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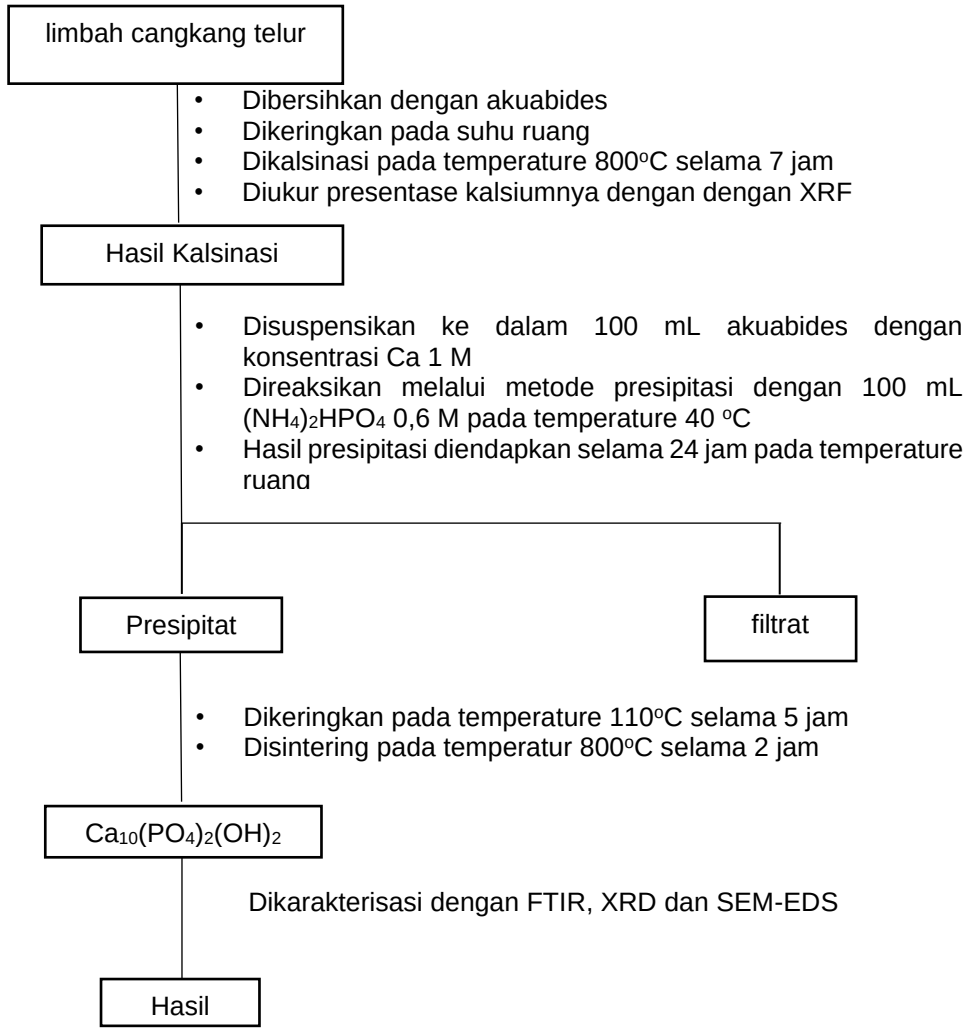
LAMPIRAN

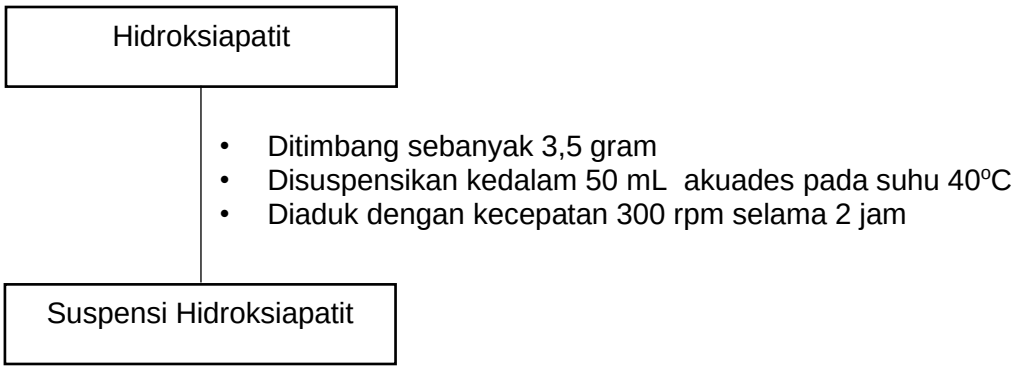
Lampiran 1. Bagan Kerja Penelitian

Lampiran 1.1. Sintesis Hidroksiapatit dari cangkang telur

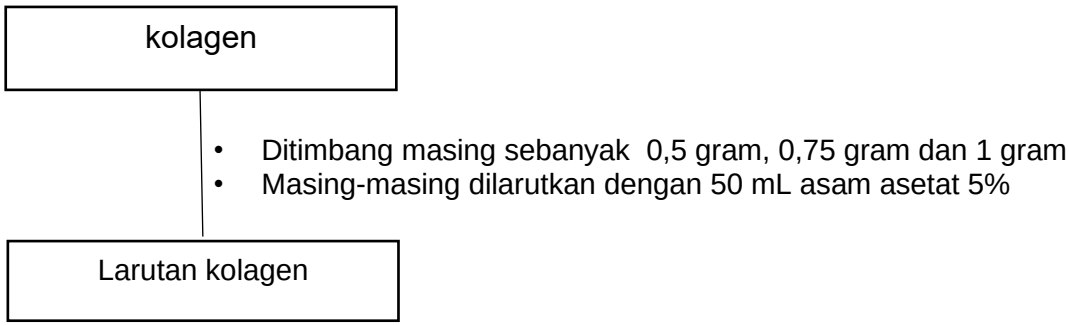


Lampiran 1.2. Preparasi Hidroksiapatit, kolagen dan kitosan dengan perbandingan HA:Kitosan:Kolagen yaitu sebesar (70:10:20), (70:15:15) dan (70:20:10)

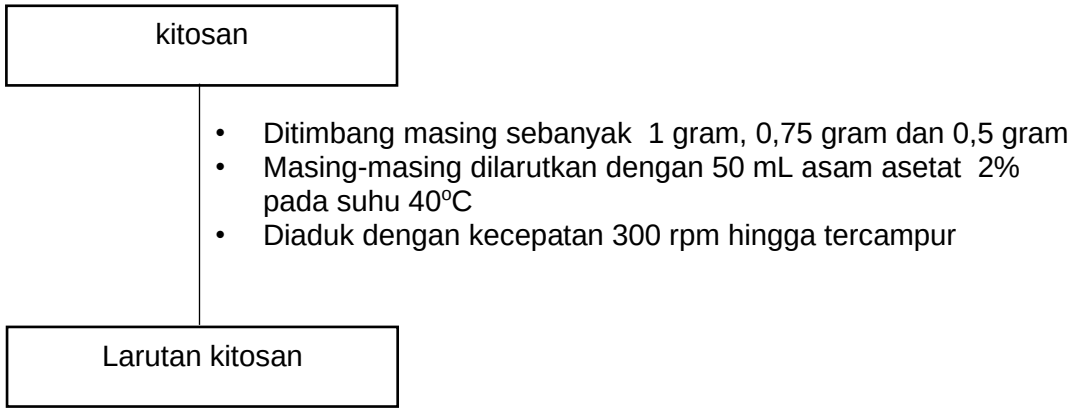
1) pembuatan suspensi Hidroksiapatit



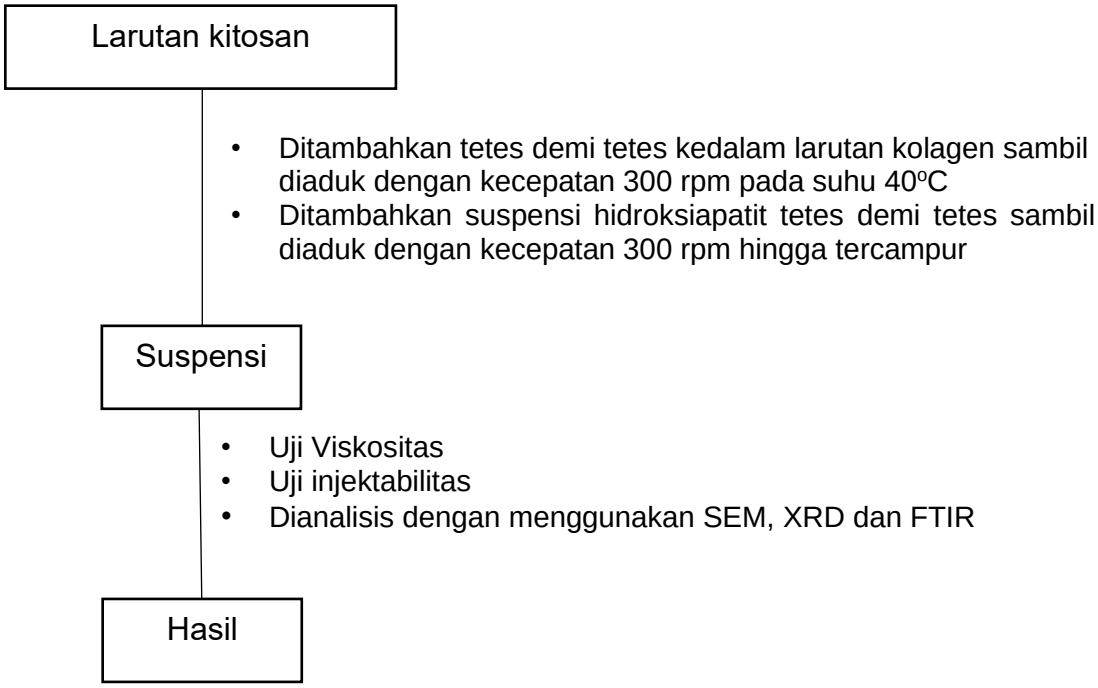
2) Pembuatan Larutan Kolagen



3) Pembuatan Larutan Kitosan

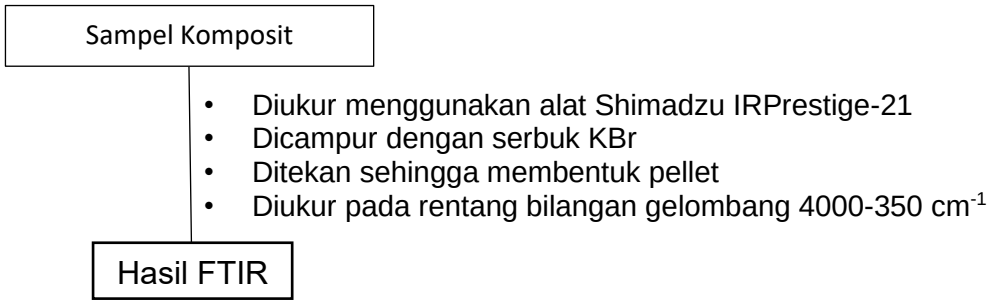


Lampiran 1.3. Sintesis IBS komposit hidroksiapatit /kitosan/kolagen

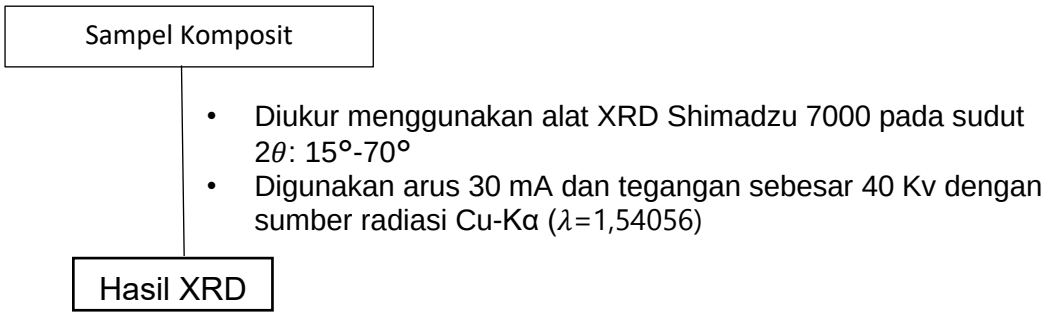


Karakterisasi

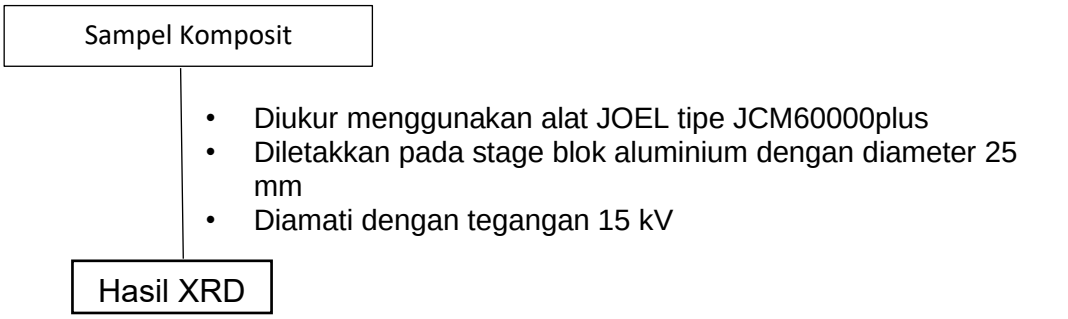
a. Karakterisasi dengan Fourier Transform Infrared (FTIR)



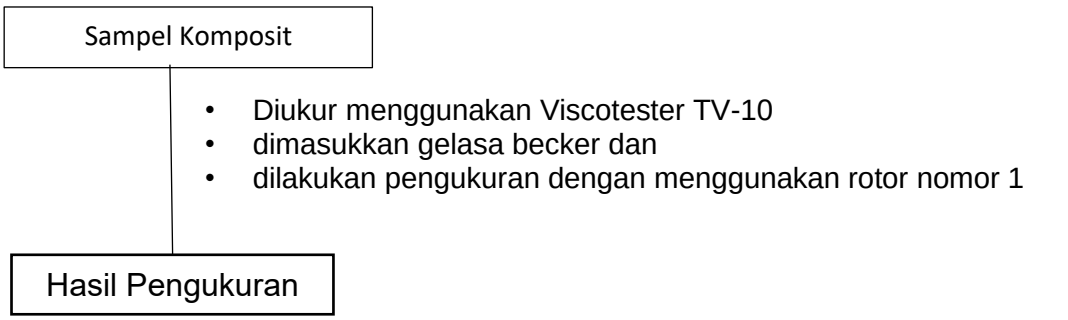
b. Karakterisasi dengan X-ray Diffraction (XRD)



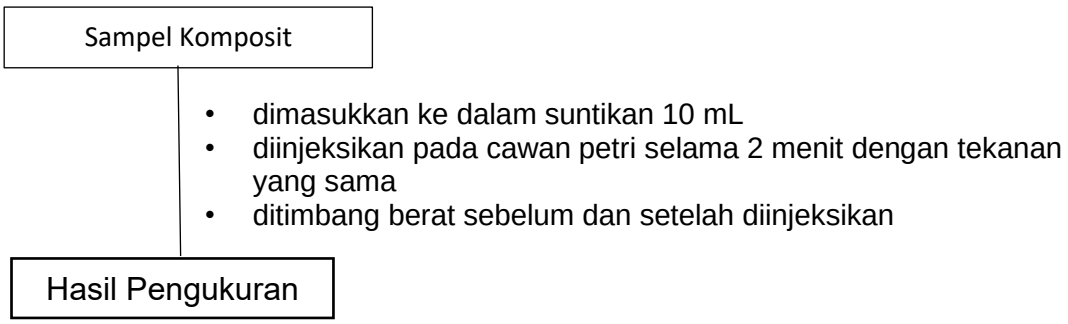
c. Karakterisasi dengan Scanning Electron Microscope



d. Uji Viscositas



e. Uji Injektabilitas



Lampiran 2. Analisis Data

Uji Injektabilitas

Komposit HA/Kolagen/Kitosan	Berat sebelum Injeksi (g)	Berat Setelah Injeksi (g)
70:20:10	9,9939	9,9022
70:15:15	10,2410	101270
70:10:20	10,2462	10,1138

% injeksi = $\frac{Berat\ setelah\ injeksi}{Berat\ sebelum\ injeksi}\ x\ 100\%$

a. %injeksi 70:20:10 = $\frac{9,9022}{9,9939}\ x\ 100\% = 99,08\ \%$

b. %injeksi 70:20:10 = $\frac{10,1270}{10,2410}\ x\ 100\% = 98,88\ \%$

c. %injeksi 70:20:10 = $\frac{10,1138}{10,2462}\ x\ 100\% = 98,71\ \%$

Lampiran 3. Hasil Analisis

Lampiran 3.1 Karakterisasi XRF sampel cangkang telur

LABORATORIUM PENELITIAN DAN PENGEMBANGAN SAINS
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
UNIVERSITAS HASANUDDIN
Jl. Perintis Kemerdekaan Km. 10 Tamalanrea, Makassar 90245
Telp. 0411-586016 • Fax. 0411-588551 • Email : lpps.fmipa.unhas@gmail.com

LAPORAN HASIL PENGUJIAN
CERTIFICATE OF ANALYSIS

Nomor Pekerjaan : LPPS.XJ-2304-1/1

I. Pelanggan / *Principal*

1.1 Nama / *Name*	: Afdaliah Yahya
1.2 Alamat / *Address*	: Universitas Hasanuddin
1.3 Telepon / *Phone*	: 082197772166
1.4 Personil Penghubung / *Contact Person*	: -
1.5 Email / *Email*	: afdaliahyahya57@gmail.com

II. Contoh Uji / *Sample*

2.1 Kode Sampel / *Sampel Code*	: LPPS.X-2304-1/1
2.2 Kemasan / *Packaging*	: Plastik
2.3 Nama Sampel / *Sample Name*	: Cangkang Telur
2.4 Jumlah Sampel / *Number of Sample*	: 1
2.5 Tanggal Sampling / *Date of Sampling*	: -
2.6 Diterima / *Date of Received*	: 3 April 2023
2.7 Tanggal Uji / *Date of Analysis*	: 10 April 2023
2.8 Jenis Uji / *Type of Analysis*	: Unsur dan Oksida

III. Hasil Uji / *Result*

Parameter	Satuan	Hasil
Ca	m/m%	99.37
Si	m/m%	0.2970
Px	m/m%	0.2410
Ti	m/m%	0.0280
Nb	m/m%	0.0178
Mo	m/m%	0.0132
Sn	m/m%	0.0080
In	m/m%	0.0080
Sb	m/m%	0.0069
Te	m/m%	0.0055

Parameter	Satuan	Hasil
CaO	m/m%	98.94
SiO2	m/m%	0.5200
P2O5	m/m%	0.4570
TiO2	m/m%	0.0290
Nb2O5	m/m%	0.0158
MoO3	m/m%	0.0124
SnO2	m/m%	0.0067
In2O3	m/m%	0.0063
Sb2O3	m/m%	0.0055

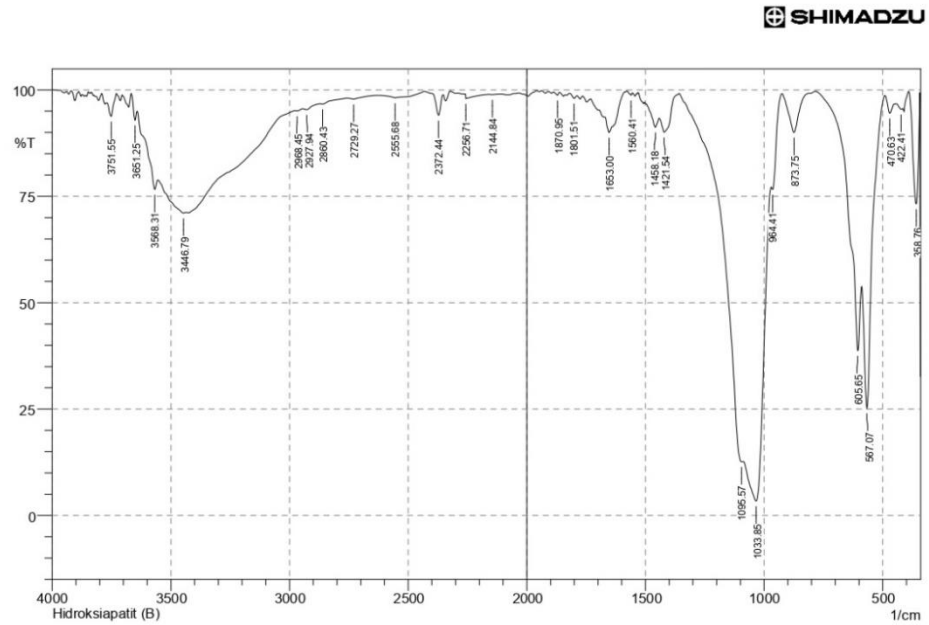
Makassar, 12 April 2023
Penanggung Jawab Mutu

Prof. Dr. Nunuk Hariani Soekamto, MS
NIP. 19601215 198702 2 001

Catatan:
- Hasil Uji hanya berlaku untuk contoh tersebut di atas
- Dilarang mengutip/menyalin sebagian isi hasil uji ini

Lampiran 3.2 Karakterisasi FTIR

Lampiran 3.2.1 Hidroksiapatit sebelum sintering



No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	358.76	73.206	22.466	389.62	345.26	3.324	2.659
2	422.41	95.457	0.394	443.63	416.62	0.48	0.023
3	470.63	94.551	3.122	489.92	451.34	0.659	0.263
4	567.07	25.265	38.381	588.29	491.85	21.062	8.765
5	605.65	38.769	18.602	783.1	590.22	19.88	2.626
6	873.75	90.019	9.279	923.9	785.03	2.386	2.011
7	964.41	76.631	3.394	970.19	925.83	2.483	0.283
8	1033.85	3.419	39.293	1087.85	972.12	98.577	41.16
9	1095.57	12.623	1.935	1357.89	1089.78	54.894	0.284
10	1421.54	90.056	4.647	1440.83	1359.82	2.134	0.824
11	1458.18	91.227	3.097	1494.83	1442.75	1.528	0.349
12	1560.41	98.767	0.636	1579.7	1554.63	0.084	0.03
13	1653	90.001	4.849	1670.35	1589.34	2.264	1.032
14	1801.51	98.036	0.836	1816.94	1788.01	0.194	0.054
15	1870.95	98.745	0.681	1888.31	1861.31	0.1	0.034
16	2144.84	98.901	0.061	2160.27	2108.2	0.239	0.006
17	2256.71	97.964	1.189	2291.43	2160.27	0.751	0.227
18	2372.44	94.018	5.023	2432.24	2353.16	0.734	0.476
19	2555.68	98.136	0.904	2621.26	2432.24	1.144	0.475
20	2729.27	97.837	0.367	2756.28	2623.19	0.981	0.058
21	2860.43	96.696	0.147	2870.08	2758.21	1.237	0.012
22	2927.94	95.361	0.454	2943.37	2872.01	1.247	0.044
23	2968.45	95.087	0.137	2976.16	2945.3	0.651	0.012
24	3446.79	71.055	0.794	3552.88	3437.15	15.23	0.665
25	3568.31	76.591	4.739	3641.6	3554.81	6.281	0.747
26	3651.25	92.918	3.669	3666.68	3641.6	0.525	0.198
27	3751.55	93.776	4.164	3768.91	3730.33	0.689	0.357

Comment;
Hidroksiapatit (B)

Date/Time; 10/20/2023 12:30:49 PM
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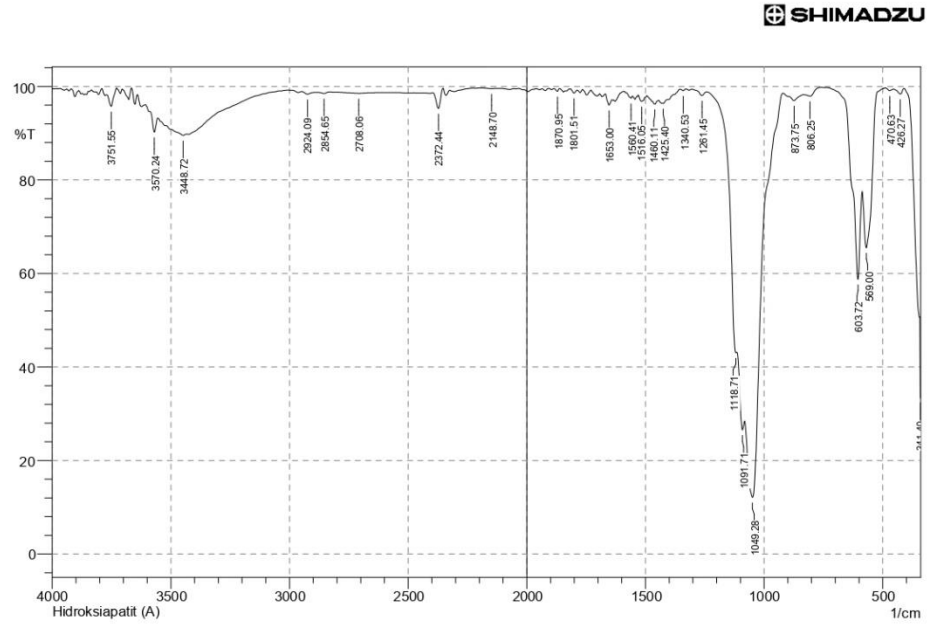
Resolution;
Apodization;

Lampiran 3.2.2 Hidroksiapatit setelah sintering



No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	341.4	33.584	8.706	343.33	339.47	1.82	0.176
2	426.27	98.381	1.152	455.2	408.91	0.199	0.102
3	470.63	99.118	0.451	489.92	455.2	0.097	0.034
4	569	65.544	15.882	586.36	489.92	7.11	2.792
5	603.72	58.781	20.618	738.74	588.29	8.798	2.829
6	806.25	97.945	0.864	833.25	758.02	0.41	0.09
7	873.75	96.989	1.404	920.05	833.25	0.846	0.239
8	1049.28	12.12	30.636	1082.07	921.97	52.461	16.465
9	1091.71	26.548	5.408	1114.86	1083.99	15.182	0.997
10	1118.71	43.04	1.798	1242.16	1114.86	10.934	-12.617
11	1261.45	98.048	0.988	1303.88	1242.16	0.327	0.096
12	1340.53	99.088	0.366	1354.03	1328.95	0.077	0.018
13	1425.4	96.38	0.137	1427.32	1408.04	0.275	0.005
14	1460.11	96.215	1.13	1494.83	1444.68	0.667	0.122
15	1516.05	96.809	0.42	1529.55	1512.19	0.213	0.027
16	1560.41	97.476	0.607	1593.2	1554.63	0.296	0.034
17	1653	96.033	1.612	1670.35	1641.42	0.39	0.106
18	1801.51	98.605	0.758	1816.94	1788.01	0.128	0.049
19	1870.95	98.983	0.583	1886.38	1861.31	0.075	0.028
20	2148.7	99.557	0.064	2183.42	2125.56	0.102	0.008
21	2372.44	95.304	3.909	2397.52	2353.16	0.513	0.349
22	2708.06	98.528	0.221	2831.5	2619.33	1.237	0.086
23	2854.65	98.507	0.283	2889.37	2831.5	0.337	0.029
24	2924.09	98.358	0.48	2949.16	2889.37	0.361	0.054
25	3448.72	89.538	0.509	3498.87	3433.29	2.981	0.077
26	3570.24	90.232	3.655	3589.53	3554.81	1.195	0.251
27	3751.55	95.741	3.099	3768.91	3728.4	0.454	0.267

Comment;
Hidroksiapatit (A)

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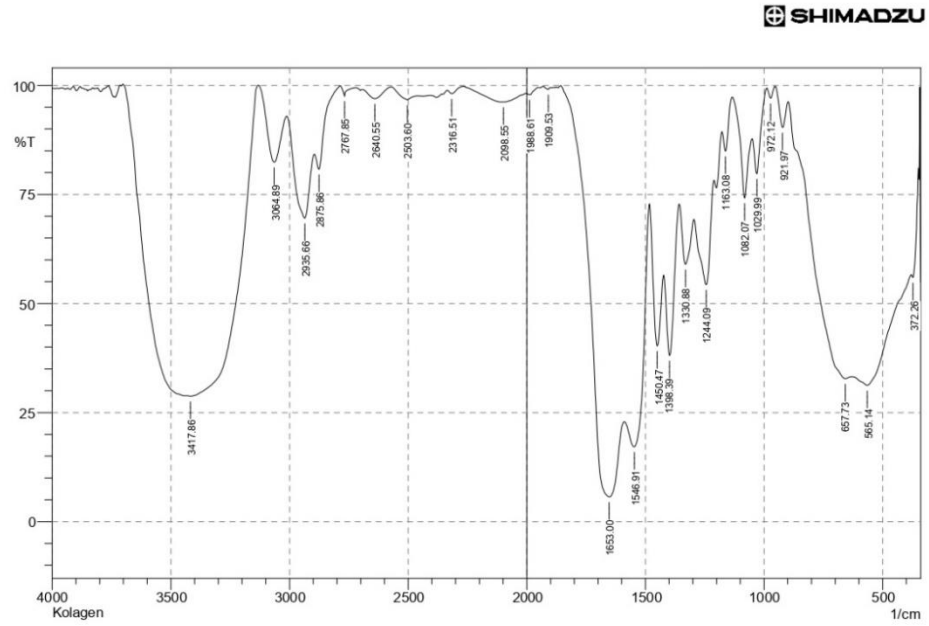
No. of Scans;
Resolution;
Apodization;

Lampiran 3.2.3 Kolagen



No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	372.26	55.954	5.473	378.05	349.12	5.7	0.934
2	565.14	31.256	8.066	630.72	379.98	100.327	9.523
3	657.73	32.775	6.414	896.9	632.65	73.912	9.085
4	921.97	90.363	7.314	954.76	898.83	1.385	0.873
5	972.12	97.072	2.468	987.55	954.76	0.248	0.184
6	1029.99	79.751	11.727	1049.28	989.48	3.184	1.459
7	1082.07	74.219	17.12	1132.21	1051.2	5.487	2.645
8	1163.08	84.947	6.928	1176.58	1134.14	1.884	0.641
9	1244.09	54.316	20.33	1294.24	1211.3	17.076	6.065
10	1330.88	58.976	12.24	1355.96	1296.16	11.657	2.714
11	1398.39	38.091	24.133	1421.54	1357.89	18.643	6.398
12	1450.47	40.313	23.492	1483.26	1423.47	17.644	5.983
13	1546.91	17.162	25.324	1587.42	1485.19	59.336	19.894
14	1653	5.686	35.493	1857.45	1589.34	137.078	59.646
15	1909.53	99.091	0.486	1930.74	1899.88	0.085	0.034
16	1988.61	97.866	0.675	2004.04	1951.96	0.339	0.07
17	2098.55	96.171	2.542	2266.36	2004.04	2.897	1.667
18	2316.51	98.1	1.009	2335.8	2268.29	0.333	0.126
19	2503.6	96.658	1.757	2569.18	2459.24	1.127	0.449
20	2640.55	96.948	2.348	2692.63	2571.11	0.984	0.637
21	2767.85	97.571	2.215	2787.14	2719.63	0.281	0.19
22	2875.86	80.776	6.25	2895.15	2787.14	3.98	0.676
23	2935.66	69.577	17.541	3010.88	2897.08	12.369	6.244
24	3064.89	82.383	13.687	3130.47	3012.81	5.733	3.836
25	3417.86	28.753	3.77	3433.29	3132.4	111.573	31.087

Comment;
Kolagen

Date/Time; 3/28/2024 10:08:39 AM
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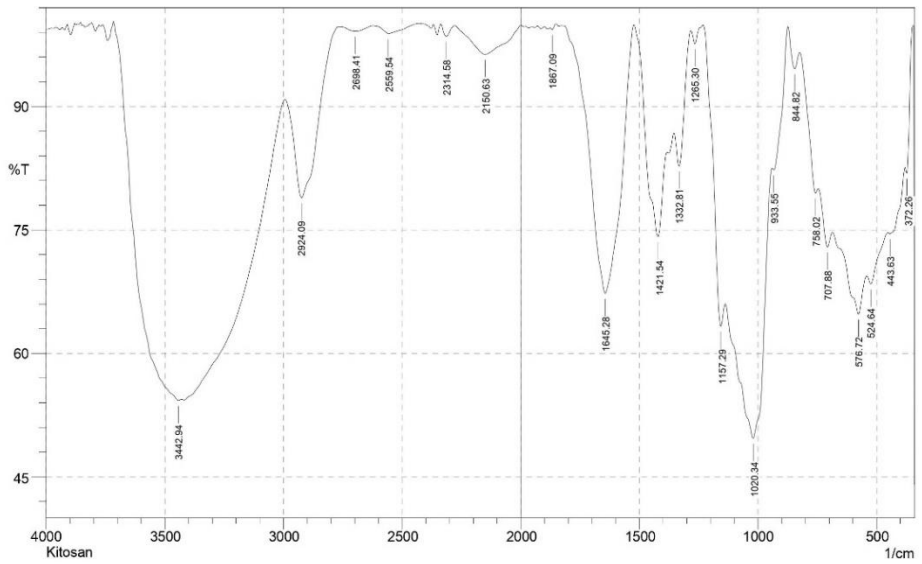
Resolution;
Apodization;

Lampiran 3.2.4 Kitosan

SHIMADZU

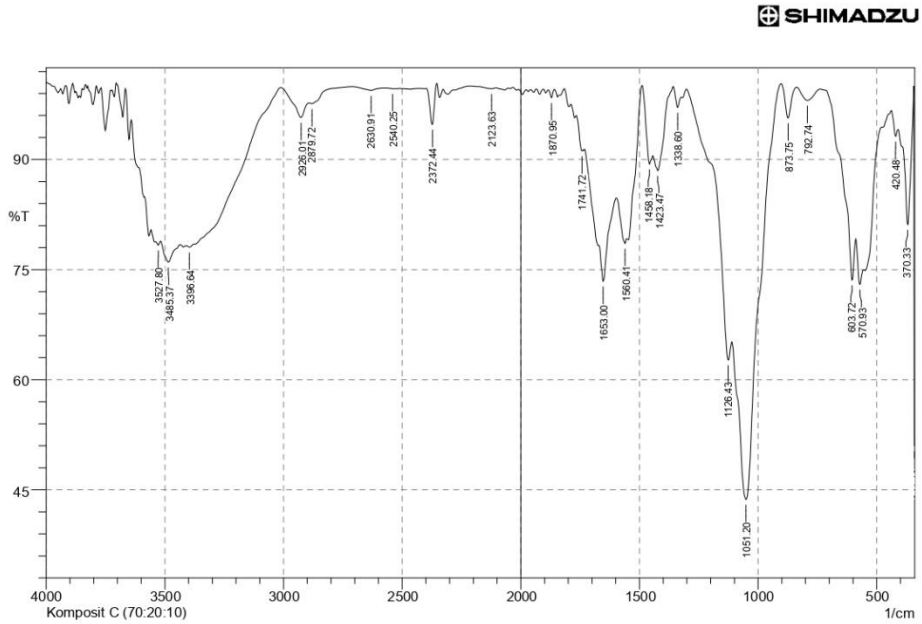


No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	372.26	81.899	3.664	378.05	345.26	1.395	0.229
2	443.63	74.535	0.984	451.34	379.98	8.086	0.639
3	524.64	68.435	1.899	540.07	453.27	12.712	0.366
4	576.72	64.78	5.917	684.73	542	22.719	2.334
5	707.88	72.935	3.72	744.52	686.66	7.093	0.601
6	758.02	79.489	3.013	823.6	746.45	4.659	0.34
7	844.82	94.592	3.309	873.75	823.6	0.833	0.422
8	933.55	82.287	2.166	941.26	873.75	3.617	0.752
9	1020.34	49.661	26.119	1136.07	941.26	44.954	19.305
10	1157.29	63.305	9.774	1230.58	1138	9.913	1.694
11	1265.3	97.647	1.824	1282.66	1232.51	0.25	0.157
12	1332.81	82.753	7.807	1354.03	1284.59	3.477	1.281
13	1421.54	74.181	14.552	1521.84	1382.96	10.502	5.308
14	1645.28	67.289	32.613	1818.87	1523.76	23.254	23.114
15	1867.09	99.335	0.406	1876.74	1851.66	0.041	0.019
16	2150.63	96.343	3.506	2277.93	2000.18	2.591	2.41
17	2314.58	98.516	1.428	2337.72	2277.93	0.203	0.183
18	2559.54	98.823	1.028	2607.76	2428.38	0.434	0.38
19	2698.41	99.163	0.596	2765.92	2623.19	0.343	0.196
20	2924.09	78.91	14.666	2991.59	2773.64	12.362	7.701
21	3442.94	54.274	2.01	3714.9	3431.36	50.011	12.509

Comment;
Kitosan

Date/Time; 3/28/2024 10:13:28 AM
No. of Scans;
Resolution;
Apodization;

Lampiran 3.2.5 Komposit hidroksiapatit/kolagen/kitosan 70:20:10



No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	341.4	50.971	25.01	343.33	339.47	1.113	0.29
2	370.33	81.143	15.393	408.91	345.26	3.189	2.102
3	420.48	93.178	1.831	437.84	410.84	0.664	0.108
4	570.93	72.989	3.832	586.36	557.43	3.674	0.356
5	603.72	73.606	7.693	736.81	588.29	7.265	0.77
6	792.74	98.058	1.682	837.11	738.74	0.502	0.385
7	873.75	95.676	4.447	902.69	837.11	0.508	0.535
8	1051.2	43.704	31.261	1109.07	902.69	34.436	15.746
9	1126.43	62.696	5.271	1300.02	1111	13.608	0.621
10	1338.6	97.106	2.025	1357.89	1323.17	0.266	0.146
11	1423.47	88.498	4.185	1442.75	1359.82	2.4	0.684
12	1458.18	89.389	4.131	1487.12	1444.68	1.365	0.404
13	1560.41	78.588	1.374	1597.06	1554.63	3.876	0.189
14	1653	73.432	14.033	1730.15	1598.99	11.882	4.561
15	1741.72	91.172	0.738	1766.8	1737.86	0.88	0.049
16	1870.95	98.421	1.107	1884.45	1859.38	0.105	0.053
17	2123.63	99.662	0.138	2216.21	2104.34	0.081	0.022
18	2372.44	94.789	5.321	2399.45	2355.08	0.471	0.478
19	2540.25	99.642	0.069	2574.97	2511.32	0.085	0.006
20	2630.91	99.4	0.425	2711.92	2574.97	0.194	0.1
21	2879.72	97.616	0.242	2893.22	2711.92	0.647	-0.3
22	2926.01	95.739	2.531	3012.81	2893.22	1.211	0.548
23	3396.64	78.064	0.289	3410.15	3375.43	3.698	0.026
24	3485.37	76.006	2.66	3516.23	3437.15	8.853	0.588
25	3527.8	78.348	0.486	3537.45	3518.16	2.018	0.026

Comment;
Komposit C (70:20:10)

Date/Time; 12/27/2023 11:43:17 AM
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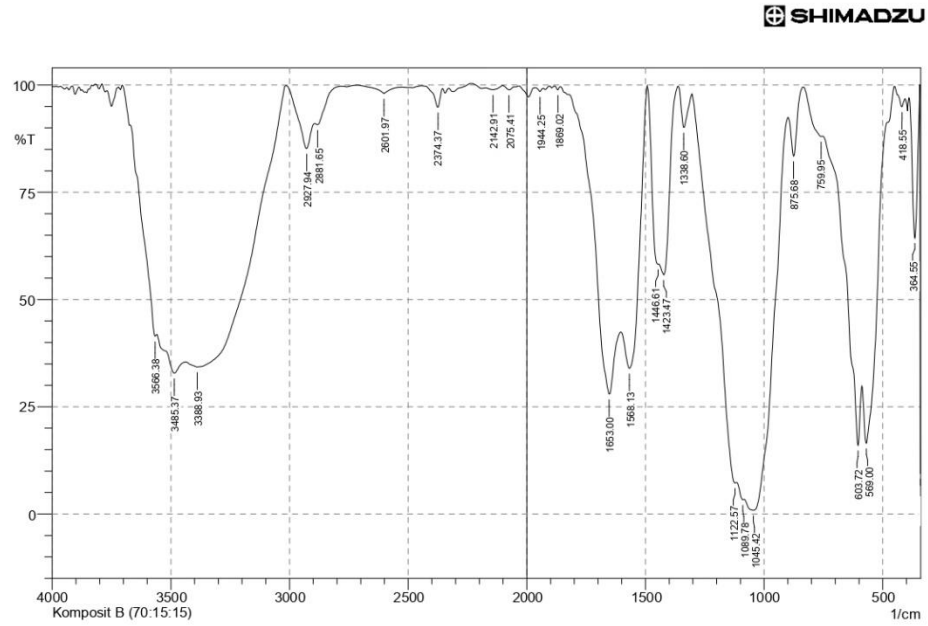
Resolution;
Apodization;

Lampiran 3.2.6 Komposit hidroksiapatit/kolagen/kitosan 70:15:15



No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	341.4	9.432	45.369	343.33	339.47	3.952	0.991
2	364.55	64.384	32.076	387.69	345.26	4.47	3.808
3	418.55	94.944	2.265	437.84	405.05	0.545	0.154
4	569	16.516	23.211	586.36	480.28	41.624	13.279
5	603.72	16.051	19.232	752.24	588.29	46.27	6.355
6	759.95	88.02	0.853	835.18	754.17	2.865	0.521
7	875.68	83.46	11.436	896.9	837.11	2.397	1.338
8	1045.42	0.864	20.342	1082.07	898.83	167.791	40.694
9	1089.78	3.331	0.823	1114.86	1083.99	41.391	1.142
10	1122.57	7.236	2.906	1303.88	1116.78	72.531	0.61
11	1338.6	90.107	8.793	1361.74	1305.81	1.434	1.115
12	1423.47	55.761	12.587	1442.75	1363.67	10.889	2.419
13	1446.61	58.26	1.679	1492.9	1444.68	6.485	0.806
14	1568.13	33.969	27.229	1604.77	1492.9	34.486	13.591
15	1653	27.955	25.372	1857.45	1604.77	53.334	13.626
16	1869.02	98.898	0.786	1882.52	1859.38	0.068	0.037
17	1944.25	98.485	0.8	1963.53	1930.74	0.146	0.046
18	2075.41	98.894	0.848	2100.48	2050.33	0.15	0.094
19	2142.91	98.927	0.63	2173.78	2100.48	0.246	0.119
20	2374.37	94.832	4.475	2441.88	2355.08	0.743	0.547
21	2601.97	97.996	1.697	2713.84	2526.75	0.656	0.444
22	2881.65	90.763	1.154	2893.22	2781.35	1.921	0.113
23	2927.94	85.2	8.275	3012.81	2895.15	4.464	1.989
24	3388.93	34.302	8.504	3437.15	3014.74	123.351	28.604
25	3485.37	32.814	5.113	3558.67	3439.08	53.046	3.424
26	3566.38	41.455	2.931	3670.54	3560.59	22.062	0.341

Comment;
Komposit B (70:15:15)

Date/Time; 12/27/2023 11:37:28 AM
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Resolution;
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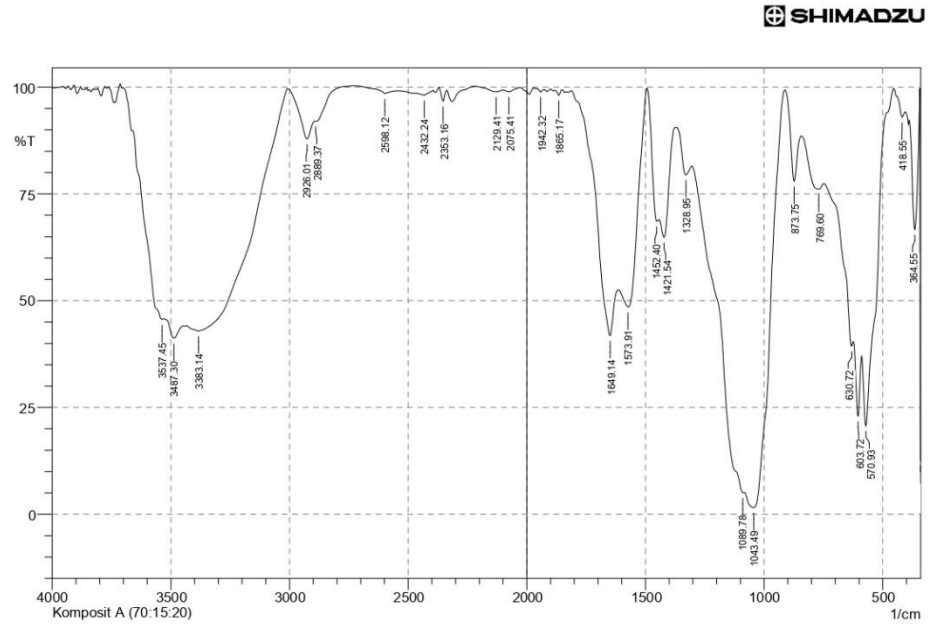
Lampiran 3.2.7 Komposit hidroksiapatit/kolagen/kitosan 70:10:20



No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	341.4	12.71	43.637	343.33	339.47	3.438	0.872
2	364.55	66.674	26.924	387.69	345.26	4.645	3.412
3	418.55	92.951	2.822	453.27	405.05	0.882	0.23
4	570.93	20.729	24.384	588.29	455.2	34.568	9.434
5	603.72	22.995	15.23	623.01	590.22	17.061	3.43
6	630.72	39.394	2.764	746.45	624.94	25.123	0.279
7	769.6	76.108	3.832	840.96	748.38	9.065	1.419
8	873.75	77.968	15.483	910.4	842.89	4.091	2.156
9	1043.49	1.57	24.934	1082.07	912.33	134.67	34.863
10	1089.78	5.041	2.092	1303.88	1083.99	111.194	0.421
11	1328.95	79.475	5.321	1369.46	1305.81	5.028	0.818
12	1421.54	64.853	10.438	1440.83	1375.25	8.229	1.739
13	1452.4	68.586	6.305	1492.9	1442.75	4.978	0.879
14	1573.91	48.563	19.925	1614.42	1494.83	24.6	8.086
15	1649.14	41.824	18.535	1811.16	1616.35	31.741	7.001
16	1865.17	98.112	1.184	1880.6	1849.73	0.163	0.068
17	1942.32	98.869	0.7	1971.25	1926.89	0.118	0.046
18	2075.41	98.93	0.607	2100.48	2029.11	0.209	0.092
19	2129.41	98.904	0.641	2220.07	2100.48	0.265	0.149
20	2353.16	96.731	2.835	2370.51	2337.72	0.254	0.195
21	2432.24	98.081	0.873	2480.46	2393.66	0.557	0.146
22	2598.12	98.463	1.003	2727.35	2542.18	0.433	0.192
23	2889.37	91.986	0.101	2891.3	2729.27	1.527	0.022
24	2926.01	87.864	6.281	3008.95	2893.22	3.516	1.311
25	3383.14	42.921	7.776	3433.29	3010.88	97.267	22.174
26	3487.3	41.215	3.673	3527.8	3448.72	28.788	1.272
27	3537.45	45.626	2.562	3701.4	3529.73	28.789	1.609

Comment;
Komposit A (70:15:20)

Date/Time; 12/27/2023 11:31:44 AM
No. of Scans;
Resolution;
Apodization;

Lampiran 3.3 Karakterisasi XRD

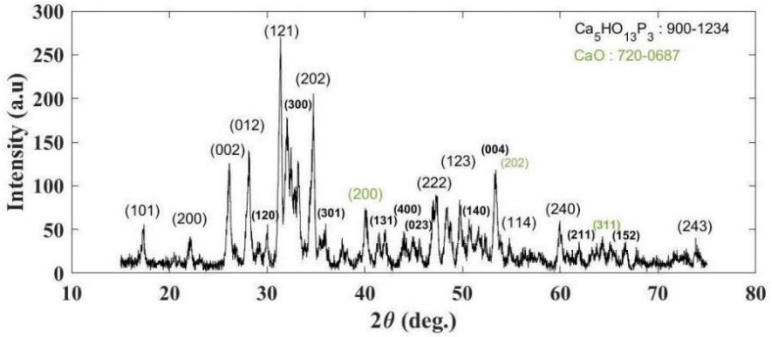
Lampiran 3.3.1 Hidroksiapatit

A: Calcium oxide

Formula sum	Ca O
Entry number	96-720-0687
Total number of peaks	13
Space group	F m -3 m
Crystal system	cubic
Unit cell	a= 4.8107 Å
I/cor	5.16
Calc. density	3.345 g/cm³
Reference	Verbraeken Maarten C., Suard Emmanuelle, Irvine John T. S., "Structural and electrical properties of calcium and strontium hydrides", Journal of Materials Chemistry **19(18)**, 2766 (2009)

B: Hydroxylapatite

Formula sum	Ca5 H O13 P3
Entry number	96-900-1234
Total number of peaks	134
Space group	P 63/m
Crystal system	hexagonal
Unit cell	a= 9.4166 Å,c= 6.8745 Å
I/cor	1.60
Calc. density	3.160 g/cm³
Reference	Hughes J.M, Cameron M, Crowley K.D, "Structural variations in natural F, OH, and Cl apatites Locality: Holly Springs, Georgia, USA", American Mineralogist **74**, 870-876 (1989)



*** Basic Data Process ***

Group : Standard
Data : unnamed

Strongest 3 peaks

no.	peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	12	31.3221	2.85353	100	0.35080	154	2878
2	19	34.6688	2.58535	66	0.36770	101	1739
3	13	32.0400	2.79122	62	0.54660	95	2116

Peak Data List

peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	17.2983	5.12224	16	0.29670	24	404
2	20.5250	4.32368	4	0.21000	6	76
3	22.0916	4.02049	12	0.44330	18	408
4	23.1100	3.84557	3	0.30000	5	91
5	23.3000	3.81464	3	0.08000	5	38
6	26.0833	3.41355	47	0.35330	72	1438
7	26.7800	3.32631	5	0.32000	8	201
8	28.0912	3.17396	51	0.38250	78	1510
9	28.4200	3.13798	10	0.14660	15	141
10	29.1200	3.06412	6	0.36000	10	167
11	29.9500	2.98107	14	0.26000	22	321
12	31.3221	2.85353	100	0.35080	154	2878
13	32.0400	2.79122	62	0.54660	95	2116
14	32.4400	2.75771	44	0.48000	67	1430
15	32.8200	2.72664	29	0.00000	44	0
16	33.1800	2.69787	41	0.27120	63	1316
17	33.8700	2.64447	3	0.06000	5	25
18	34.3200	2.61082	23	0.18660	35	399
19	34.6688	2.58535	66	0.36770	101	1739
20	35.4000	2.53361	8	0.32000	13	223
21	35.8566	2.50238	12	0.31330	19	319
22	36.2616	2.47536	4	0.10330	6	39
23	37.6533	2.38700	10	0.26670	15	239
24	38.1500	2.35706	6	0.26000	10	149
25	39.4500	2.28233	5	0.26000	8	133
26	40.0716	2.24835	26	0.39670	40	861
27	41.4050	2.17897	14	0.29000	21	381
28	42.0166	2.14866	16	0.27330	25	443
29	43.9933	2.05659	11	0.42670	17	328
30	44.2400	2.04569	5	0.32000	8	131
31	44.9100	2.01672	9	0.38000	14	298
32	45.5625	1.98934	10	0.19500	16	165
33	45.8150	1.97896	3	0.15000	5	49
34	46.9600	1.93334	28	0.31340	43	764
35	47.3200	1.91947	32	0.28000	49	761
36	48.3410	1.88129	27	0.38200	41	792
37	48.7600	1.86610	19	0.22000	29	398
38	49.7058	1.83278	28	0.28170	43	711
39	50.1000	1.81928	7	0.12000	11	116
40	50.7033	1.79904	15	0.35330	23	457
41	51.2400	1.78145	3	0.00000	5	0
42	51.5800	1.77050	12	0.32000	18	306
43	51.8850	1.76081	7	0.17000	11	97
44	52.2783	1.74849	11	0.22330	17	191
45	53.3225	1.71668	43	0.37500	66	1296
46	53.8700	1.70052	10	0.28000	15	241
47	54.7800	1.67440	9	0.24000	14	220
48	56.1700	1.63622	4	0.14000	6	54
49	56.4400	1.62903	3	0.12000	5	43

peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
50	57.8150	1.59351	4	0.21000	6	128
51	59.8900	1.54317	20	0.30000	31	562
52	60.6700	1.52518	5	0.14000	7	70
53	61.8666	1.49852	8	0.25330	12	185
54	63.2350	1.46935	5	0.27000	8	115
55	63.7000	1.45974	7	0.18000	11	104
56	64.2300	1.44897	9	0.34000	14	221
57	65.1067	1.43156	8	0.24000	13	183
58	65.5100	1.42372	6	0.18000	9	92
59	66.6100	1.40285	9	0.42000	14	306
60	67.7650	1.38172	6	0.23000	9	163
61	71.6600	1.31589	4	0.40000	6	175
62	72.3600	1.30488	3	0.24000	5	88
63	72.7700	1.29853	5	0.14000	8	104
64	73.8133	1.28274	9	0.26670	14	216
65	74.2500	1.27627	5	0.18000	7	78

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        ***  Basic Data Process  ***

# Data Infomation
          Group               : Standard
          Data                : unnamed
          Sample Nmae         : serbuk
          Comment             :
          Date & Time         : 08-19-23 15:03:28

# Measurement Condition
    X-ray tube
          target              : Cu
          voltage             : 40.0 (kV)
          current             : 30.0 (mA)
    Slits
          Auto Slit           : not Used
          divergence slit     :   1.00000 (deg)
          scatter slit        :   1.00000 (deg)
          receiving slit      :   0.30000(mm)
    Scanning
          drive axis          : Theta-2Theta
          scan range          :   15.0000 - 75.0000 (deg)
          scan mode           : Continuous Scan
          scan speed          :    2.0000 (deg/min)
          sampling pitch      :    0.0200 (deg)
          preset time         :    0.60 (sec)

# Data Process Condition
    Smoothing                 [ AUTO ]
          smoothing points    : 19
    B.G.Subtruction           [ AUTO ]
          sampling points     : 19
          repeat times        : 30
    Ka1-a2 Separate           [ MANUAL ]
          Ka1 a2 ratio        : 50 (%)
    Peak Search               [ AUTO ]
          differential points : 19
          FWHM threhold       : 0.050 (deg)
          intensity threhold  : 30 (par mil)
          FWHM ratio  (n-1)/n : 2
    System error Correction   [ NO ]
    Precise peak Correction   [ NO ]
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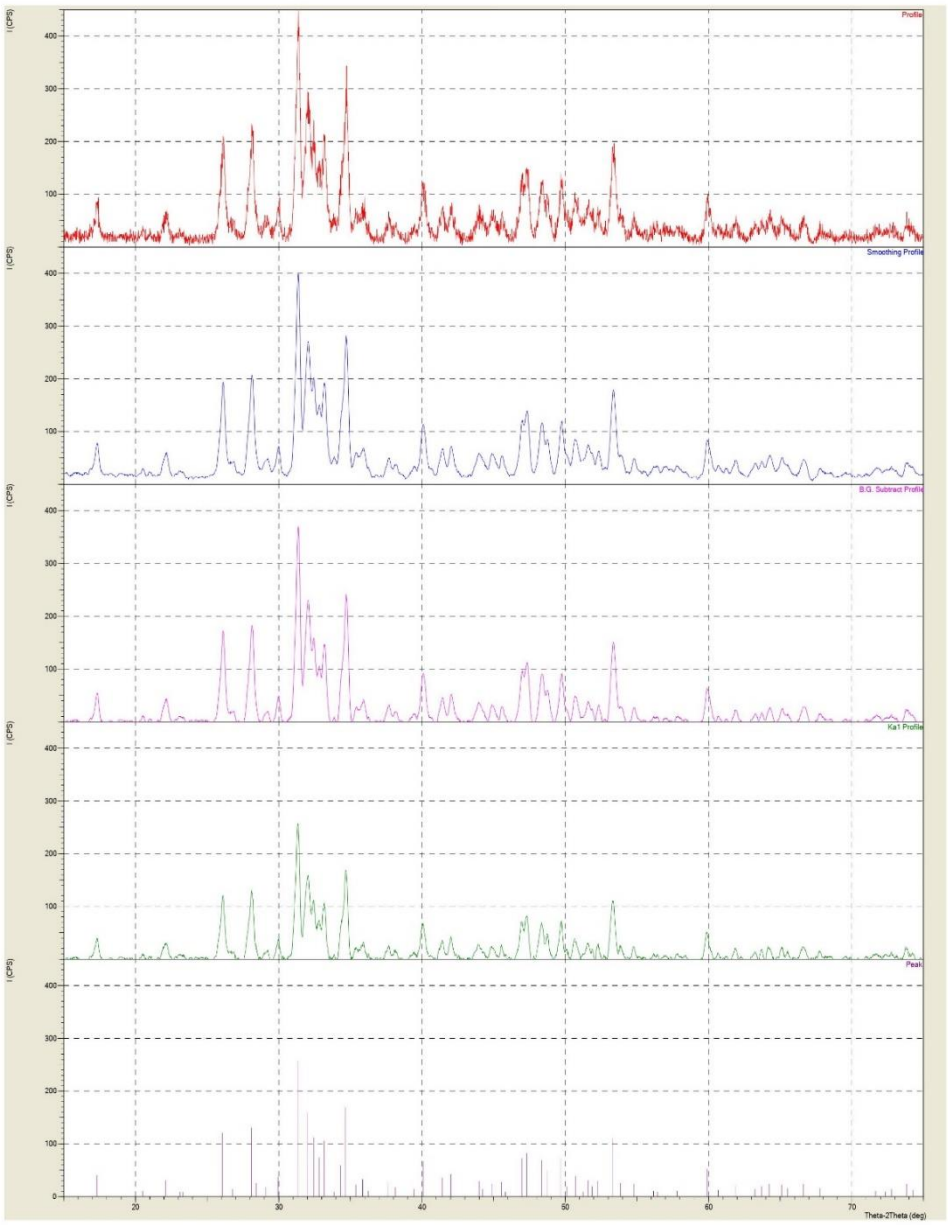
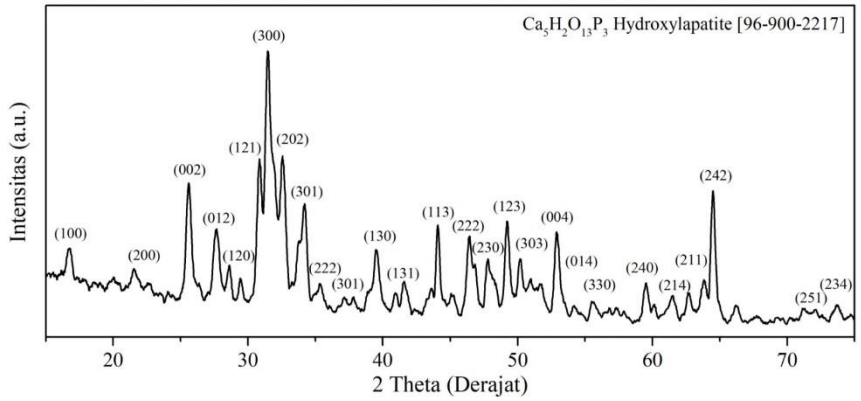


Lampiran 3.3.2 hidroksiapatit/kolagen/kitosan 70:10:20

XRD Pattern



Percentage

Hydroxyapatite = ~96%

References

Formula sum	Ca5 H2 O13 P3
Entry number	96-900-2217
Figure-of-Merit (FoM)	0.867074
Total number of peaks	134
Peaks in range	73
Peaks matched	63
Intensity scale factor	1.00
Space group	P 63/m
Crystal system	hexagonal
Unit cell	a= 9.4232 A c= 6.8833 A
I/Icor	1.59
Calc. density	3.157 g/cm³
Reference	Wilson R. M, Elliot J. C., Dowker S. E. P., "Rietveld refinement of the crystallographic structure of human dental enamel apatites Sample: Prep.63b, synthetic", American Mineralogist **84**, 1406-1414 (1999)

*** Basic Data Process ***

Group : Standard
Data : komp#hidr#kit#kola

Strongest 3 peaks

no.	peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	17	31.4200	2.84487	100	0.40660	78	2157
2	52	64.4440	1.44467	62	0.32000	48	868
3	19	32.5120	2.75176	56	0.54400	44	1567

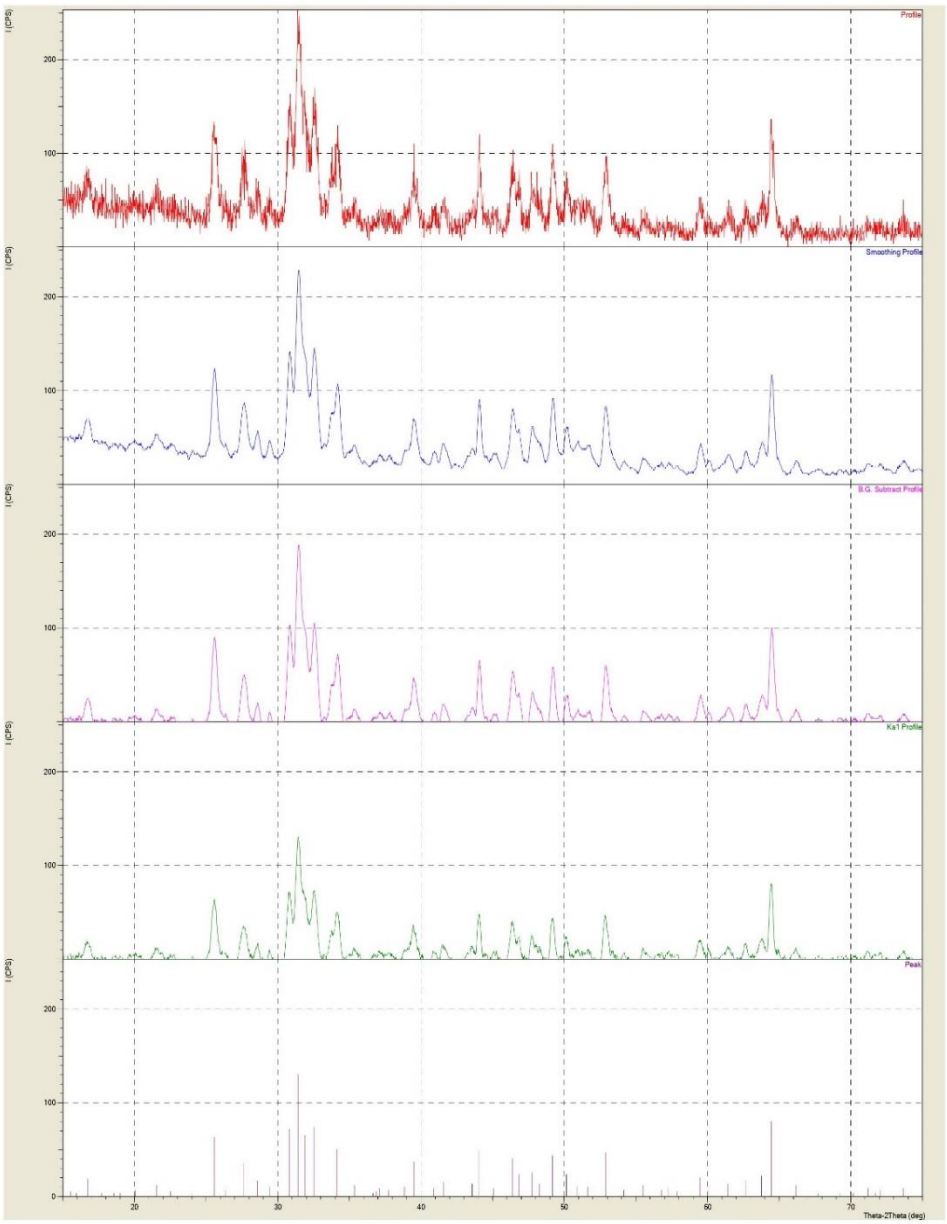
Peak Data List

peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	15.5600	5.69034	4	0.04000	3	18
2	15.9600	5.54862	3	0.04000	2	10
3	16.7350	5.29336	14	0.45000	11	295
4	17.7250	4.99988	3	0.05000	2	10
5	18.5600	4.77678	3	0.16000	2	26
6	19.0000	4.66714	3	0.08000	2	15
7	20.0500	4.42503	5	0.10000	4	59
8	21.5600	4.11841	9	0.28000	7	181
9	22.5400	3.94151	4	0.04000	3	20
10	24.0450	3.69811	3	0.03000	2	7
11	25.5800	3.47956	49	0.42000	38	880
12	26.3400	3.38087	5	0.16000	4	57
13	27.6350	3.22531	27	0.47000	21	535
14	28.5700	3.12184	13	0.26000	10	136
15	29.4200	3.03355	8	0.12000	6	49
16	30.8000	2.90071	55	0.33340	43	846
17	31.4200	2.84487	100	0.40660	78	2157
18	31.9000	2.80315	50	0.00000	39	0
19	32.5120	2.75176	56	0.54400	44	1567
20	34.1150	2.62604	38	0.51000	30	912
21	35.3700	2.53569	9	0.30000	7	156
22	36.6600	2.44937	3	0.04000	2	15
23	36.8700	2.43590	4	0.10000	3	24
24	37.0950	2.42164	6	0.17000	5	75
25	37.7500	2.38111	5	0.26000	4	100
26	38.8600	2.31561	8	0.24000	6	107
27	39.5000	2.27956	28	0.40000	22	501
28	40.8950	2.20496	6	0.17000	5	64
29	41.5900	2.16970	12	0.38000	9	177
30	43.5700	2.07558	10	0.26000	8	164
31	44.0516	2.05400	37	0.28330	29	462
32	45.0600	2.01035	6	0.12000	5	73
33	46.4033	1.95523	31	0.40670	24	475
34	46.8200	1.93880	18	0.24000	14	188
35	47.7550	1.90300	19	0.29000	15	283
36	48.2700	1.88389	10	0.14000	8	91
37	49.1875	1.85087	33	0.32500	26	447
38	50.1550	1.81741	18	0.29000	14	226
39	50.9200	1.79189	8	0.32000	6	146
40	51.6600	1.76795	8	0.20000	6	110
41	52.8908	1.72967	36	0.39170	28	583
42	54.1500	1.69239	5	0.18000	4	43
43	55.4950	1.65451	9	0.17000	7	118
44	56.8100	1.61929	5	0.18000	4	77
45	57.2700	1.60738	6	0.14000	5	75
46	57.8800	1.59188	4	0.12000	3	39
47	59.4650	1.55318	15	0.41000	12	268
48	60.0850	1.53862	9	0.15000	7	72
49	61.4300	1.50812	10	0.34000	8	199

peak no.	2Theta (deg)	d (A)	I/I1	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
50	62.6600	1.48144	13	0.28000	10	171
51	63.7700	1.45830	17	0.42000	13	348
52	64.4440	1.44467	62	0.32000	48	868
53	66.1600	1.41130	9	0.20000	7	128
54	67.7400	1.38217	3	0.08000	2	24
55	69.2400	1.35585	3	0.28000	2	50
56	70.1800	1.33997	3	0.04000	2	14
57	71.1900	1.32342	6	0.26000	5	106
58	71.7000	1.31526	3	0.00000	2	0
59	72.0500	1.30973	5	0.22000	4	74
60	73.6700	1.28488	6	0.22000	5	94

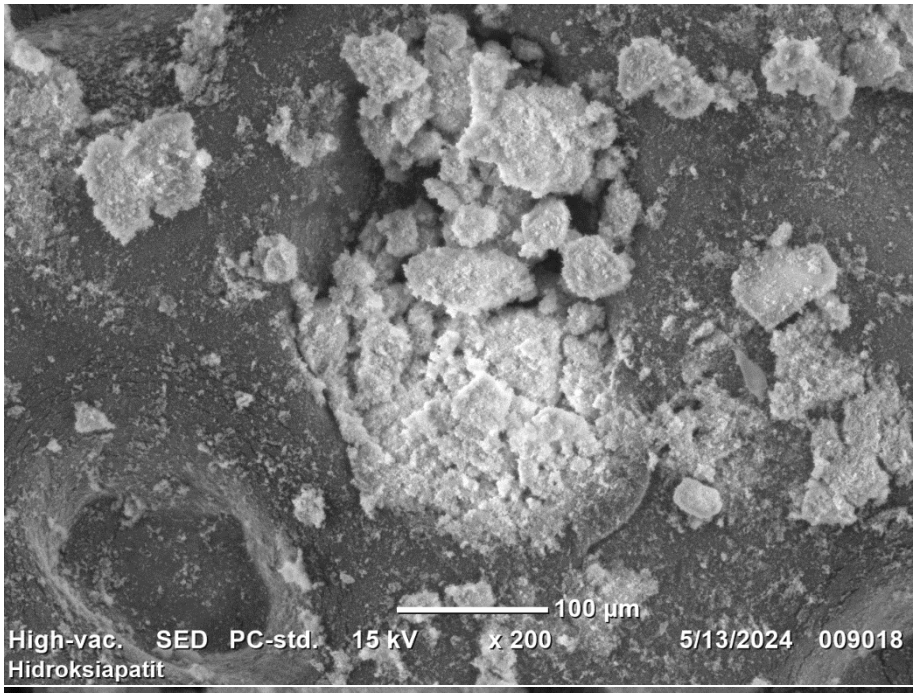
```
        ***  Basic Data Process  ***

# Data Infomation
          Group               : Standard
          Data                : komp#hidr#kit#kola
          Sample Nmae         : powder
          Comment             :
          Date & Time         : 03-16-24 10:00:55

# Measurement Condition
    X-ray tube
          target              : Cu
          voltage             : 40.0 (kV)
          current             : 30.0 (mA)
    Slits
          Auto Slit           : not Used
          divergence slit     :   1.00000 (deg)
          scatter slit        :   1.00000 (deg)
          receiving slit      :   0.30000(mm)
    Scanning
          drive axis          : Theta-2Theta
          scan range          :   15.0000 - 75.0000 (deg)
          scan mode           : Continuous Scan
          scan speed          :    2.0000 (deg/min)
          sampling pitch      :    0.0200 (deg)
          preset time         :    0.60 (sec)

# Data Process Condition
    Smoothing                 [ AUTO ]
          smoothing points    : 25
    B.G.Subtruction           [ AUTO ]
          sampling points     : 43
          repeat times        : 30
    Ka1-a2 Separate           [ MANUAL ]
          Ka1 a2 ratio        : 50 (%)
    Peak Search               [ AUTO ]
          differential points : 35
          FWHM threhold       : 0.050 (deg)
          intensity threhold  : 30 (par mil)
          FWHM ratio  (n-1)/n : 2
    System error Correction   [ NO ]
    Precise peak Correction   [ NO ]
```

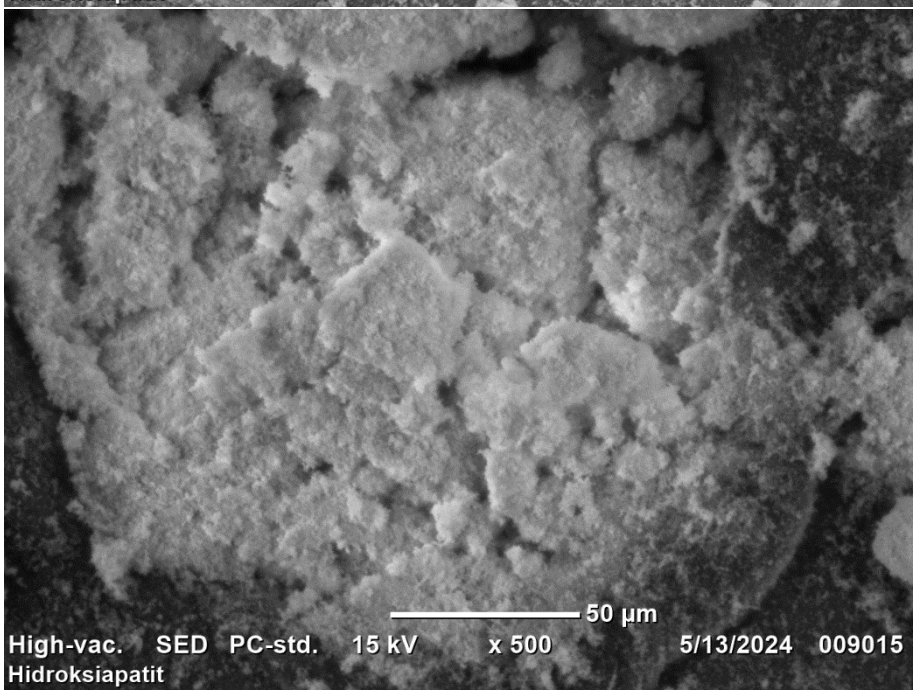
< Group: Standard Data: komp#hidr#kit#kola >

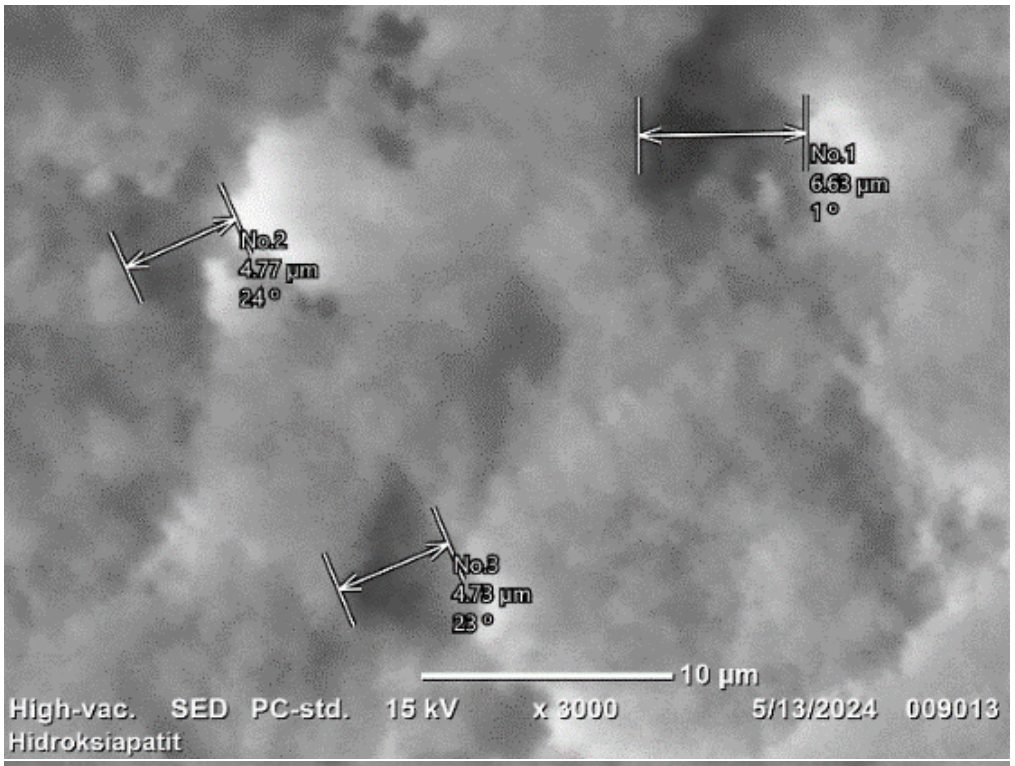


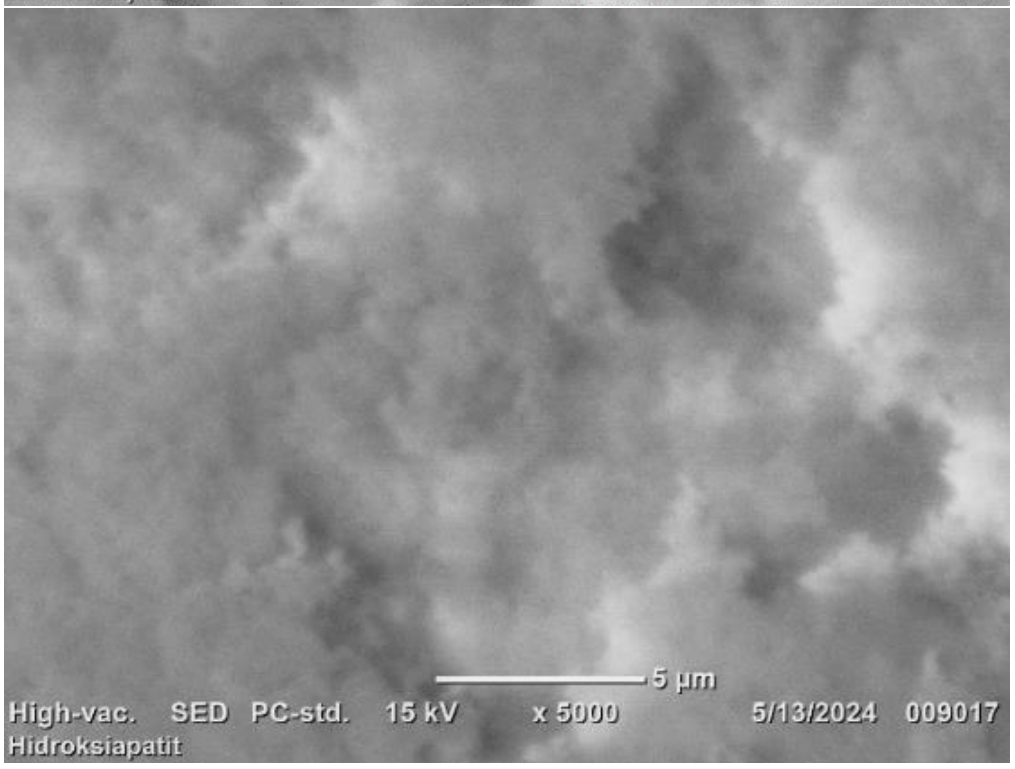
Lampiran 3.4 Karakterisasi SEM

Lampiran 3.4.1 Hidroksiapatit





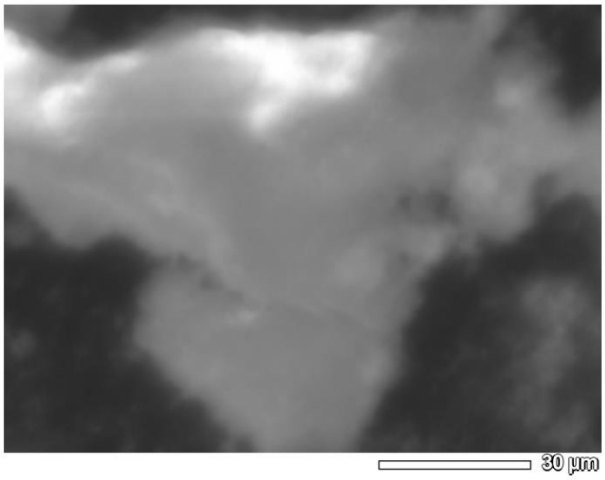

No.1
6.63 µm
1 °
No.2
4.77 µm
24 °
No.3
4.73 µm
23 °
10 µm
High-vac. SED PC-std. 15 kV x 3000 5/13/2024 009013
Hidroksiapatit


5 µm
High-vac. SED PC-std. 15 kV x 5000 5/13/2024 009017
Hidroksiapatit

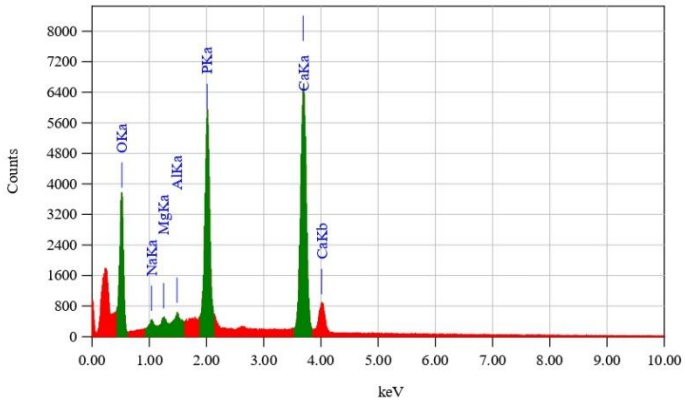
EDS Hidroksiapatit

View000

JEOL 1/1



Title	: IMG1
Instrument	: JCM-6000PLUS
Volt	: 15.00 kV
Mag.	: x 1,000
Date	: 2024/05/07
Pixel	: 512 x 384



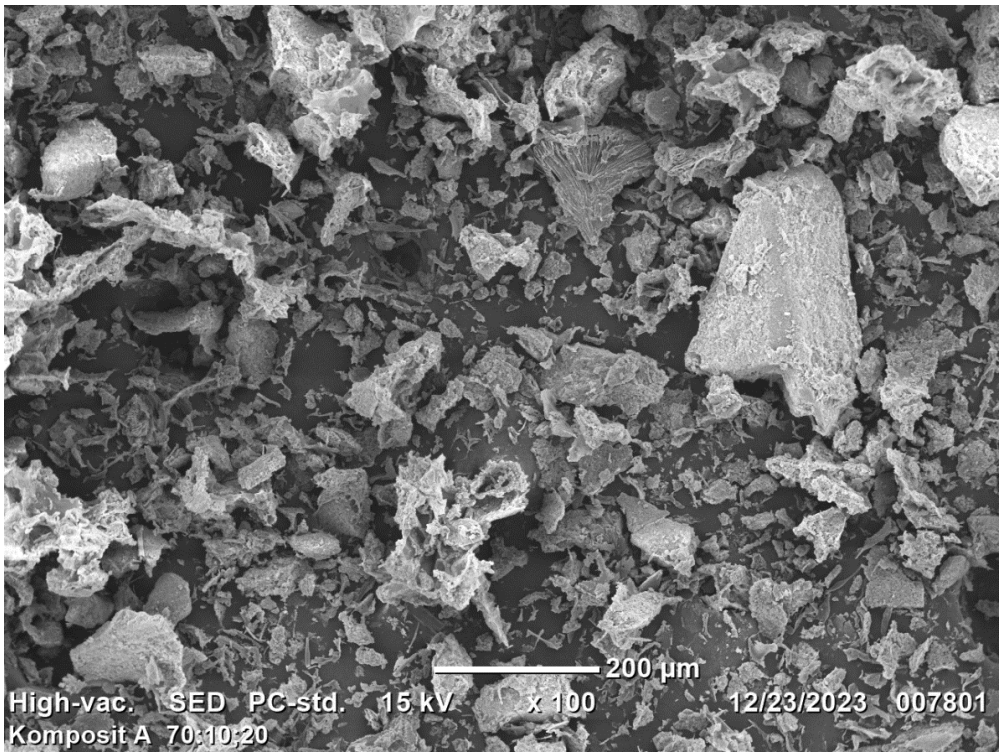
Acquisition Parameter

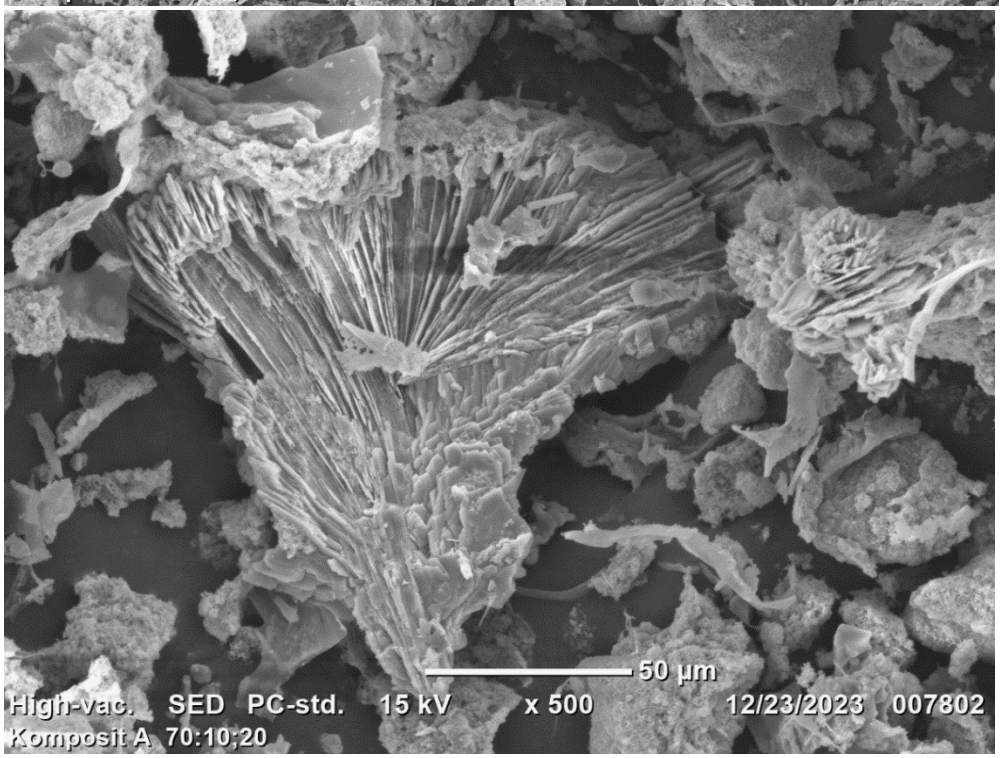
Instrument	: JCM-6000PLUS
Acc. Voltage	: 15.0 kV
Probe Current	: 1.00000 nA
PHA mode	: T3
Real Time	: 51.19 sec
Live Time	: 50.00 sec
Dead Time	: 2 %
Counting Rate	: 6700 cps
Energy Range	: 0 - 20 keV

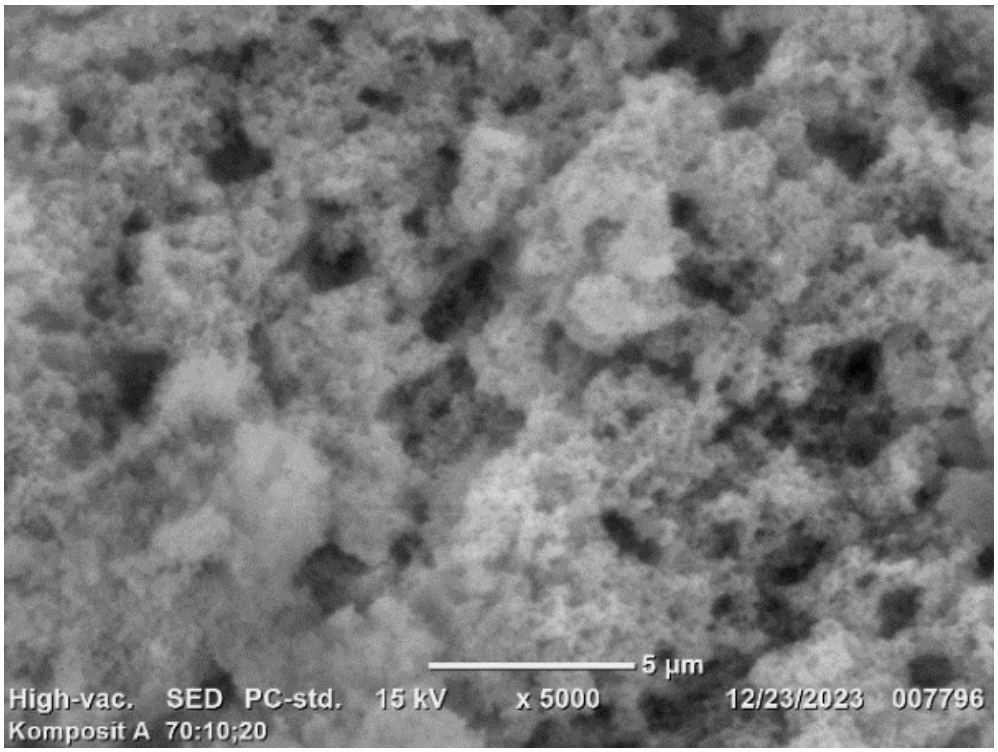
Thin Film Standardless Standardless Quantitative Analysis
Fitting Coefficient : 0.0775

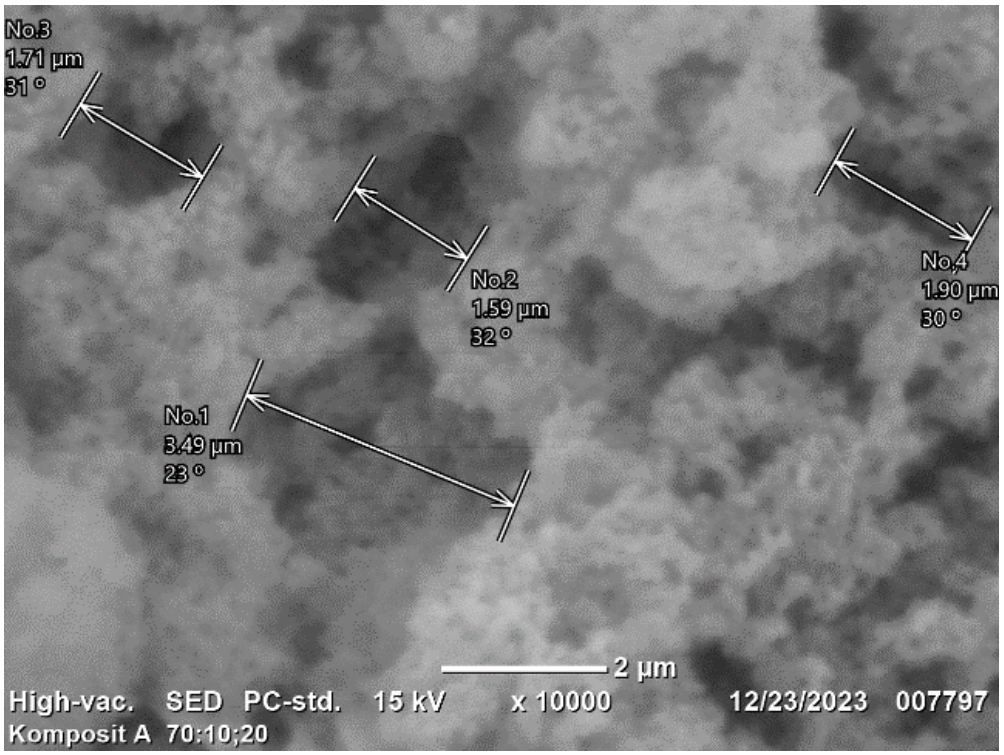
Element	(keV)	Mass%	Counts	Sigma	Atom%	Compound	Mass%	Cation	K
O K	0.525	11.90	19097.95	0.10	23.41				0.7260
Na K	1.041	0.59	1234.14	0.03	0.81				0.5593
Mg K	1.253	0.71	1522.25	0.04	0.92				0.5454
Al K	1.486	0.74	1509.25	0.04	0.87				0.5750
P K	2.013	27.66	46045.46	0.19	28.12				0.7002
Ca K (Ref.)	3.690	58.39	68059.88	0.32	45.87				1.0000
Total		100.00			100.00				

Lampiran 3.4.2 hidroksiapatit/kolagen/kitosan 70:10:20



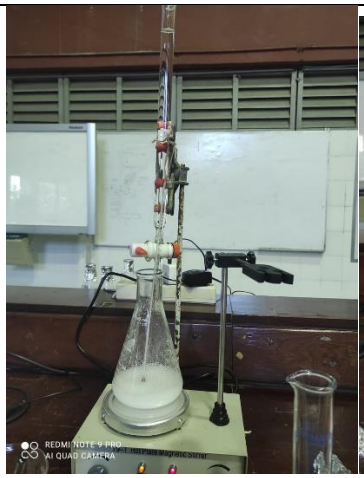



5 µm
High-vac. SED PC-std. 15 kV x 5000 12/23/2023 007796
Komposit A 70:10;20

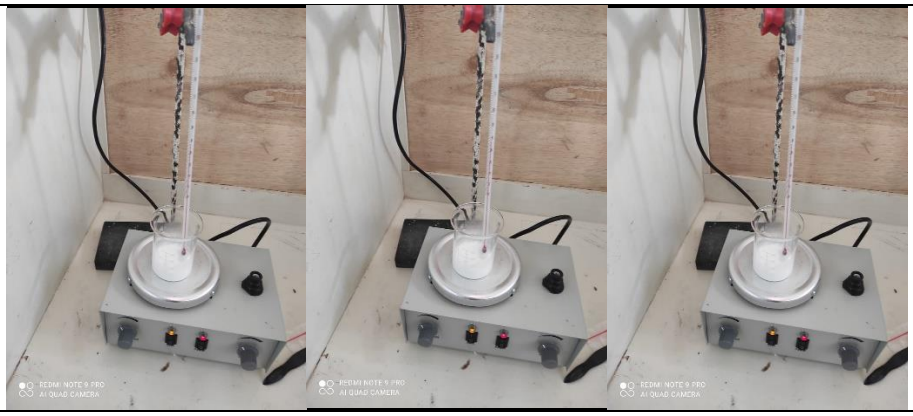

No.3
1.71 µm
31 °
No.2
1.59 µm
32 °
No.4
1.90 µm
30 °
No.1
3.49 µm
23 °
2 µm
High-vac. SED PC-std. 15 kV x 10000 12/23/2023 007797
Komposit A 70:10;20

Lampiran 4 Dokumentasi Penelitian

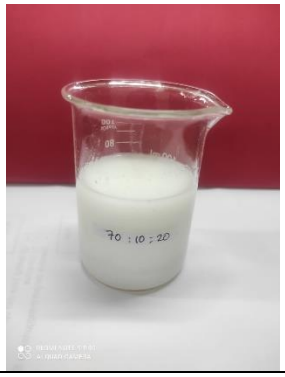
Cangkang telur setelah dibersihkan



Proses sintesis hidroksiapatit

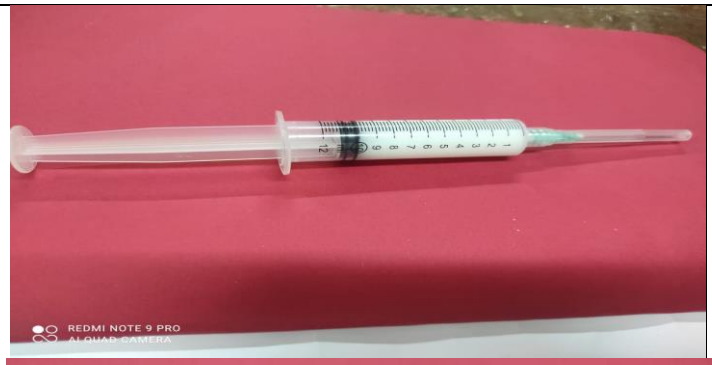


Proses komposit

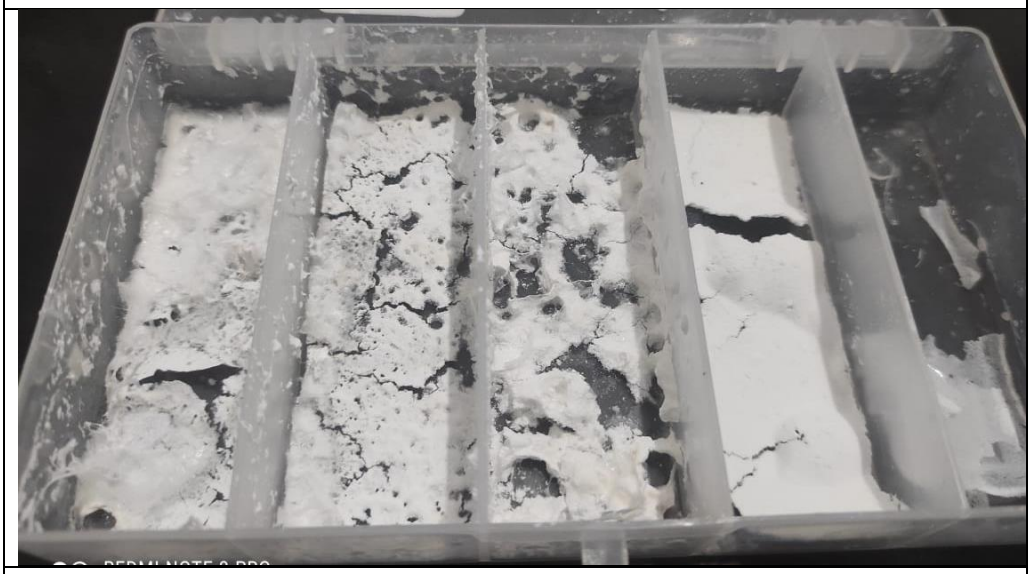


Hasil komposit

Uji viscositas



Uji injektabilitas

Komposit hidroksiapatit/kolagen/kitosan setelah di freeze dryed

70:20:10

70:15:15