

Test Report of Molecular Weight Measurement by Gel Permeation Chromatography (GPC) for [REDACTED]

1) Name and Location of Test Laboratory

Test Laboratory: [REDACTED]

Address: [REDACTED]

[REDACTED]

2) Information on Study Director and Person in Charge

Study Director: [REDACTED] (electronically signed)

Person in Charge: [REDACTED] (electronically signed)

3) Information on Testing Substance

(1) Sample Identification: Sample with ID [REDACTED]
[REDACTED] was submitted for GPC analysis.

(2) Chemical name: [REDACTED]

4) Test Conditions

(1) GPC system: Waters Alliance 2695

(2) Pump: Alliance 2695

(3) Detector: Waters 2414 RI

(4) Eluent: Stabilized tetrahydrofuran (THF) 0.1% Butylated Hydroxytoluene (BHT) Stabilizing Agent

(5) Guard Column: Waters Styragel guard column (length of 30×4.6 mm; particle size of 20 μm).

(6) GPC Columns: Two Waters Styragel HR1 and one Waters Styragel HR2 columns (length of 300×7.8 mm; particle size of 5 μm)

(7) Temperature: 40 °C

(8) Flow rate: 1.0 mL/min

(9) Injection volume and concentration of sample: 50 μ L, ~3 mg/mL

(10) Data processing system: Waters Empower Software

5) GPC System

Standard substance: polystyrene (PS) standards; 162 - 14000 Daltons from American Polymer Standards Corporation.

Preparation method and standards for calibration curve: The GPC instrument was calibrated with commercially available polystyrene standards having a narrow molecular weight distribution ranging from 162 - 14000 Daltons. PS standards were dissolved in THF and prepared at concentration of 0.1-0.5 wt. % and used without filtration.

Injection volume and concentration: 50 μ L, ~3 mg/mL

Test date: March 19th, 2021

GPC was calibrated using polystyrene standards (Figure 1, Table 1).

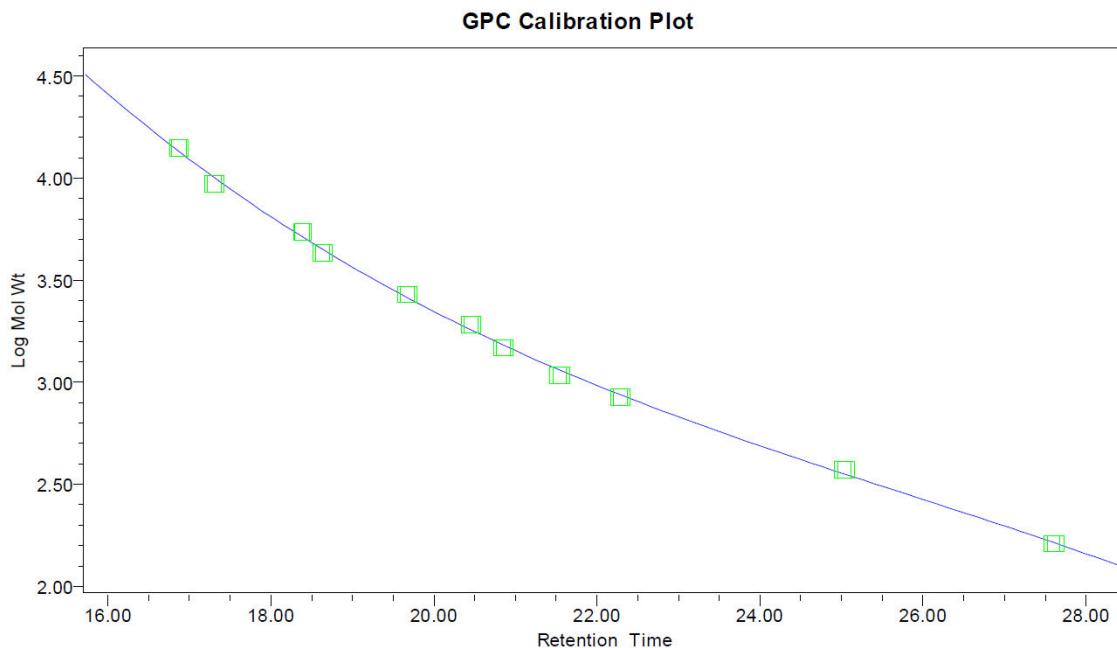


Figure 1. GPC Calibration Curve of Polystyrene Standards.

GPC Calibration Table

	Mol Wt (Daltons)	RT (min)	Calculated Weight (Daltons)	% Residual
1	14000	16.858	13657	2.513
2	2700	19.661	2612	3.385
3	14000	16.879	13457	4.034
4	2700	19.685	2581	4.591
5	9400	17.294	10139	-7.287
6	845	22.271	872	-3.145
7	9400	17.318	9977	-5.786
8	845	22.303	863	-2.029
9	5450	18.374	5184	5.129
10	1925	20.443	1813	6.167
11	5450	18.399	5110	6.663
12	1925	20.471	1791	7.461
13	4300	18.620	4507	-4.586
14	4300	18.649	4435	-3.053
15	1470	20.836	1529	-3.861
16	370	25.013	358	3.376
17	1470	20.872	1506	-2.375
18	370	25.054	353	4.689
19	1080	21.527	1154	-6.425
20	162	27.581	165	-1.847

	Mol Wt (Daltons)	RT (min)	Calculated Weight (Daltons)	% Residual
21	1080	21.567	1136	-4.959
22	162	27.631	162	-0.290

Table 1. Calibration Data of Polystyrene Standards.**6) Test Method**

The measurement of polymer's molecular weight (number average molecular weight (Mn), weight average molecular weight (Mw) and distribution (Mw/Mn or polydispersity)) was analyzed according to [REDACTED] (ISO Procedure 2201) test method. The GPC columns go up to 20000 Dalton in molecular weight. The highest standard is 14 K which elutes at 16.8 minutes as indicated in Figure 1 and Table 1. Therefore, any molecular weight information on the part of the polymer that exceeds 14000 Dalton is not valid.

7) Test Results

Number average molecular weight (Mn), weight average molecular weight (Mw), distribution (Mw/Mn or polydispersity), molecular weight at the maximum peak (Mp), and GPC chromatogram of [REDACTED] are given in Figure 2 and Table 2.

SAMPLE INFORMATION			
Sample Name:	██████████	Acquired By:	adamszj
Sample Type:	Broad Unknown	Sample Set Name:	GPC LOWMW 031821
Vial:	16	Acq. Method Set:	Low MW
Injection #:	1	Processing Method	GPC_LOWMW_031921
Injection Volume:	50.00 ul	Channel Name:	410
Run Time:	45.0 Minutes	Proc. Chnl. Descr.:	410
Date Acquired:	3/19/2021 5:19:21 AM EDT		
Date Processed:	3/19/2021 2:59:47 PM EDT		

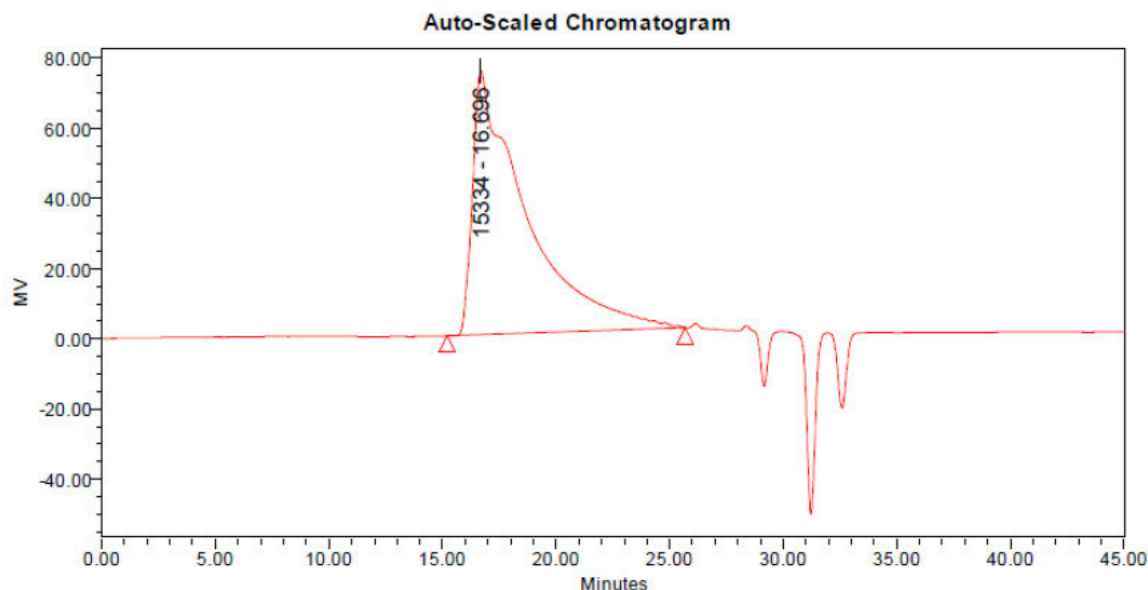


Figure 2. GPC Chromatogram of ██████████

GPC Results											
	Retention Time (min)	% Area	Mn	Mw	MP	Polydispersity	Area (μV*sec)	Height (μV)	Mz	Mz+1	Mv
1	16.696	100.00	3466	8360	15334	2.412342	12232104	75284	12725	15577	

Table 2. Mn, Mw, Mw/Mn, and Mp.

Figure 3 shows cumulative distribution curve for peak at 16.696 minutes of retention time and Table 3 shows distribution table of molecular weight of same peak of ██████████. In addition, Table 4 shows the percentage of polymeric species for the peak at 16.696 minutes which had molecular weight species greater than 500 and 1000 Dalton markers.

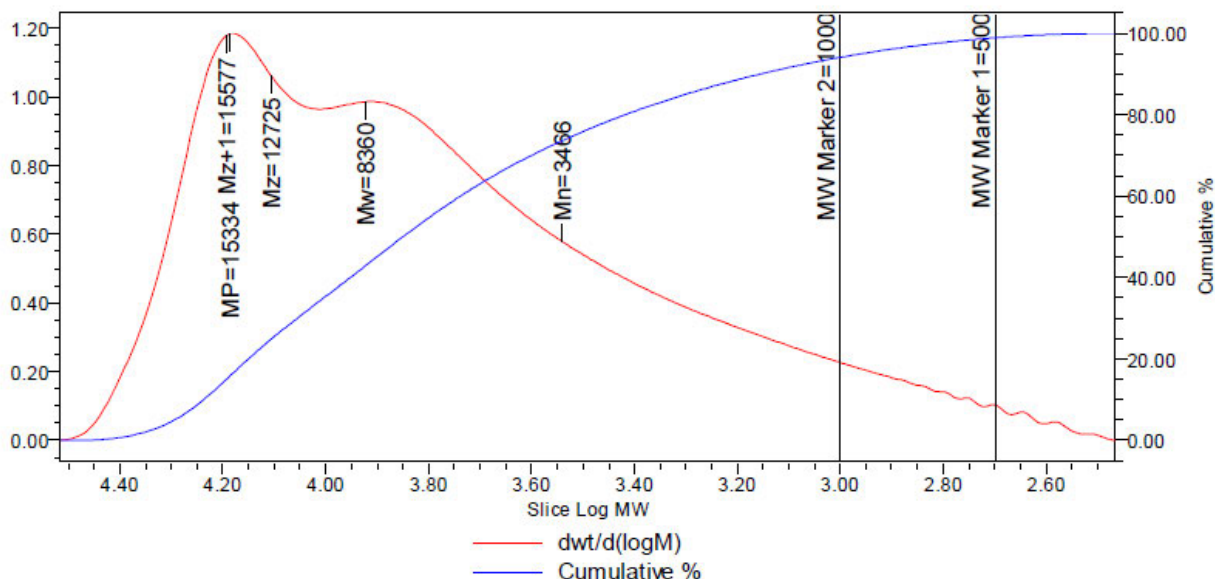


Figure 3. Distribution Curve of Molecular Weight of [REDACTED] (Peak at 16.696 mins).

GPCV Distribution Table, Mp: 15334 Name: Peak 1

	Slice EV	Slice MW	Slice Log MW	Slice Area	Cumulative %	dwt/d(logM)	Outside Vo-Vt
1	16.078	24334	4.38622	122321	1	0.228449	No
2	16.178	22519	4.352546	122321	2	0.355053	No
3	16.25	21314	4.328664	122321	3	0.469152	No
4	16.307	20414	4.309924	122321	4	0.577113	No
5	16.355	19690	4.294256	122321	5	0.678056	No
6	16.397	19083	4.280648	122321	6	0.770321	No
7	16.435	18556	4.268481	122321	7	0.853361	No
8	16.469	18087	4.257367	122321	8	0.926664	No
9	16.501	17661	4.247013	122321	9	0.990563	No
10	16.532	17268	4.237239	122321	10	1.044937	No
11	16.561	16901	4.227906	122321	11	1.089993	No
12	16.59	16553	4.218886	122321	12	1.126355	No
13	16.618	16222	4.210097	122321	13	1.154554	No
14	16.645	15903	4.201478	122321	14	1.174332	No
15	16.672	15594	4.192958	122321	15	1.187153	No
16	16.699	15293	4.184493	122321	16	1.19357	No
17	16.727	14998	4.176036	122321	17	1.193531	No
18	16.754	14708	4.16755	122321	18	1.188422	No
19	16.781	14421	4.159003	122321	19	1.178711	No
20	16.81	14137	4.150355	122321	20	1.164997	No
21	16.838	13855	4.141593	122321	21	1.148381	No

22	16.867	13574	4.132692	122321	22	1.129563	No
23	16.897	13293	4.123625	122321	23	1.109388	No
24	16.927	13013	4.114388	122321	24	1.088528	No
25	16.958	12734	4.104976	122321	25	1.068007	No
26	16.99	12456	4.095389	122321	26	1.048535	No
27	17.023	12180	4.085636	122321	27	1.030869	No
28	17.056	11905	4.075727	122321	28	1.015038	No
29	17.09	11633	4.065679	122321	29	1.001412	No
30	17.124	11364	4.055513	122321	30	0.990539	No
31	17.159	11098	4.045257	122321	31	0.982479	No
32	17.194	10838	4.034936	122321	32	0.976675	No
33	17.23	10582	4.024572	122321	33	0.973341	No
34	17.265	10332	4.01419	122321	34	0.972238	No
35	17.301	10088	4.003808	122321	35	0.972573	No
36	17.337	9850	3.993441	122321	36	0.974399	No
37	17.373	9618	3.983098	122321	37	0.97689	No
38	17.409	9393	3.972789	122321	38	0.980181	No
39	17.446	9173	3.962515	122321	39	0.983585	No
40	17.482	8959	3.952278	122321	40	0.987103	No
41	17.518	8751	3.942071	122321	41	0.989751	No
42	17.554	8549	3.93189	122321	42	0.992337	No
43	17.591	8351	3.921727	122321	43	0.993695	No
44	17.627	8158	3.911572	122321	44	0.994204	No
45	17.664	7969	3.901415	122321	45	0.993581	No
46	17.701	7785	3.891243	122321	46	0.991986	No
47	17.739	7604	3.881039	122321	47	0.988458	No
48	17.776	7427	3.870792	122321	48	0.983912	No
49	17.814	7253	3.860488	122321	49	0.97781	No
50	17.853	7081	3.850107	122321	50	0.970264	No
51	17.892	6912	3.839634	122321	51	0.961487	No
52	17.932	6746	3.829058	122321	52	0.951226	No
53	17.972	6582	3.818352	122321	53	0.939765	No
54	18.013	6420	3.807507	122321	54	0.926976	No
55	18.055	6259	3.7965	122321	55	0.913019	No
56	18.098	6100	3.785318	122321	56	0.898056	No
57	18.142	5942	3.773935	122321	57	0.88224	No
58	18.187	5786	3.762344	122321	58	0.865432	No
59	18.233	5630	3.75052	122321	59	0.848253	No
60	18.28	5476	3.738446	122321	60	0.830584	No
61	18.329	5322	3.726111	122321	61	0.812636	No
62	18.379	5170	3.713498	122321	62	0.79424	No

63	18.43	5019	3.700588	122321	63	0.775772	No
64	18.483	4868	3.68737	122321	64	0.757308	No
65	18.538	4719	3.673816	122321	65	0.738622	No
66	18.595	4570	3.659923	122321	66	0.720242	No
67	18.654	4423	3.645673	122321	67	0.701866	No
68	18.714	4276	3.631049	122321	68	0.683629	No
69	18.777	4131	3.616023	122321	69	0.665434	No
70	18.842	3986	3.600589	122321	70	0.647476	No
71	18.91	3843	3.584725	122321	71	0.629846	No
72	18.98	3702	3.568412	122321	72	0.612211	No
73	19.052	3561	3.55163	122321	73	0.594791	No
74	19.128	3423	3.534344	122321	74	0.577408	No
75	19.206	3285	3.516537	122321	75	0.560171	No
76	19.288	3149	3.498178	122321	76	0.543292	No
77	19.373	3015	3.479238	122321	77	0.526433	No
78	19.463	2882	3.459683	122321	78	0.509252	No
79	19.556	2751	3.439454	122321	79	0.492341	No
80	19.654	2621	3.418521	122321	80	0.475234	No
81	19.756	2494	3.396825	122321	81	0.458264	No
82	19.864	2368	3.374319	122321	82	0.441508	No
83	19.978	2244	3.350931	122321	83	0.42455	No
84	20.097	2121	3.32661	122321	84	0.407991	No
85	20.224	2001	3.301287	122321	85	0.391724	No
86	20.359	1883	3.274878	122321	86	0.375077	No
87	20.501	1767	3.247287	122321	87	0.35849	No
88	20.654	1653	3.218396	122321	88	0.342088	No
89	20.816	1542	3.188058	122321	89	0.324884	No
90	20.992	1432	3.156066	122321	90	0.30782	No
91	21.182	1325	3.122153	122321	91	0.289276	No
92	21.389	1219	3.085982	122321	92	0.270432	No
93	21.616	1115	3.047166	122321	93	0.25115	No
94	21.87	1012	3.005172	122321	94	0.231058	No
95	22.155	910	2.959188	122321	95	0.209398	No
96	22.481	809	2.908186	122321	96	0.187757	No
97	22.862	709	2.850494	122321	97	0.162327	No
98	23.333	605	2.781891	122321	98	0.12935	No
99	23.978	492	2.691774	122321	99	0.098244	No
100	25.667	294	2.468838	122321	100	0.00051	No

Table 3. Distribution Table of Molecular Weight of XXXXXXXXXX (Peak at 16.696 mins).

GPC Distribution Table
Mp: 15334 Name: Peak 1

	Slice RT	Slice MW	Slice Log MW	Slice Area	Cumulative %	dwt/d(logM)	Outside Vo-Vt
1	23.925	500	2.698970	2882	98.928	0.103006	No
2	21.901	1000	3.000000	7529	94.117	0.226354	No

Table 4. Distribution Table of Molecular Weight of [REDACTED] (Peak at 16.696 mins).

Thus, Table 5 shows the GPC results show that the [REDACTED] peak at 16.696 minutes had 1.072 % and 5.883 % of polymeric species with molecular weight less than 500 Dalton and less than 1000 Dalton respectively.

% By Distribution of Molecular Weight	
% Polymeric species less than 500 Dalton	1.072 %
% Polymeric species less than 1,000 Dalton	5.883 %

Table 5. GPC Cumulative Molecular Weight Distribution Results.