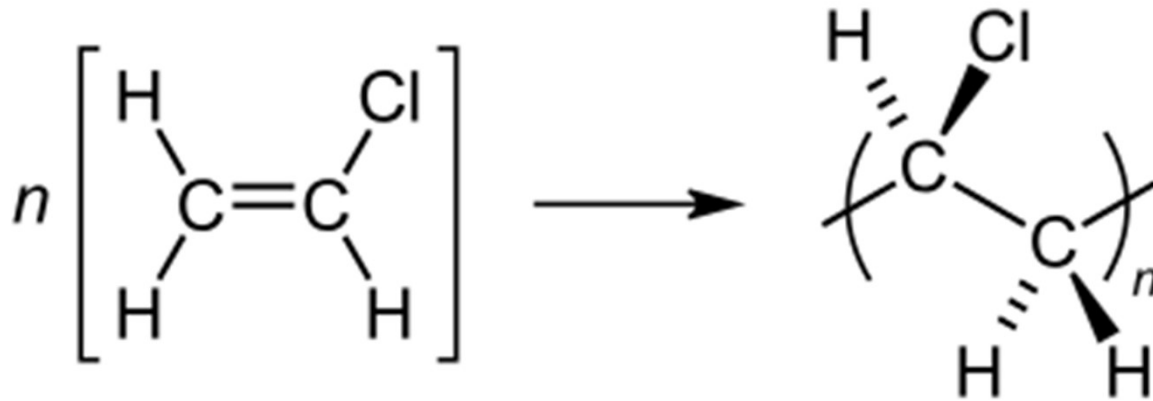




General Information For PVC Plasticizer

Mr. Supatchai Sangwong
Adeka Fine Chemical (Thailand) Co., Ltd.

PVC is Rigid Polymer



Vinyl chloride monomer

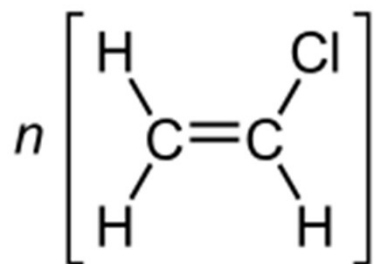
PVC Polymer
Poly Vinyl Chloride

PVC
Rigid

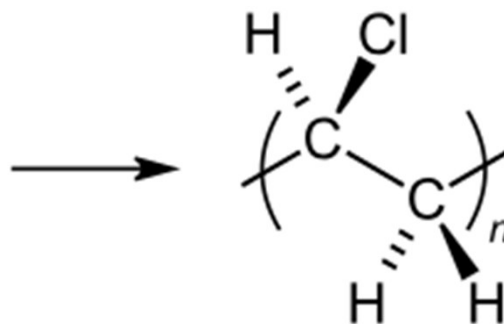
Rigid PVC Applications



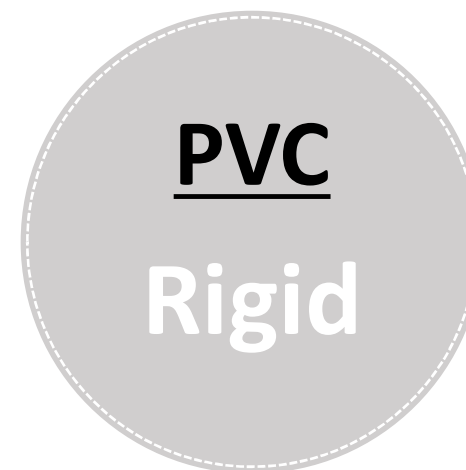
Why is PVC Rigid Polymer?



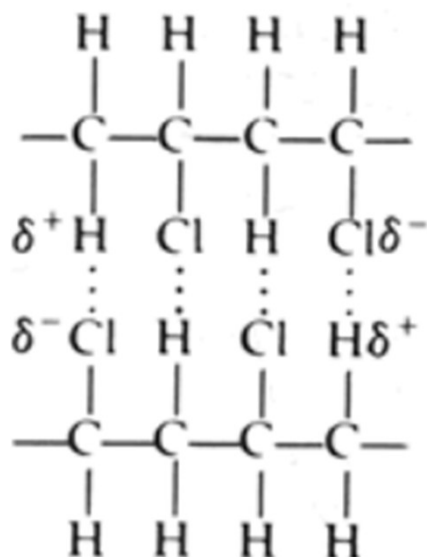
Vinyl chloride monomer



PVC Polymer
Poly Vinyl Chloride



Reason : Dipole-Dipole interactions between PVC polymer chains



- ✓ PVC polymer consists of polar molecules which are attracted to each other by dipole-dipole interactions
- ✓ These intermolecular attractions between polymer chains make PVC a rigid/strong material

Examples of PVC Application

Rigid PVC

PVC without Plasticizer



Flexible PVC

PVC + Plasticizer



What is PVC Plasticizer?

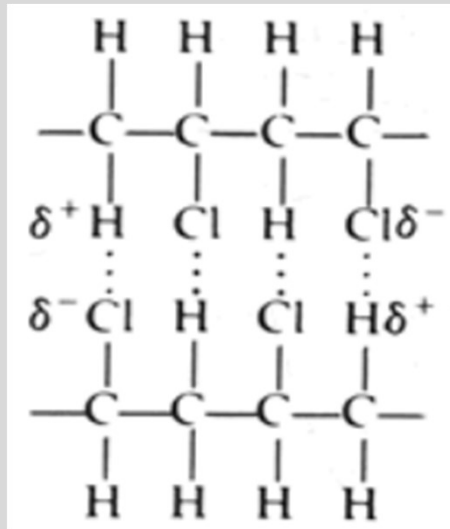
PVC Plasticizer :

- ✓ Can impart flexibility to PVC polymer
- ✓ Can control hardness of PVC products by adjusting dosage of plasticizer
- ✓ Can make processability of PVC easier



How can Plasticizer make PVC flexible?

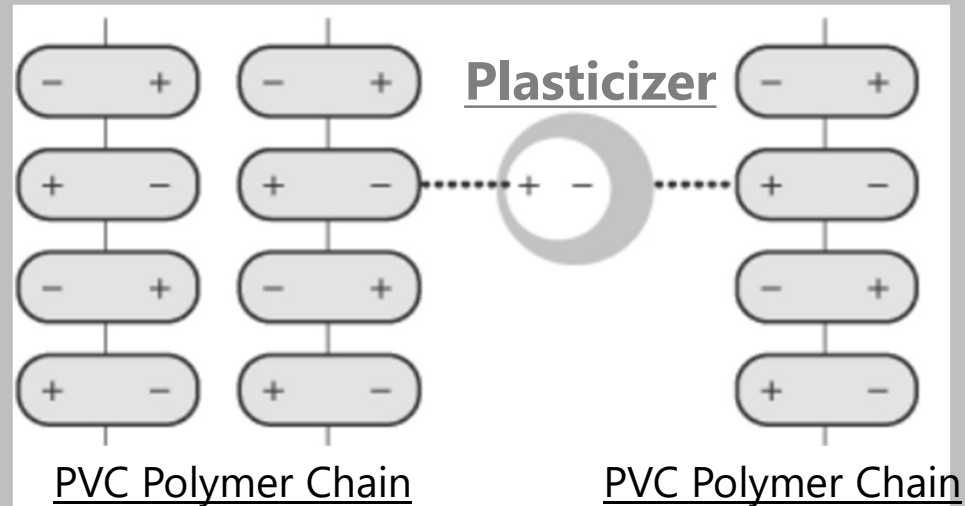
PVC : Rigid



Dipole Interactions

- ✓ These intermolecular attractions between polymer chains make PVC a rigid material

PVC + Plasticizer : Flexible

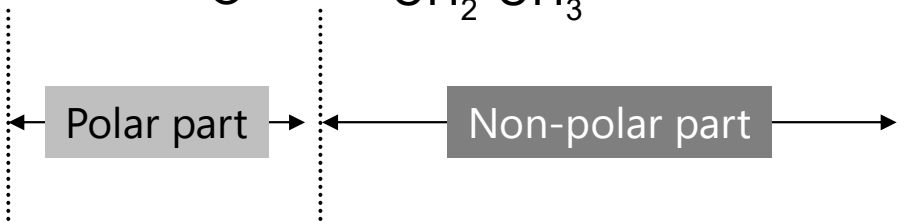
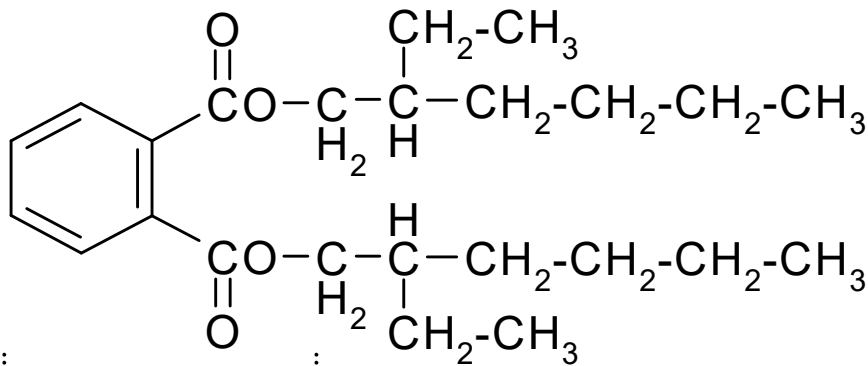


- ✓ Plasticizers work by embedding themselves between the chains of PVC polymer
- ✓ Plasticizers can space polymer chains apart

Softness is maintained even at normal temperature

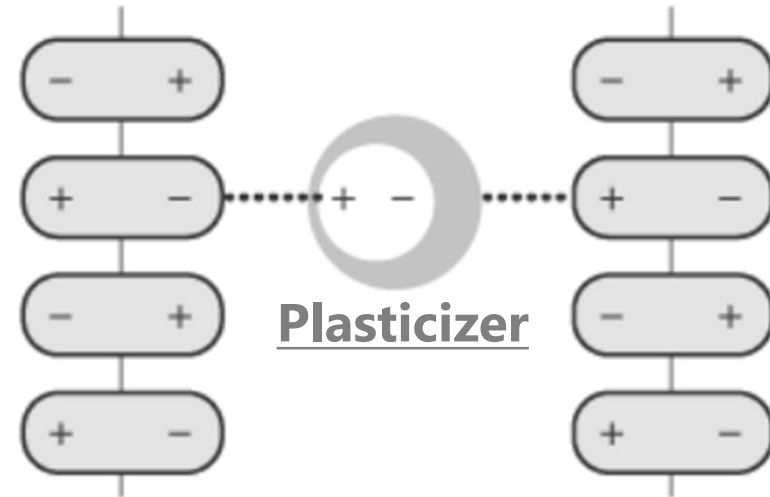
Chemical Structure of Plasticizers

Example : DOP



Polar Part	Important for compatibility with PVC matrix
Non-Polar Part	Important for spacing PVC polymer chains apart

PVC Polymer Chain

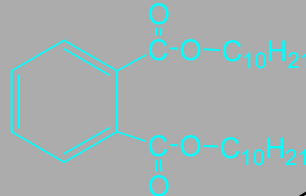


- ✓ **The balance between polar and non-polar portions of plasticizer molecule is critical to control the plasticization effect**

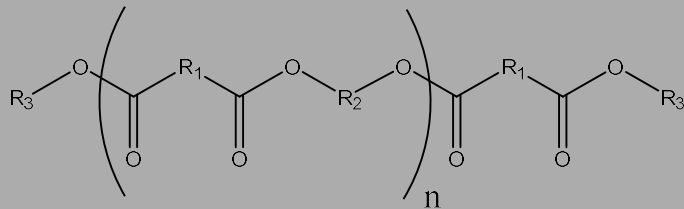
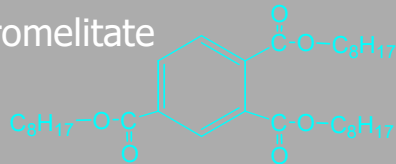
Features of Plasticizers

Long chained alkyl phthalate DIDP, DINP

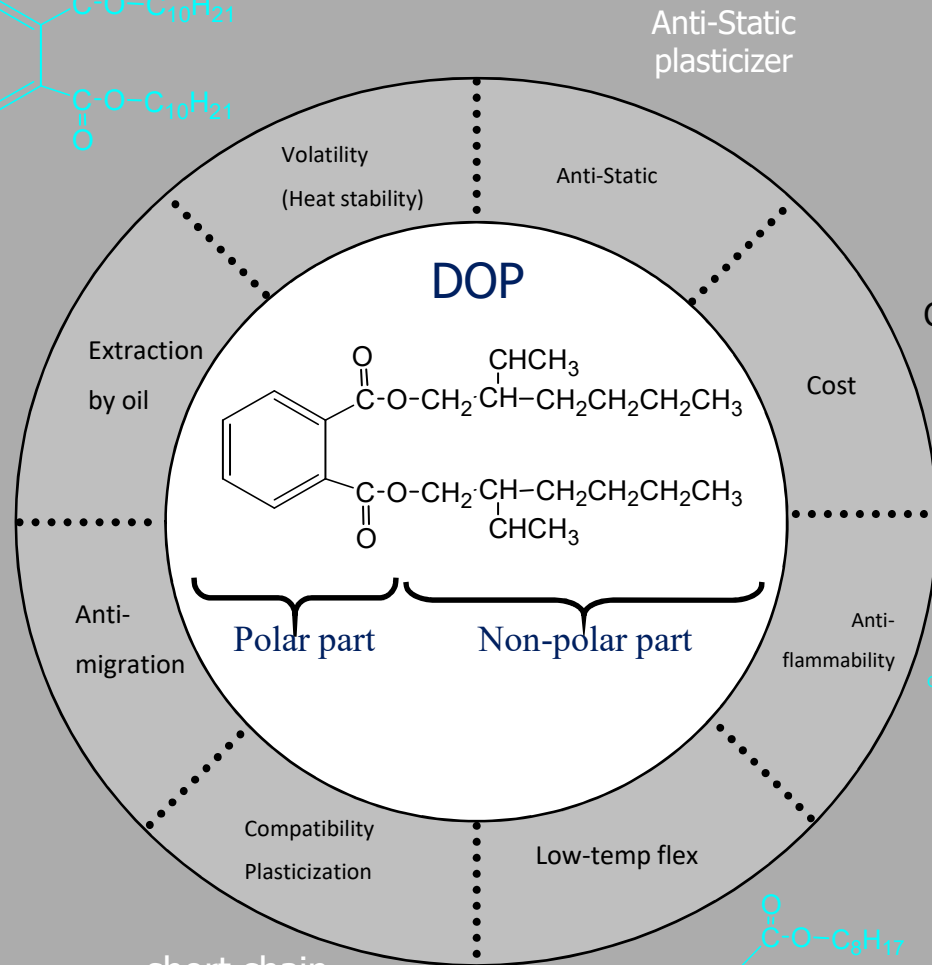
Linear alkyl phthalate



Trimelitate , Pyromelitate

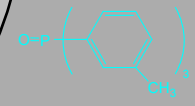


Polymeric plasticizer



Anti-Static plasticizer

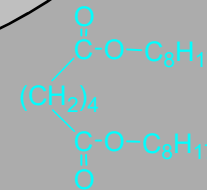
Cl-paraffin



Phosphate

short chain alkyl phthalate
DHP, DBP, BBP

Aliphatic diester



Features of Plasticizers

Property	Commodity			Specialty
	Phthalate DOP	Aliphatic DOA	Trimellitate TOTM	Polymeric PN-7650
Compatibility	++	-	+	+
Plasticizing Efficiency	+	++	-	-
Low-Temperature Flexibility	+	++	+	--
Migration	--	--	-	++
Oil Resistance	--	--	--	++
Volatile Loss	-	--	++	+
Weatherability	+	--	+	-

++: Excellent +: Good -: Moderate --: Bad

- ✓ **Each plasticizer has both advantages and disadvantages**
- ✓ **It is important to select suitable plasticizers depending on applications**

Plasticizer for PVC

- Polymeric Plasticizer
- Linear Trimellitate Plasticizer
- Bio Based Plasticizer



Polymeric Plasticizer : Application

Polymeric Plasticizer can impart **Oil Resistance** to PVC



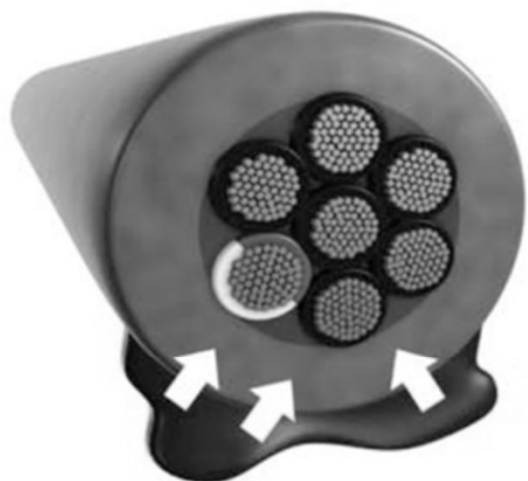
Main Application
Oil Resistant Cable



Why is Polymeric Plasticizer Required?

Why is Polymeric Plasticizer required for oil resistant wire & cable?

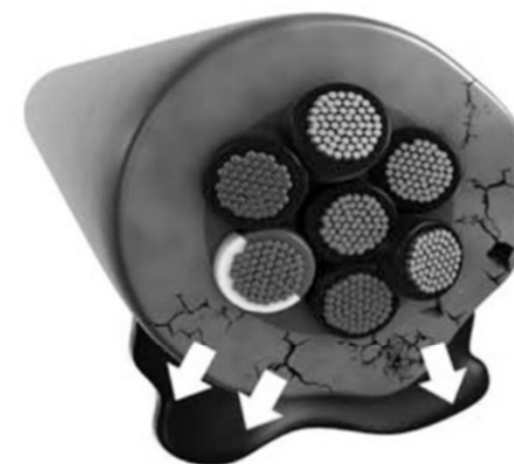
- Example : Wire & Cable contains commodity plasticizers (DOP, TOTM, etc)



Step 1: When process oils come in contact with PVC & Polyolefin compounds, the process oils are attracted to the plasticizers in the cable.



Step 2: The oils can be absorbed by a Polyolefin material resulting in swelling and weakening of the cable jacket.



Step 3: The oils can extract the plasticizers from PVC materials making the cable jacket hard and lead to failures.

- ✓ Polymeric Plasticizer is not easily extracted by the process oils
- ✓ Polymeric Plasticizer can impart to excellent oil resistance to Wire & Cable

Polymeric Plasticizer : Other Application

Polymeric Plasticizer : Oil Resistant Applications

Main Application



**Oil Resistant
Wire & Cable**

Other Applications



**Oil Resistant
Hose, Tube**




**Oil Resistant
Gasket**



**Oil Resistant
Leather**

Polymeric Plasticizer

ADK CIZER	Viscosity		Application
PN-5090	 High	10,000 mPa·s	<ul style="list-style-type: none"> • Oil resistant Wire & Cable • Non-migrating Wire & Cable
PN-8350*		8,000 mPa·s	
PN-250*		4,500 mPa·s	
PN-8030* PN-7650* PN-1030*		3,000 mPa·s	
PN-1020*		2,000 mPa·s	
PN-1010		1,300 mPa·s	
PN-7160		Low	160 mPa·s

“*” marked products are produced in Thailand.

Polymeric Plasticizer

Oil Resistance Test : ASTM No.2 Oil, 100°C x 96hours

Plasticizer	Viscosity (mPa·s)	Oil Resistance	
		Extraction rate (%)	Retention of elongation (%)
DOP	<u>Low</u> 60	<u>Bad</u> 17.7	<u>Bad</u> 40
TOTM	220	8.1	59
PN-1010	1,300	6.0	73
PN-1020	2,000	3.5	80
PN-1030	3,000	2.1	83
PN-7650	3,000	0.8	96
PN-400	<u>High</u> 4,000	<u>Good</u> 0.4	<u>Good</u> 98

Formulation : PVC 100/ Plasticizer 50/ Ba/Zn Stabilizer 2.5

Linear Trimellitate Plasticizer

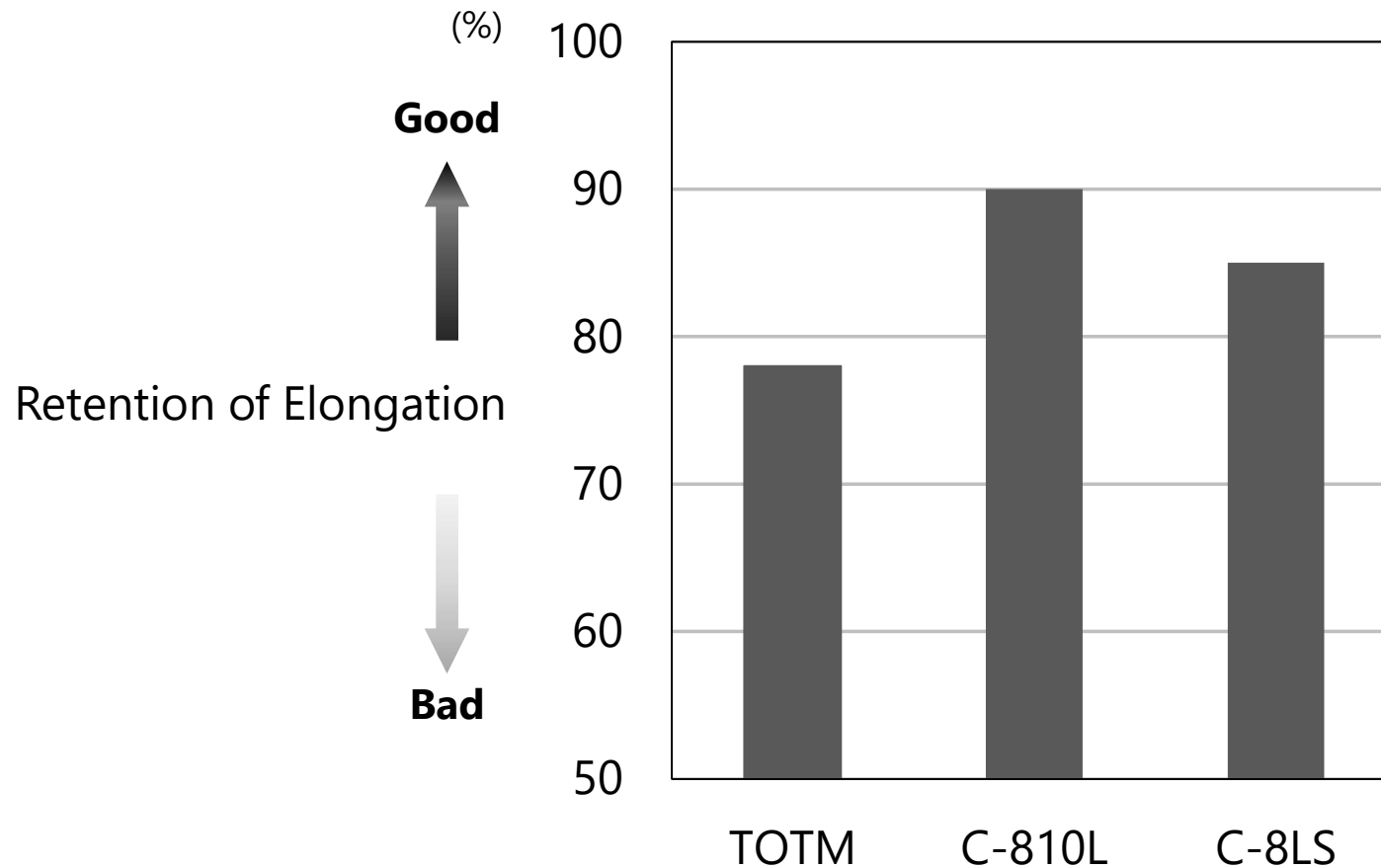
ADK CIZER C-810L, C-8LS

- ✓ Linear Alcohol Based Trimellitate
- ✓ Suitable for Wire & Cable
Suitable for 125°C Rating Cable
- ✓ Low Volatility
Excellent Heat Stability
Excellent Cold Resistance
Excellent Electrical Property
Excellent Mechanical Property



C-810L, C-8LS : Trimellitate

Tensile Test After Heat Aging @ 136°C x 2weeks

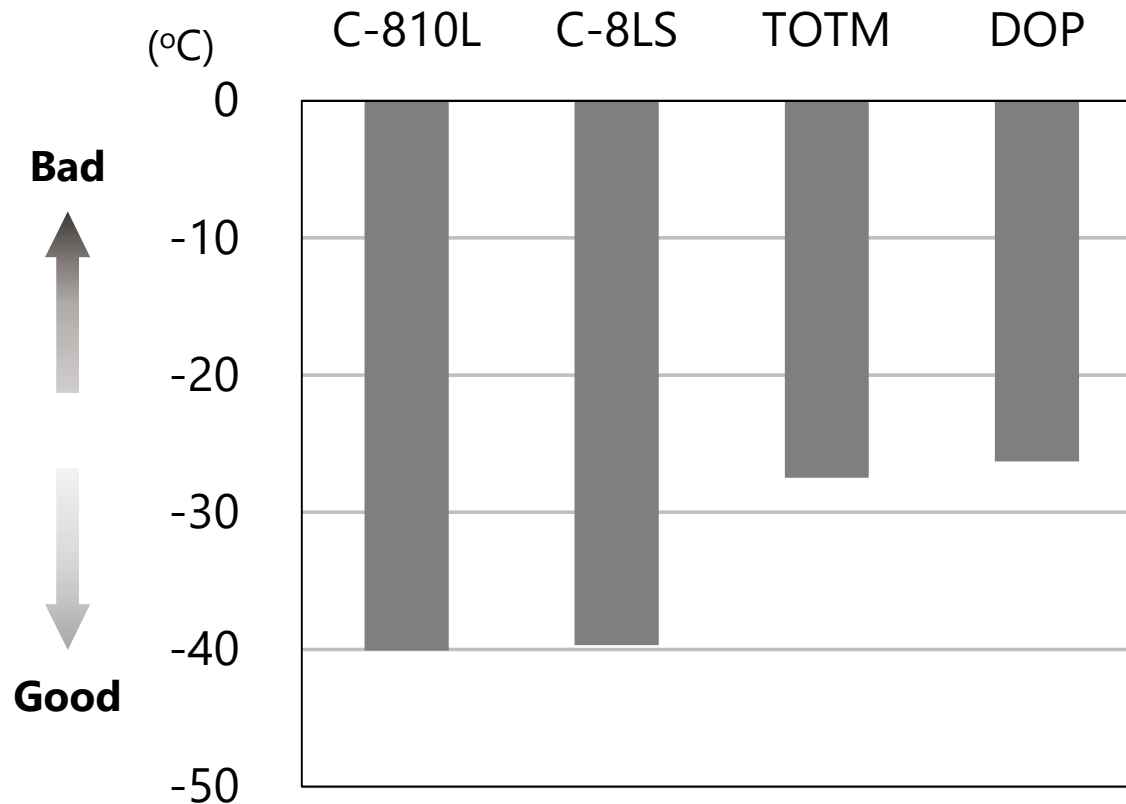


Formulation : PVC 100/ Plasticizer 50/ CaCO₃ 10/ Kaolin Clay 10/ Stabilizer 5

C-810L, C-8LS : Trimellitate

Cold Resistance : Flexibility at Low Temperature

Cold Flex Temperature : Clash & Berg Test



Formulation : PVC 100/ Plasticizer 60/ ESBO 3/ Stabilizer 3.2

Bio Based Plasticizer for PVC



Polymeric Plasticizer

Epoxidized Soybean oil

Phthalate

ADK CYCLOAID
PNB-205

Biomass **95%**

ADK CYCLOAID
O-130B

Biomass **90%**

ADK CYCLOAID
PHB-10

Biomass **70%**

ADK CYCLOAID
PNB-25XX

Biomass **95%**

"We plan to further expand our product lineup in the future."



THANK YOU

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ADEKA

