.459	8.07
14	1602.85	72.343	27.634	1697.36	1535.34	9.635	9.615
15	1724.36	97.819	2.033	1751.36	1699.29	0.283	0.249
16	1789.94	99.318	0.272	1803.44	1776.44	0.064	0.016
17	1909.53	99.824	0.11	1923.03	1896.03	0.014	0.006
18	1982.82	99.883	0.072	2002.11	1975.11	0.007	0.005
19	2173.78	99.089	0.293	2212.35	2071.55	0.398	0.128
20	2312.65	97.697	2.025	2337.72	2270.22	0.359	0.29
21	2513.25	99.328	0.536	2584.61	2466.96	0.187	0.125
22	2661.77	99.212	0.66	2723.49	2584.61	0.279	0.206
23	2740.85	99.745	0.063	2765.92	2723.49	0.042	0.007
24	2935.66	83.977	3.407	2991.59	2922.16	2.98	0.52
25	3412.08	61.575	3.092	3628.1	3394.72	31.343	6.68

Comment;
Hidrogel PVA - CMC

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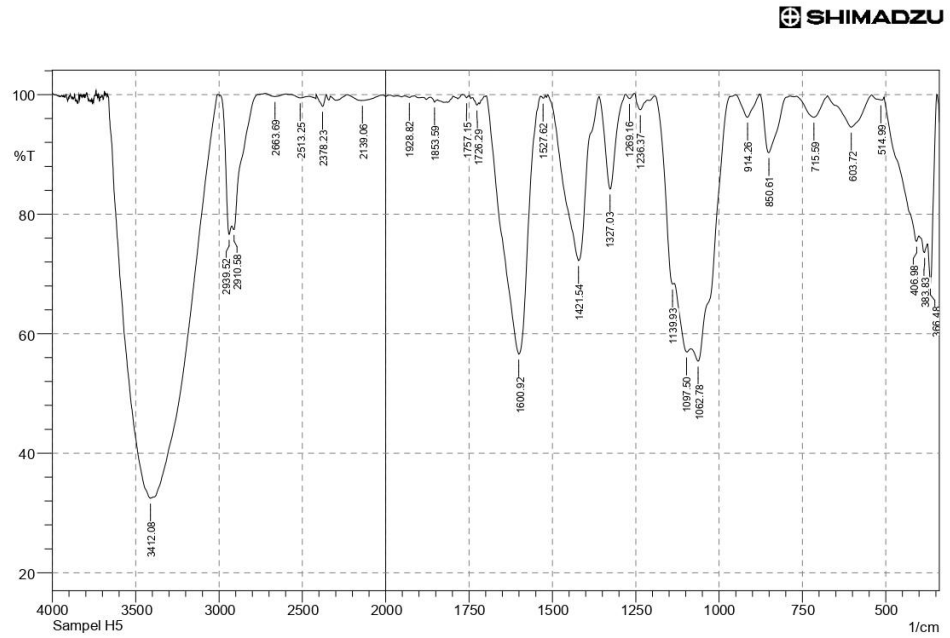
No. of Scans;
Resolution;
Apodization;

5. Hidrogel PVA-CMC (H_5)



No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	366.48	68.46	13.71	374.19	347.19	2.54	0.99
2	383.83	73.59	1.84	399.26	376.12	2.92	0.11
3	406.98	75.48	2.16	505.35	401.19	6.98	0.67
4	514.99	99.1	0.6	542	505.35	0.11	0.07
5	603.72	94.54	4.4	650.01	543.93	1.55	1.12
6	715.59	96.21	3.58	767.67	675.09	0.87	0.78
7	850.61	90.29	9.6	877.61	798.53	1.85	1.78
8	914.26	96.23	3.79	950.91	877.61	0.59	0.6
9	1062.78	55.39	9.82	1083.99	968.27	16.99	3.44
10	1097.5	56.92	3.17	1134.14	1085.92	10.46	0.62
11	1139.93	68.29	3.27	1192.01	1134.14	4.51	-0.29
12	1236.37	97.47	2.22	1253.73	1215.15	0.26	0.2
13	1269.16	99.35	0.75	1280.73	1253.73	0.03	0.05
14	1327.03	84.21	15.6	1359.82	1282.66	2.54	2.49
15	1421.54	72.24	27.42	1512.19	1361.74	9.75	9.55
16	1527.62	99.38	0.45	1535.34	1521.84	0.02	0.01
17	1600.92	56.58	43.18	1697.36	1535.34	18.94	18.78
18	1726.29	98.27	0.63	1739.79	1720.5	0.1	0.03
19	1757.15	99.47	0.38	1764.87	1753.29	0.02	0.01
20	1853.59	98.76	0.56	1867.09	1843.95	0.08	0.02
21	1928.82	99.52	0.26	1944.25	1915.31	0.04	0.01
22	2139.06	99.02	0.02	2140.99	2029.11	0.31	0.05
23	2378.23	98.05	1.98	2416.81	2357.01	0.28	0.28
24	2513.25	99.45	0.06	2569.18	2507.46	0.07	0.01
25	2663.69	99.67	0.49	2723.49	2598.12	0.06	0.14
26	2910.58	77.43	2.2	2922.16	2765.92	6.51	0.18
27	2939.52	76.6	6.41	2991.59	2924.09	4.21	0.77
28	3412.08	32.48	4.99	3662.82	3392.79	79.48	13.22

Comment;
Sampel H5

Date/Time; 10/22/2021 3:09:39 PM
No. of Scans;
Resolution;
Apodization;

6. Hidrogel PVA

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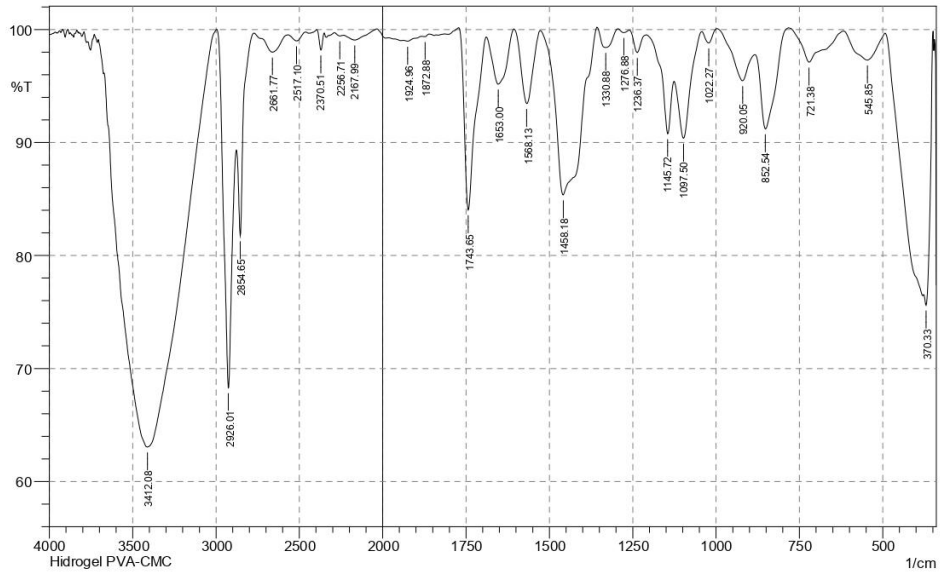

No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	370.33	75.606	6.148	376.12	351.04	2.118	0.728
2	545.85	97.293	2.457	617.22	493.78	0.916	0.789
3	721.38	97.104	2.933	781.17	617.22	0.969	0.969
4	852.54	91.211	7.29	883.4	783.1	1.988	1.539
5	920.05	95.463	3.022	997.2	885.33	1.176	0.638
6	1022.27	98.799	1.133	1043.49	997.2	0.121	0.109
7	1097.5	90.366	6.469	1124.5	1043.49	1.879	1.028
8	1145.72	90.77	5.598	1209.37	1126.43	1.475	0.555
9	1236.37	97.962	1.78	1261.45	1209.37	0.233	0.173
10	1276.88	99.72	0.277	1294.24	1261.45	0.022	0.022
11	1330.88	98.408	1.738	1357.89	1294.24	0.244	0.281
12	1458.18	85.354	14.66	1525.69	1357.89	5.739	5.774
13	1568.13	93.447	6.511	1604.77	1527.62	1.107	1.091
14	1653	95.157	4.471	1687.71	1606.7	1.022	0.912
15	1743.65	84.039	15.817	1770.65	1689.64	2.69	2.589
16	1872.88	99.363	0.116	1882.52	1859.38	0.055	0.005
17	1924.96	98.964	0.163	1938.46	1882.52	0.207	0.016
18	2167.99	99.068	0.605	2233.57	2034.9	0.484	0.286
19	2256.71	99.429	0.15	2289.5	2233.57	0.118	0.02
20	2370.51	98.183	1.634	2395.59	2351.23	0.175	0.144
21	2517.1	98.99	0.655	2567.25	2463.1	0.31	0.152
22	2661.77	97.999	1.597	2771.71	2569.18	1.03	0.679
23	2854.65	81.743	9.876	2877.79	2773.64	3.329	1.035
24	2926.01	68.293	25.278	2995.45	2879.72	9.336	6.454
25	3412.08	63.056	34.538	3670.54	2997.38	75.352	69.555

Comment;
Hidrogel PVA-CMC

Date/Time; 9/17/2021 1:57:32 PM
No. of Scans;
Resolution;
Apodization;

7. Hidrogel CMC

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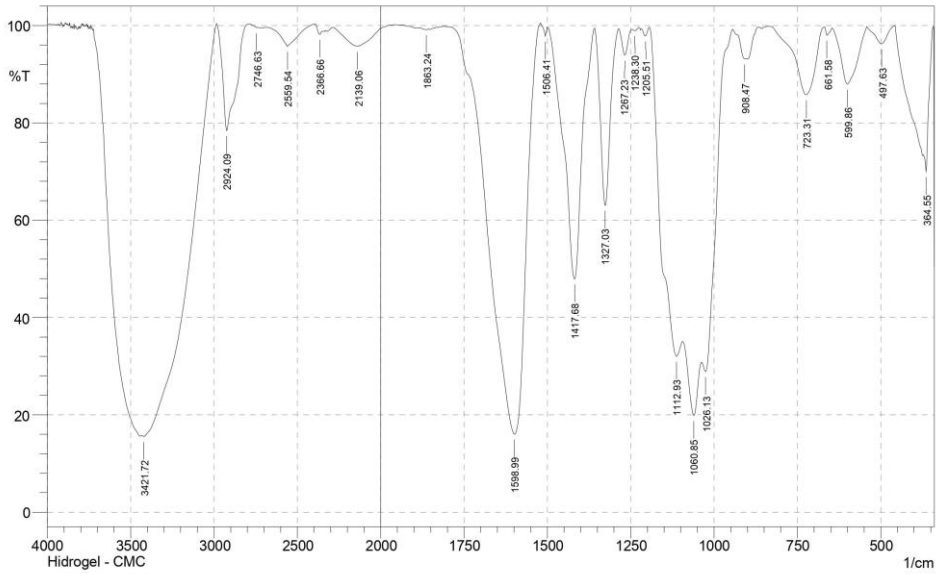


No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	364.55	70.001	10.457	372.26	343.33	2.342	0.544
2	497.63	96.227	3.72	542	457.13	0.693	0.672
3	599.86	87.98	11.587	644.22	542	3.048	2.872
4	661.58	97.979	1.682	667.37	646.15	0.122	0.086
5	723.31	85.79	13.957	835.18	669.3	4.585	4.425
6	908.47	93.176	0.623	943.19	904.61	0.63	-0.026
7	1026.13	28.89	9.118	1035.77	945.12	19.809	1.526
8	1060.85	19.875	12.694	1093.64	1037.7	32.622	5.537
9	1112.93	32.04	14.385	1193.94	1095.57	29.861	7.146
10	1205.51	97.854	1.657	1219.01	1193.94	0.144	0.089
11	1238.3	98.956	0.416	1246.02	1224.8	0.074	0.021
12	1267.23	93.932	5.364	1286.52	1246.02	0.567	0.442
13	1327.03	63.031	36.389	1357.89	1286.52	6.107	5.924
14	1417.68	47.917	51.612	1498.69	1359.82	16.745	16.471
15	1506.41	97.843	2.11	1521.84	1500.62	0.067	0.078
16	1598.99	16.048	84.224	1786.08	1521.84	72.511	72.635
17	1863.24	99.171	0.208	1882.52	1857.45	0.077	0.018
18	2139.06	95.763	4.06	2285.65	1978.97	3.306	3.084
19	2366.66	98.222	1.307	2393.66	2343.51	0.224	0.133
20	2559.54	95.719	4.219	2684.91	2393.66	2.097	2.083
21	2746.63	99.587	0.135	2791	2738.92	0.001	-0.006
22	2924.09	78.437	21.899	2983.88	2791	8.683	8.959
23	3421.72	15.569	2.351	3433.29	2985.81	185.662	10.699

Comment;
Hidrogel - CMC

Date/Time; 9/17/2021 2:02:12 PM
No. of Scans;
Resolution;
Apodization;

Lampiran 9. Hasil uji XRD

Match! Phase Analysis Report

Sample: Hidrogel (5-50)

Sample Data

File name	Hidrogel.RAW
File path	F:/Hidrogel
Data collected	May 31, 2022 21:10:43
Data range	5.000° - 50.000°
Original data range	5.000° - 50.000°
Number of points	4501
Step size	0.010
Rietveld refinement converged	No
Alpha2 subtracted	No
Background subtr.	No
Data smoothed	Yes
Radiation	X-rays
Wavelength	1.540600 Å

Peak List

No.	*2theta [°]*	*d [Å]*	*I/I0 (peak height)*	*Counts (peak area)*	*FWHM*
1	5.33	16.5669	0.27	0.10	0.9700
2	6.76	13.0653	2.22	0.81	0.9700
3	11.42	7.7422	23.21	13.01	1.4851
4	16.41	5.3975	113.01	73.04	1.7126
5	19.65	4.5142	1000.00	732.14	1.9400
6	22.89	3.8820	318.66	233.30	1.9400
7	27.72	3.2156	72.56	62.08	1.9400
8	29.26	3.0498	42.80	36.62	1.9400
9	31.73	2.8178	36.50	67.64	4.9104
10	36.61	2.4526	51.85	18.98	0.9700
11	38.04	2.3636	47.61	34.85	1.9400
12	40.78	2.2109	108.84	120.45	2.9326
13	44.35	2.0409	83.97	61.48	1.9400

Integrated Profile Areas

Based on calculated profile

Profile area	*Counts*	*Amount*
Overall diffraction profile	336870	100.00%
Background radiation	198304	58.87%
Diffraction peaks	138565	41.13%
Peak area belonging to selected phases	0	0.00%
Unidentified peak area	138565	41.13%

Peak Residuals

Peak data	*Counts*	*Amount*
Overall peak intensity	1454	100.00%
Peak intensity belonging to selected phases	0	0.00%
Unidentified peak intensity	1454	100.00%

Diffraction Pattern Graphics

Lampiran 10. Contoh perhitungan daya jerap

Dik : W_d = 0,18 gram

W_t = 0,47 gram

Dit : % Derajat ikat silang….?

Peny :

%Daya jerap $= \frac{W_{t-}w_d}{W_d} \times 100\%$

%Daya jerap $= \frac{0,47-0,18}{0,18} \times 100\%$

%Daya jerap $= \frac{0,29}{0,18} \times 100\%$

%Daya jerap = 1,62 x 100%

%Daya jerap = 162%

Lampiran 11. Contoh perhitungan fraksi gel

Dik : W_1 = 0,54 gram

W_0 = 0,19 gram

Dit : % Derajat ikat silang….?

Peny :

%Derajat ikat silang $= \frac{W_1}{W_0} \times 100\%$

%Derajat ikat silang $= \frac{0,54}{0,19} \times 100\%$

%Derajat ikat silang = 2,85 X100%

%Derajat ikat silang = 285%

Lampiran 12. Contoh perhitungan pelepasan urea

Dik : Absorbansi (y) = 0,046

Persamaan yang dihasilkan y = 0,0002x + 0,034

Nilai regresi = 0,997

Dit : kosentrasi….?

Penye :

y = 0,0002x + 0,034

x = $\frac{0,035-0,034}{0,0002}$

x = 5

jadi, kosentrasi pelepasan urea yang sebenarnya 5 ml/L

Dik : konsentrasi urea terabsopsi = 5 ml/L

Konsentrasi urea terdesopsi = 60 ml/L

Dit : % rasio kosentrasi….?

Penye :

% rasio konsentrasi urea = $\frac{W_A}{W_B} \times 100\%$

= $\frac{5}{60} \times 100\%$

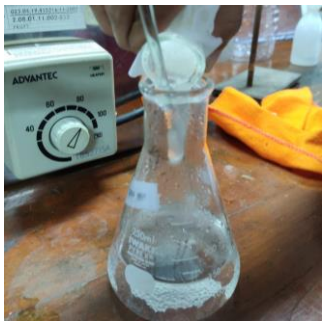
= 8%

Jadi, % rasio konsentrasi urea teradsopsi yang sebenarnya 8%

Lampiran 13. Dokumentasi Penelitian

1. Sintesis hidrogel PVA CMC

Pemanasan PVA dan CMC



PVA + CMC

Hidrogel PVA CMC sebelum FTC

Hidrogel PVA CMC setelah 3 siklus

2. Uji daya jerap air

Hidrogel PVA, Hidrogel CMC, Hidrogel PVA-CMC

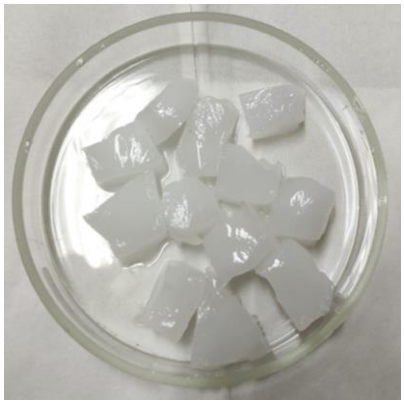
Hidrogel + Aquades

Hidrogel menjerap air

Hidrogel CMC yang larut

3. Uji fraksi gel

Hidrogel kering



Hidrogel menjerap air

Hidrogel dipanaskan

Hidrogel setelah dipanaskan selama 24 jam

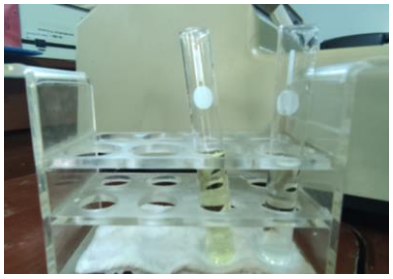
4. Uji daya jerap pada berbagai pH

Hidrogel kering

Hidrogel + larutan HCl dan Hidrogel + NaOH

5. Uji Pelepasan urea

Hidrogel + Urea



Warna filtrat di uji UV-Vis

6. Penerapan hidrogel dan urea pada tanaman cabai

Hidrogel + Urea

Hidrogel + urea + cabai

Hidrogel + cabai

Tanaman cabai setelah 4 minggu