

## Supporting Information

### **Hydrogen-bond-dominated mechanical stretchability in PVA films: from phenomenological to numerical insight**

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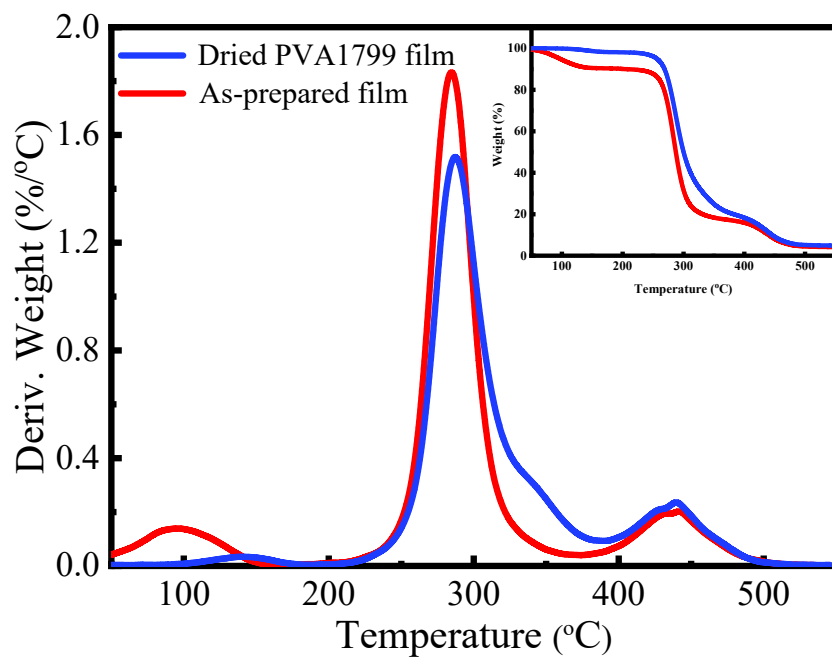


Figure S1. The TGA curves of dried and as-prepared PVA films

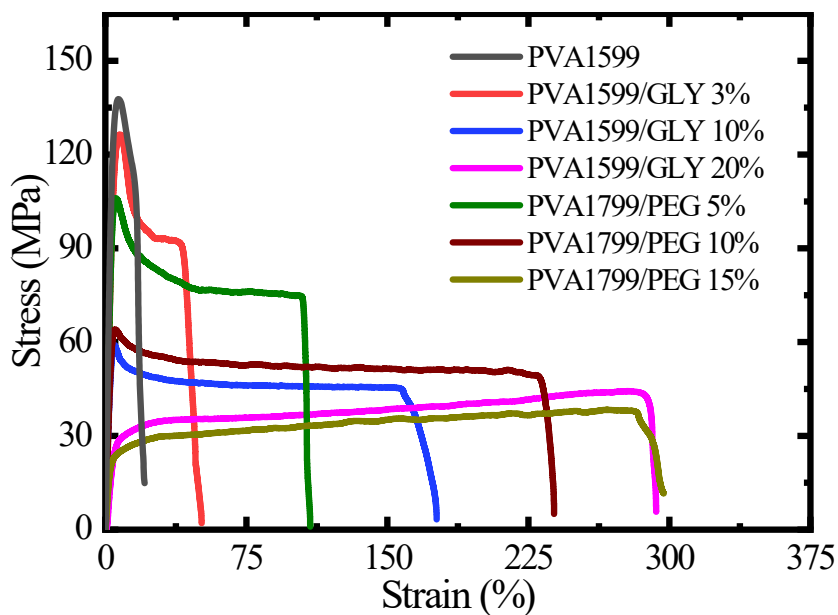


Figure S2. Typical stress-strain curves of PVA1599, PVA1599/GLY and PVA1799/PEG plasticized films

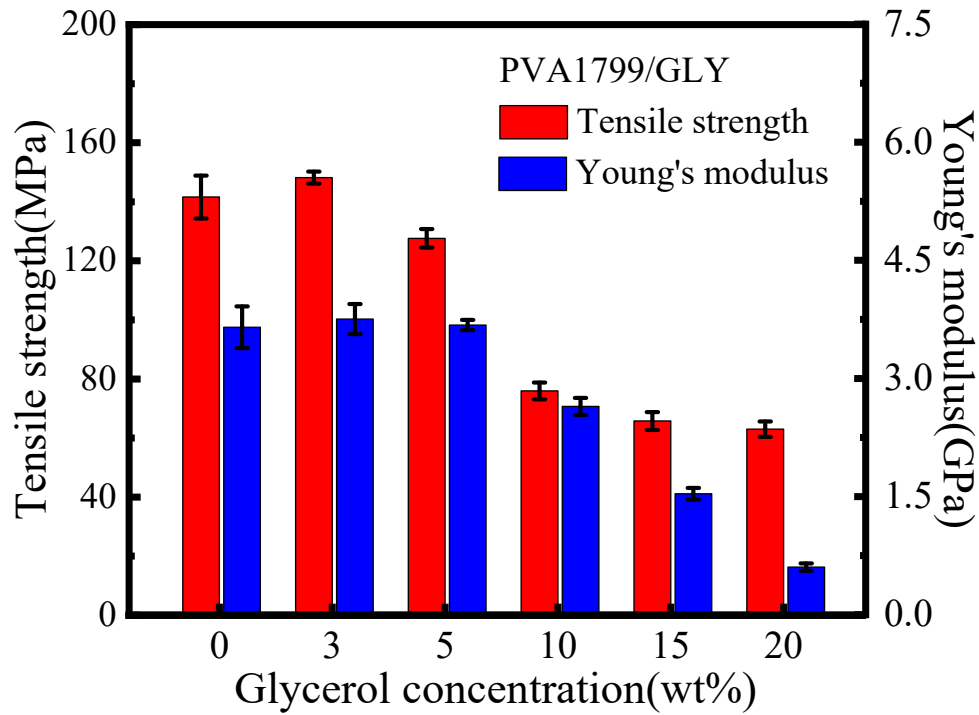


Figure S3. The tensile strength and Young's modulus of PVA1799 and PVA1799/GLY plasticized films

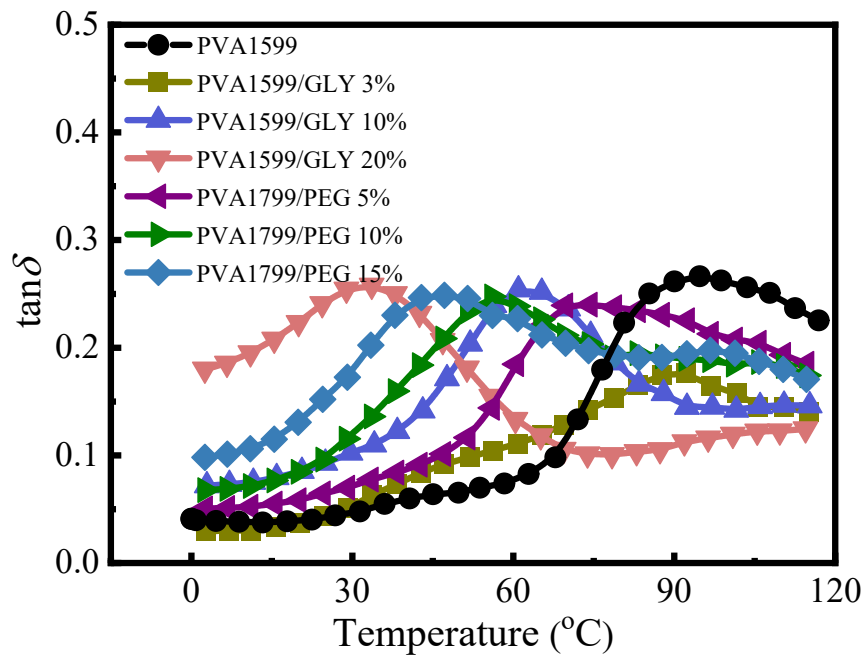
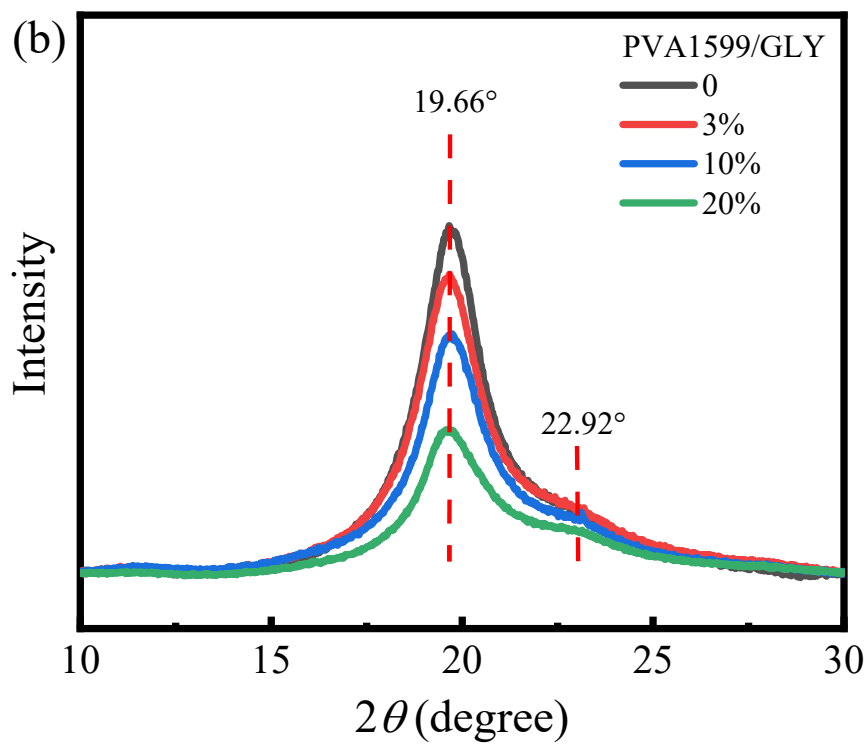
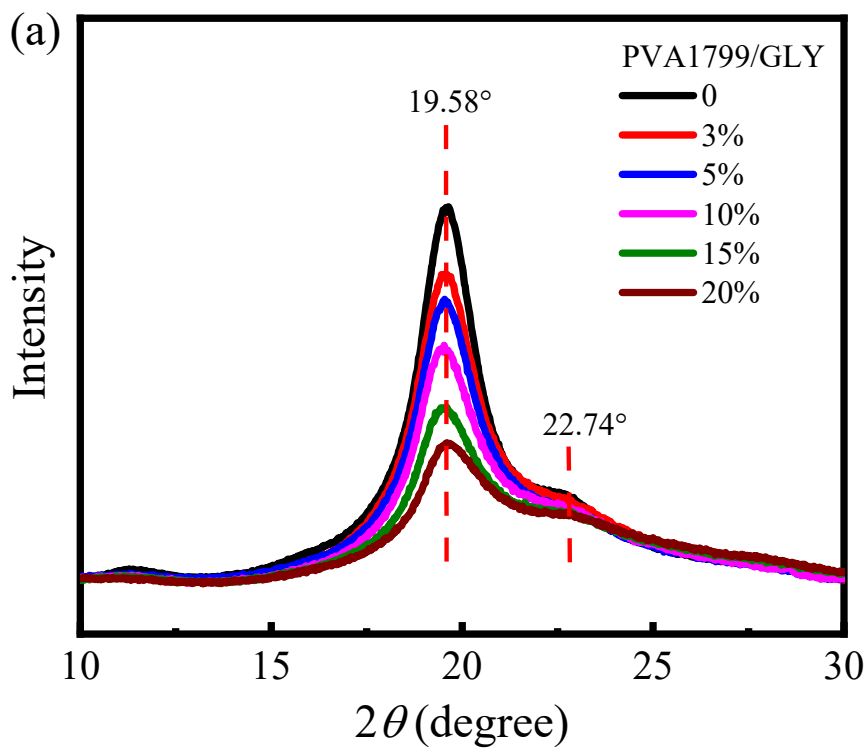


Figure S4. Temperature dependence of  $\tan\delta$  of neat PVA1599, PVA1599/GLY and PVA1799/PEG plasticized films



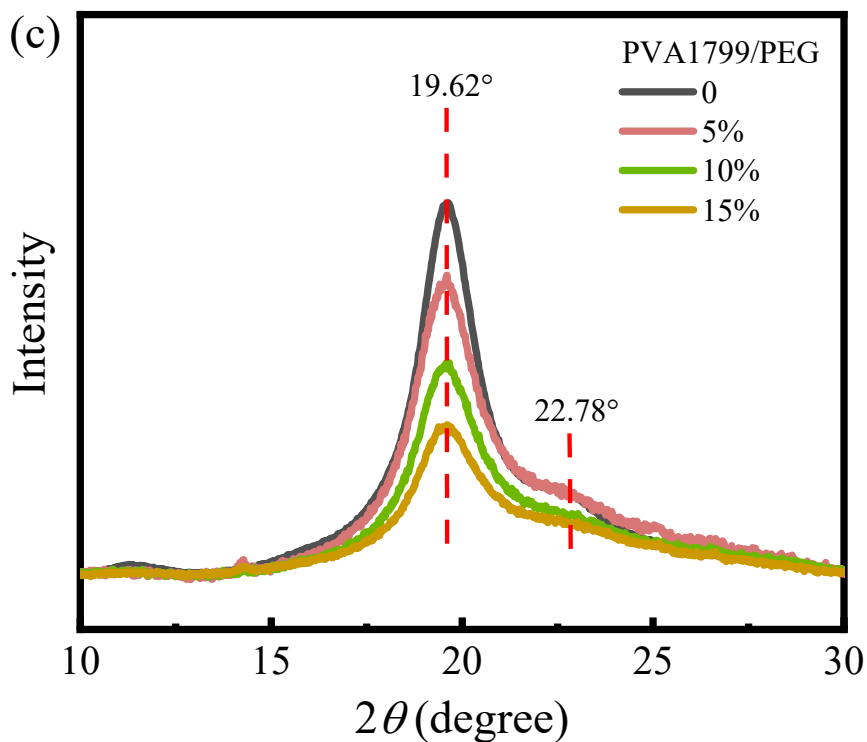


Figure S5. XRD patterns of PVA1799/GLY (a), PVA1599/GLY (b) and PVA1799/PEG (c)

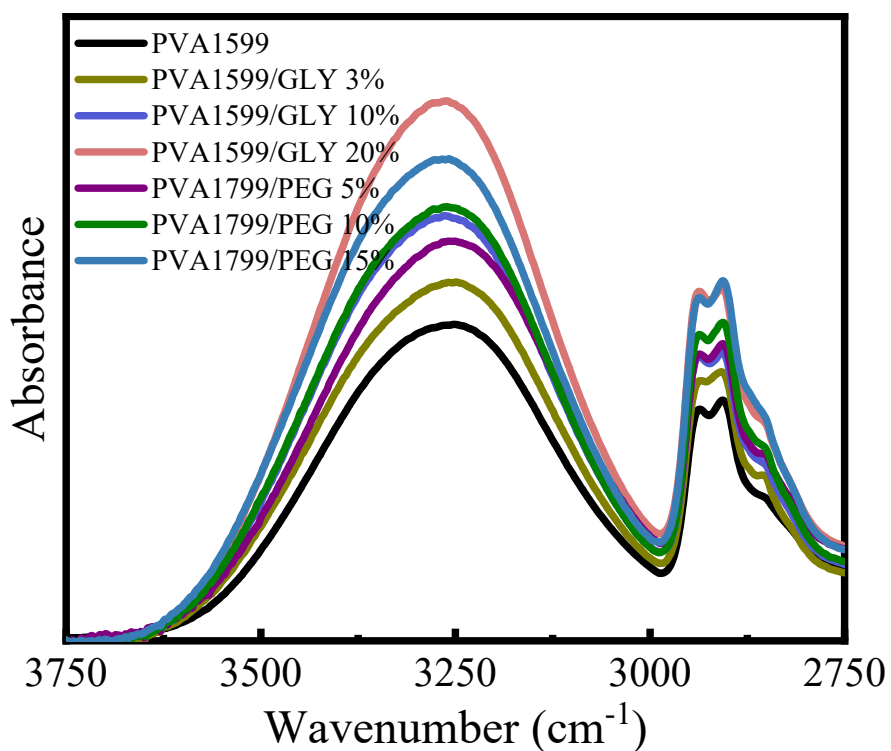


Figure S6. FTIR spectra of PVA1599/GLY and PVA1799/PEG plasticized films

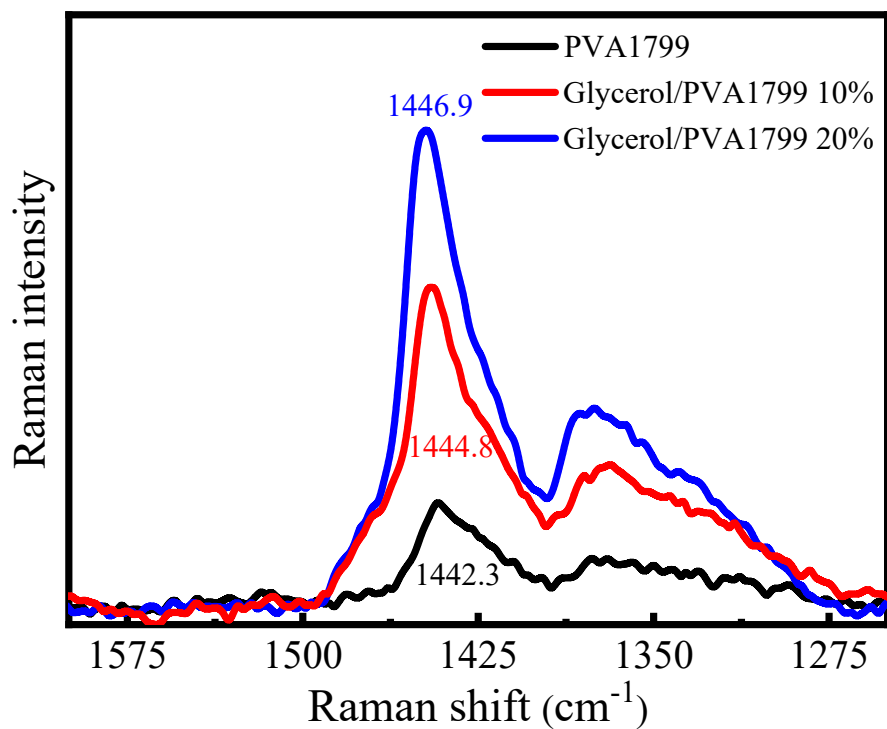


Figure S7. Raman spectra of neat PVA1799 and PVA1799/GLY plasticized films

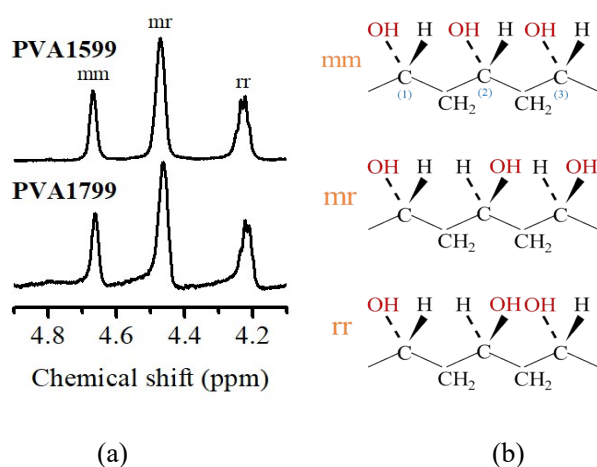
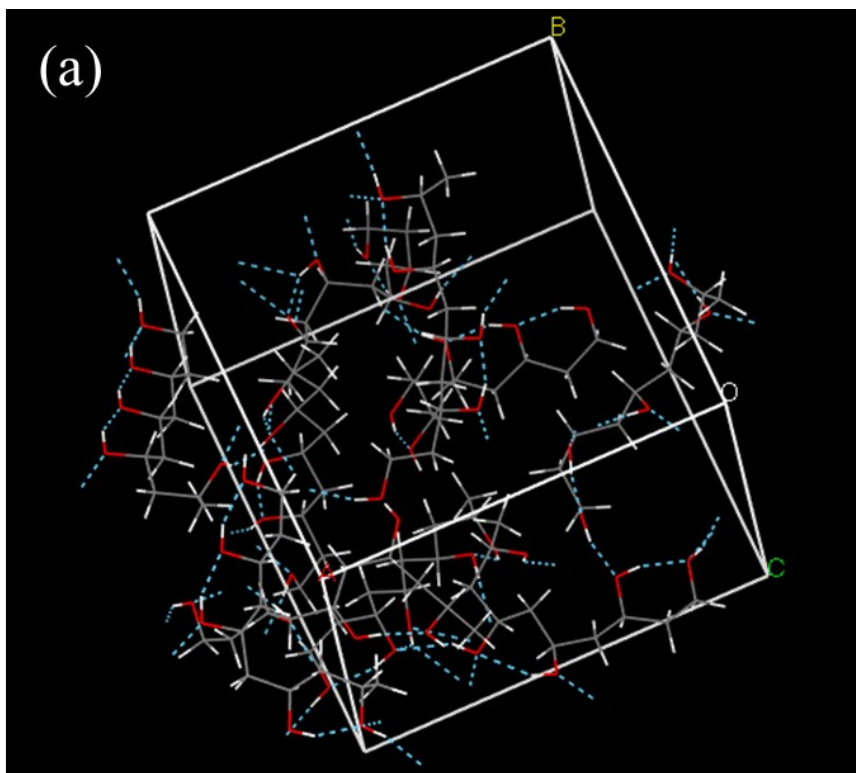


Figure S8. (a)  $^1\text{H}$  NMR spectra of PVA1599 and PVA1799 in solution; (b) Schematic diagram of triad sequence structure in PVA

Table S1. The tacticity statistics of PVA with different molecular weights

	<b>mm</b>	<b>mr</b>	<b>rr</b>
<i>1599</i>	0.21	0.49	0.3
<i>1799</i>	0.22	0.51	0.27



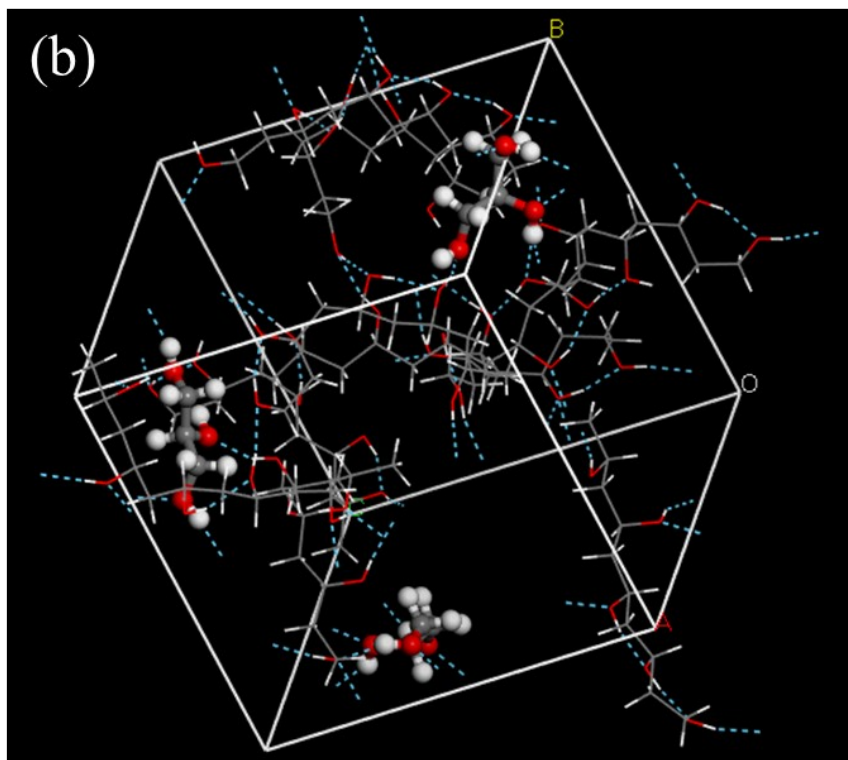


Figure S9. Diagrams of pure PVA (a) and PVA/GLY 10% (b) system model for DFT calculation



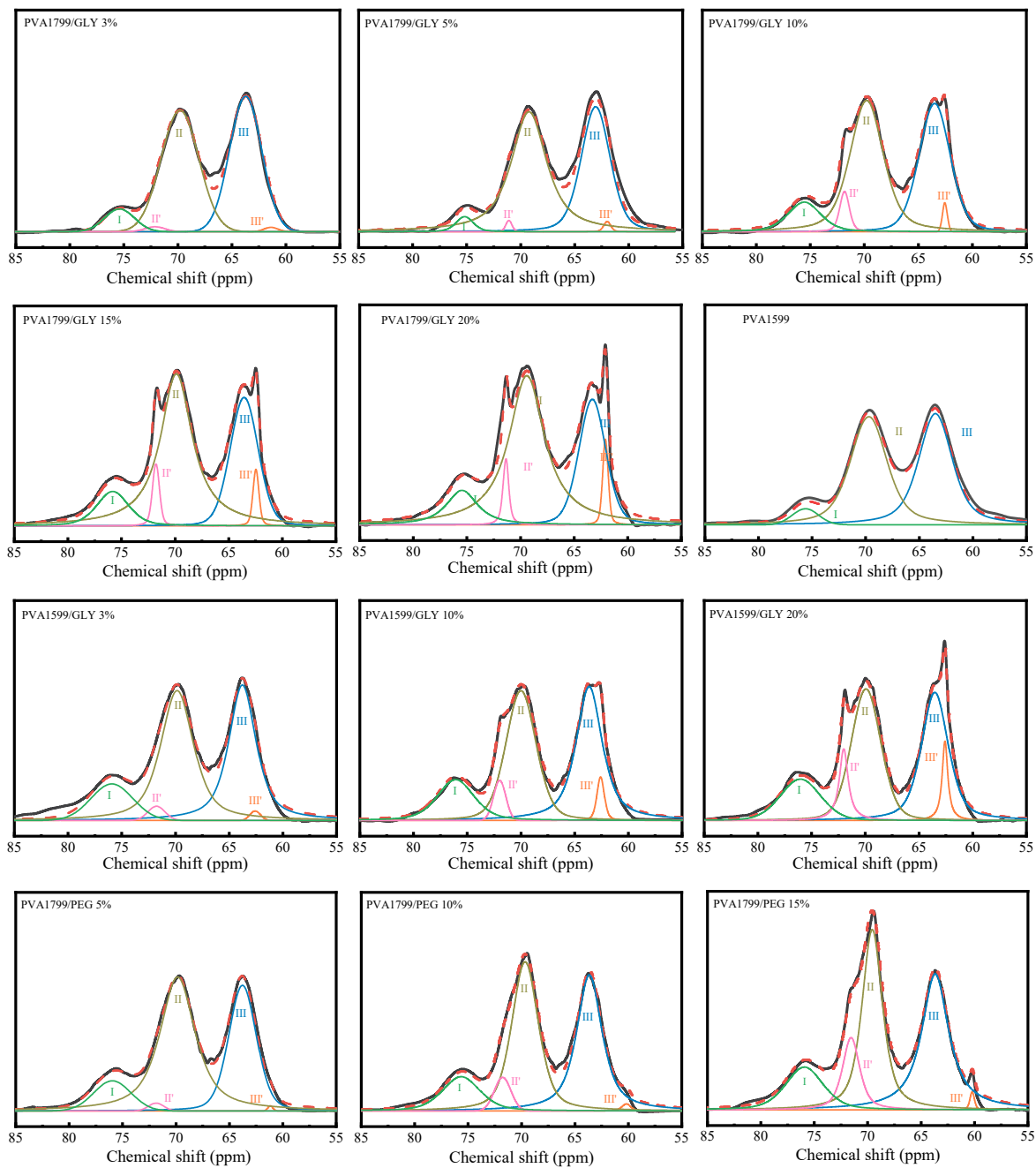


Figure S10. The line shape analysis for the CH resonance lines of neat PVA1799 and plasticized PVAfilms

Table S2. The results statistics of lineshape analysis for neat PVA and plasticizer/PVA composite films

<b>Sample</b>	<b>Peak</b>	<b>Chemical shift (ppm)</b>	<b>Intensity (%)</b>
PVA1599	I	75.20	4.5
	II	69.36	49.14
	III	63.54	46.36
PVA1799	I	75.23	5.42
	II	69.07	49.44
	III	63.49	45.14
Glycerol/PVA1599 3%	I	75.92	13.03
	II'	71.77	2.09
	II	69.82	44.58
	III	63.79	39.46
	III'	62.58	0.84
Glycerol/PVA1599 10%	I	76.08	15.09
	II'	71.98	4.36
	II	70.07	37.89
	III	63.67	39.33
	III'	62.58	3.33
Glycerol/PVA1599 20%	I	76.04	15.11
	II'	72.01	8.03
	II	69.95	36.26
	III	63.55	34.97
	III'	62.58	5.62
PEG/PVA1799 5%	I	75.91	10.11
	II'	71.77	1.10
	II	69.82	54.37

	III	63.80	34.19
	III'	61.18	0.23
PEG/PVA1799 10%	I	75.61	13.11
	II'	71.77	4.99
	II	69.70	41.62
	III	63.67	39.62
	III'	60.20	0.66
PEG/PVA1799 15%	I	75.91	13.97
	II'	71.59	11.91
	II	69.58	35.52
	III	63.67	37.85
	III'	60.22	0.74
Glycerol/PVA1799 3%	I	75.40	6.97
	II'	72.13	1.02
	II	69.71	46.83
	III	63.73	44.56
	III'	61.38	0.62
Glycerol/PVA1799 5%	I	75.19	3.06
	II'	71.10	0.81
	II	69.23	55.37
	III	63.06	39.91
	III'	61.99	0.84
Glycerol/PVA1799 10%	I	75.55	10.05
	II'	71.83	4.10
	II	69.78	45.89
	III	63.49	38.69
	III'	62.54	1.29
Glycerol/PVA1799 15%	I	75.83	9.94
	II'	71.80	4.01

	II	69.87	53.19
	III	63.55	29.78
	III'	62.45	3.08
Glycerol/PVA1799 20%	I	75.46	10.49
	II'	71.37	3.61
	II	69.42	54.66
	III	63.31	27.20
	III'	62.09	4.04