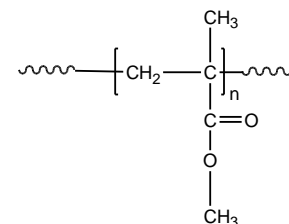




CERTIFICATE OF ANALYSIS

Product name and structure: **Poly(methyl methacrylate)**
Syndiotactic rich contents > 79%
ISO Certified Reference Material



PS standards kit number: **R12-1k2.1m-PMMA**

Part numbers:	1-PMMA-1k_R7609	5- PMMA-45k_R11406	9-PMMA-350k_R9620
	2-PMMA-3k_R9059	6- PMMA-85k_R5516A	10- PMMA-400k_R8508
	3-PMMA-10k_R5518	7- PMMA-120k_R9346	11- PMMA-550k_R9711
	4-PMMA-25k_R9396	8- PMMA-230k_R9407	12- PMMA-2.1m_R10787

PS Certified Reference Material:

Polymer: Poly(methyl methacrylate) (PMMA) *Syndiotactic rich contents > 79%*
Chemical formula: $[\text{C}_5\text{O}_2\text{H}_8]_n$
CAS number: 9011-14-7
Purity: 99.9 %
Appearance: White solid material
Production: Syndiotactic Poly(methyl methacrylate) is obtained by living anionic polymerization using sec.BuLi as initiator end capped with a unit of diphenyl ethylene or few units of α -methylstyrene. The polymerization of MMA monomer is carried out in THF at -78°C in the presence of LiCl as additive.
Quality Control: Polymer Source is **ISO 9001:2015** certified company, and our Testing and Calibration Laboratory is complying with **ISO 17025** standards.

GPC/SEC Instrument Details and Analysis Conditions:

Instrument: Varian liquid chromatograph equipped with refractive and UV light scattering detectors
Columns: Three columns (G6000-4000-2000 HXL), Supelco.
Solvent (mobile phase): THF with 1% (v/v) triethylamine as the eluent
Temperature: 30°C
Flow rate: 1 mL/min
Injection volume: 100 μL
System calibration: Certified polystyrene narrow standards
Sample concentration: 1–5 mg/mL
dn/dc (mL/g): 0.084
*Abbreviations used in Results: M_n and M_w are the respective number and weight molecular weight averages.
 M_w/M_n is the polydispersity ratio.

**¹H NMR Instrument Details and Analysis Conditions:**

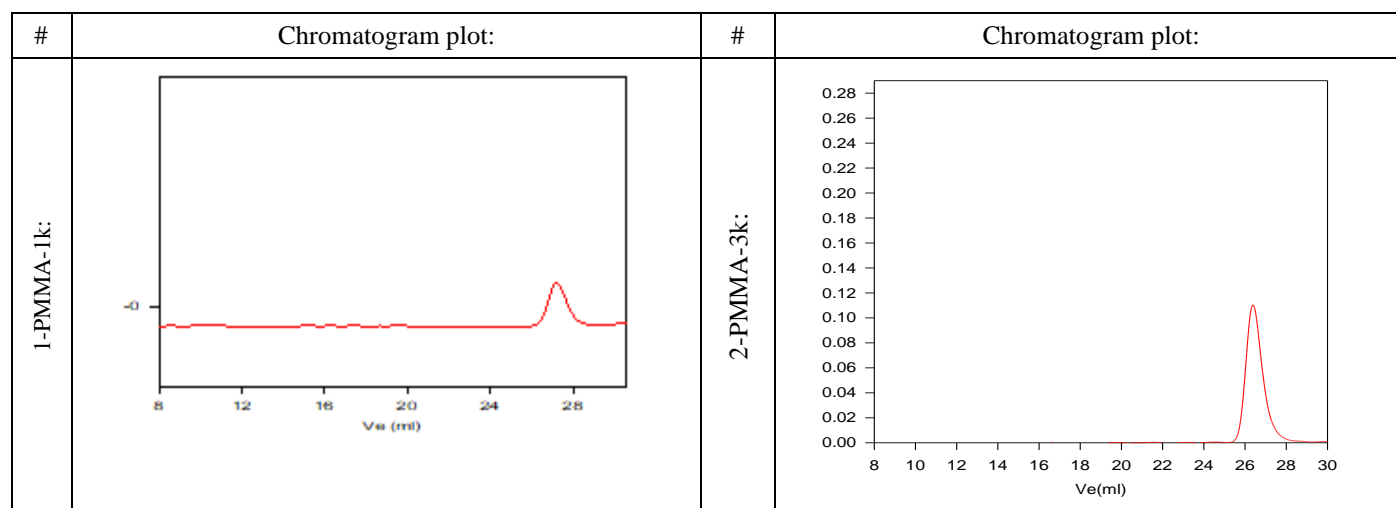
Instrument: Bruker Avance III 500 NMR spectrometer
Solvent: CDCl₃ (99.8%D)

DSC Instrument Details and Analysis Conditions:

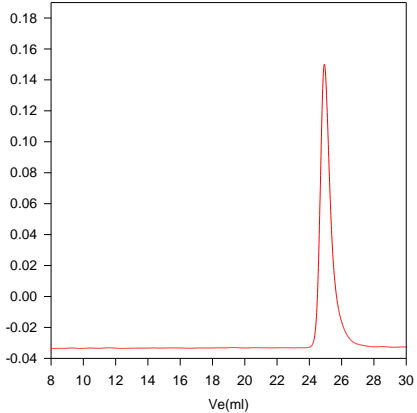
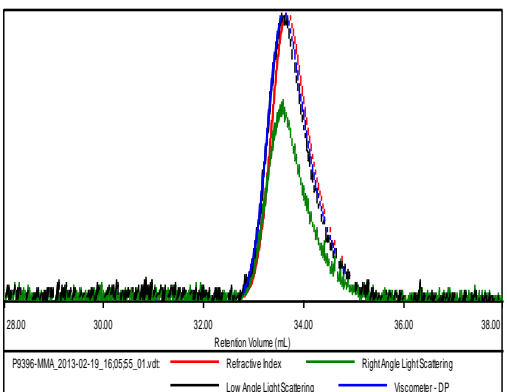
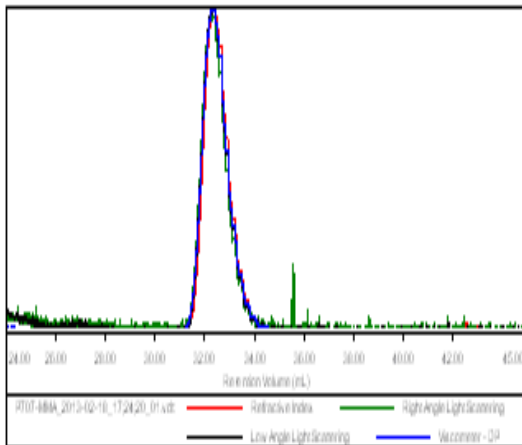
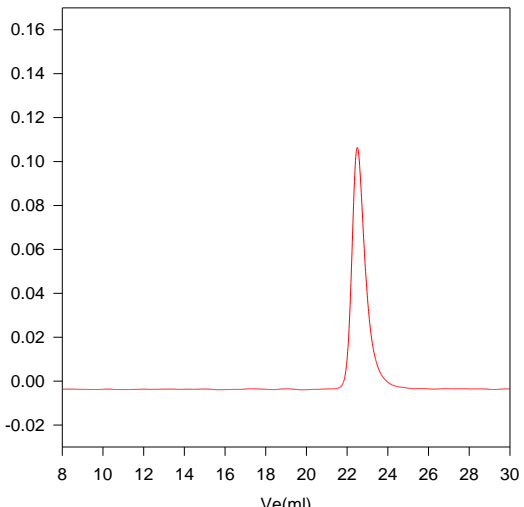
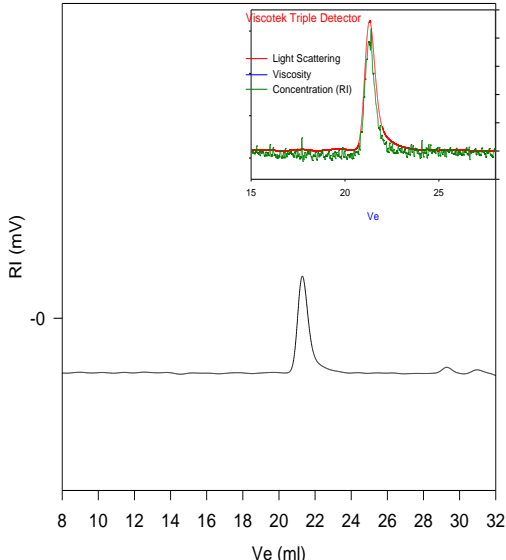
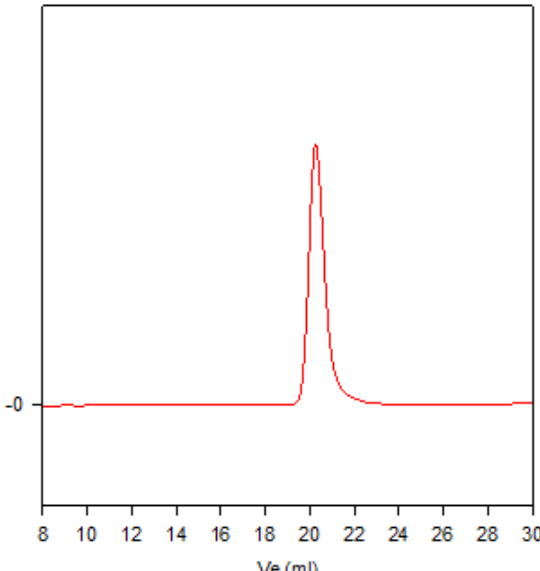
Instrument: TA Instruments DSC Q100
Gas: Nitrogen
Thermal analysis: Glass transition temperature (T_g) was measured at a scan rate of 10°C/min.

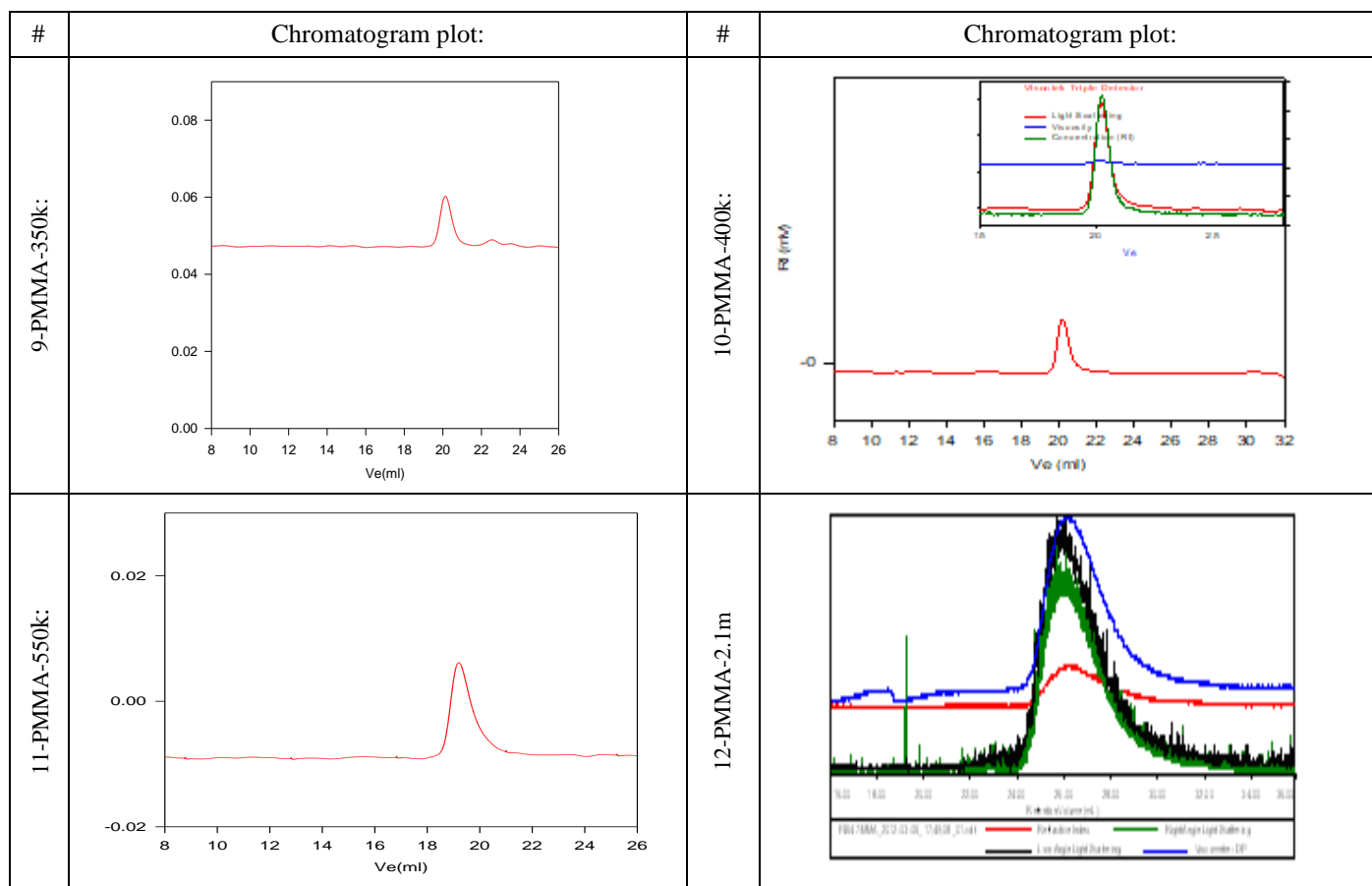
RESULTS:

Sample #	GPC/SEC Results		
	Molecular weight averages (g/mol)		M _w /M _n
	M _n	M _w	
1-PMMA-1k	1,100	1,200	1.07
2-PMMA-3k	3,100	3,400	1.09
3-PMMA-10k	9,800	10,300	1.09
4-PMMA-25k	26,600	28,100	1.06
5-PMMA-45k	45,000	46,000	1.02
6-PMMA-85k	84,500	89,100	1.05
7-PMMA-120k	119,200	128,800	1.08
8-PMMA-230k	230,500	257,200	1.12
9-PMMA-350k	356,000	388,000	1.09
10-PMMA-400k	395,900	431,900	1.09
11-PMMA-550k	540,000	632,000	1.17
12-PMMA-2.1m	2,120,000	2,446,000	1.16



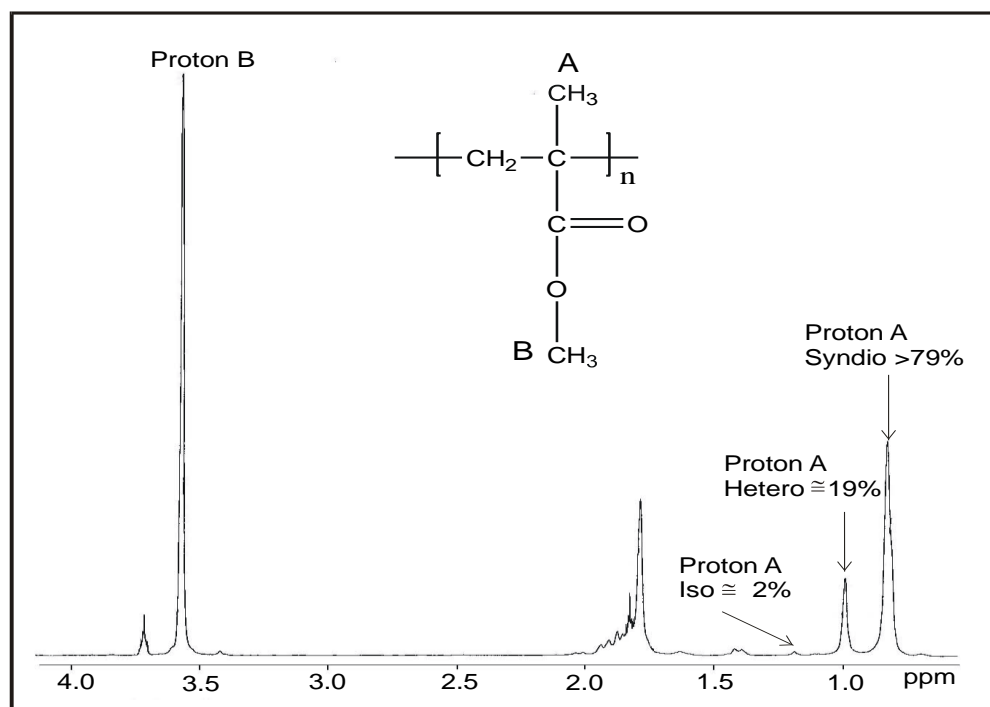


#	Chromatogram plot:	#	Chromatogram plot:
3-PMMA-10k:	 <p>Size exclusion chromatography of poly(methyl methacrylate): $M_n=9,800$, $M_w=10,300$, $M_w/M_n=1.09$</p>	4-PMMA-25k:	
5-PMMA-45k:		6-PMMA-85k:	
7-PMMA-120k:		8-PMMA-230k:	



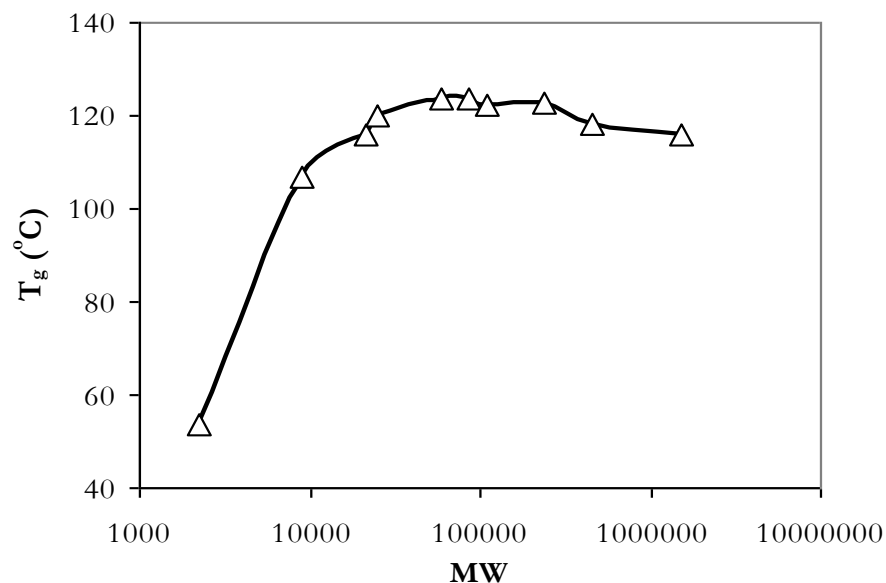
Sample of PMMA ^1H NMR spectra is presented below.

6-PMMA-85k_R5516





Dependence of glass transition temperature (T_g) of PMMA from its molecular weight:



The above analyses run according to ISO 9001:2015 and ISO 17025 standards.
Manufacture and quality control run according to *Polymer Source* methods of analysis.

Sunil K. Varshney, Ph.D.

