Plastization of new polymers derivatives from poly vinyl alcohol

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Abstract

Plastization of new prepared esters with poly vinyl chloride (pvc) which containing pendant esters group on polymeric chain .

Preparatiom of ester containing pendant ester on polymeric chain by reacting of acidic anhydride with copoly (vinylchloride-vinyl alcohol) in acidic medium under reflex at 62 °c for six hours,filter and Purified by Tetrahydrofuran (THF) .Then plastization of different wights of new prepared with 1gm of solid poly vinyl chloride . The prepared polymers were identified by FTIR and by studying physical properties such as softening points , melting points, and solubility in different solvents .

Introduction

Poly (vinyl chloride) is partially syndiotactic material with sufficient irregularity structure crystallinity is quite low .

Its structural characterization is complicated by the possibility of chain branching and tendency of polymer to associate in solution. copolymer. The a advantages in polymer properties resulting from the copolymerization (1) of small a mounts of vinylacetate with vinyl chloride were discovered a round 1928. Ues the lower softening point and high solubility of copolymer make the fabrication very much easier . stability is improved, color and clarity are also better . Plasticization , Many properties of poly (vinyl chloride) (PVC) and (vinyl chloride – vinyl acetate) copolymer are improved by plasticization(2) . The large majority of commercial production of vinyl resins is in the form of plasticized compostion. Esters are now widely utilized as plasticizers for vinyls. The plasticizers are added to polymers on hot rolls or in a hot mixer such as Banbury. Plasticizer content varies widely with the end use of material , but typically may be around 30% by weight . Vinyls is used for extrusion applications , and is used for insulation for electrical wire and cable . Another field for vinyls(3) is coating fabrics and is used for floor covering. Molding uses including phonograph records from rigid vinyls .

The addition of plasticizer reduce stiffness, hardness and brittleness, and has smaller effecton mechanical properties . polyesters , although the low melting points of linear aliphatic polymers were attributed to unusual flexibility of C-O bond (Bunn 1955) , the flexibility of chain molecules arises from rotation a round saturated chain bonds . The most widely used polymer of a vinyl poly ester is poly (vinyl actate) . It is utilized not only in plastic , primarily in the form of emulsions (4) , commercially available are made by emulsion polymerization mechanisms . Reaction of copoly (vinyl chloride- vinyl alcohol) with maleic anhydride) to give new ester copoly (vinyl carboxy maleate – vinyl chloride) in acidic medium(5).

Anew ester of poly (vinyl chloride – vinyl alcohol) react with phthalic anhydride in acidic medium gave copoly (vinyl carboxy phthalate- vinyl chloride) . These two prepared esters uses with PVC as plasticizer .Mixing of different weight of each ester with PVC of different weight and study the characteristic properties in plasticization .

Experimental

Melting point were determined using Gallenkamp Melting points apparatus (MFB- 600) Softening points were determined using reichert thermover SP , 10/0.25, 160 structures conformation of new prepared polymers were proved by FTIR spectroscopy and other physical properties including softening points , melting points and solubility of polymers in different solvents were studied . All chemicals were used from BDH .

1- Preparation of plastizer : Mixture of solid poly vinyl chloride (PVC) with different weighs of new ester prepared of copoly (vinyl carboxy maleate-vinyl chloride) 0.1 gm , 0.2 gm,0.3 gm, 0.4 gm , 0.5gm, 0.6gm, 0.7gm, 0.8gm, 0.9gm and 1gm with 1 gm of PVC gave new physical properties , softening points of PVC with copoly (viny carboxy maleate-vinyl chloride) .

As shown in table (3) and relationship between plasticizer in PVC (6) with softening point is shown in curve No.(1) .

2- Mixture of solid poly vinyl chloride (PVC) with different weights of new ester prepared of copoly (vinyl carboxy phthalate- vinyl chloride) (7,8) 0.1gm , 0.2 gm,0.3 gm, 0.4 gm, 0.5gm, , 0.6gm, 0.7gm, 0.8gm,0.9gm and 1gm with 1gm of PVC gave new physical properties , softening points of PVC with copoly (vinyl carboxy phthalate- vinyl chloride) is shown in table(4) and relationship between plasticizer in poly vinyl chloride (PVC) with softening point shown in curve No.(2) .

Result and discussion

One of suitable procedure for preparation of copoly (vinyl carboxy maleate–vinyl chloride) is by dissolving of copoly (vinyl choride- vinylalcohol) with maleican hydride in acidic medium heating at (60-70) ° C under reflux for 6hrs gave new ester .

IR spectrum of Copoly (vinyl carboxy maleate – vinyl chloride) showed the following band (9) at (3300) cm^{-1} for OH- group of carboxylic acid at 3055cm $^{-1}$ for oliphenic = CH , at 2916 cm^{-1} for aliphatic – CH, at 1710 cm^{-1} for C=O ester group, at 1650 m $^{-1}$ for C=O carboxy group , at 1218 $cm^{-1}$for C-O carboxylic group and at 1600 cm $^{-1}$ for Oliphenic

C=C group (as shown in table3) FTIR a bsorption band .

Copoly (vinyl carboxy phthalate- vinyl chloride), preparation of copoly (vinyl carboxy phthalate – vinyl chloride) by dissolving of copoly (vinyl choride- vinyl al cohol) with phthalic an hydride in acidic medium and heating at (60-70) ° C under reflux for 6hrs gave new ester .

The FT-IR spectrum show absorption band at (3500) cm^{-1} for OH group carboxylic acid , at 1750 cm^{-1} for ester C=O, at 1700 cm^{-1} C=O for carboxylic group , 1180cm^{-1} for C-O carboxylic group , at 3100 cm^{-1} for aromatic – CH , at (1400- 1500- 1600) cm^{-1} for aromatic ring and at 2950 cm^{-1} for aliphatic – CH as shown in table (2) FT-IR absorption band .

Table (1): Physical properties for copolymers and Their derivatives

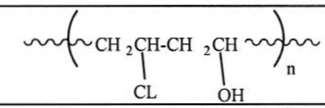
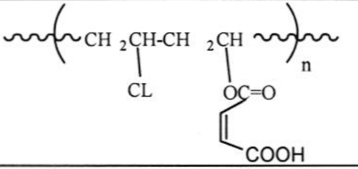
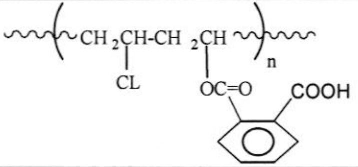
رقم المركب	تركيبه	Reaction time	Converstion %	Color of preciptate	Melting Point °c	Softening Point °c
1		6hours	78%	Pale pink Crystal	186-188	161-171
2		6 hours	89%	Pale brown	191-194	162-176
3		6 hours	84%	Reddish Blue	200-217	180-196

Table (2): Infrared absorption band $(cm)^{-1}$ of new prepared copolymers

compound No.	compound name	ν_{C-O} ν_{C-O} acid -OH	$\nu_{C=O}$ ν_{acid} ester	ν_{C-OC} cm^{-1}	ν_{C-H} bending cm^{-1}	$\nu_{C=C}$ aramatic	ν_{C-H} aliphatic cm^{-1}	ν_{C-H} aroatic cm^{-1}	Others bands cm^{-1} -OH	ν_{C-Cl}
1	Copoly(vinyl chloride - vinyl alcohol)	—1250	-	–	1370, 1459	-	2990	-	3250-3600	680
2	Copoly (vinyl chloride-vinyloxy-maleate	1218	1650 – — 1710	1265		1440,1500,1600	2916	3055	3300	620
3	Copoly (vinyl chloride-vinyloxy-phthlate	1180 —	1700 — —1750	1280	–		2950	3100	3500	590

Table(3) Solubility of new copolymer

No.	Benzene	DMF	DMSO	THF	Water	CCl4	Acetone	EtOH
Copoly (vinyl chloride- vinyl alcohol)	V.S	V.S	V.S	V.S	P.S	P.S	V.S	V.S
Copoly (vinyl chloride-vinyloxy- maleate	V.S	V.S	V.S	V.S	P.S	P.S	V.S	V.S
Copoly (vinyl chloride-vinyloxy- phthlate	V.S	V.S	V.S	V.S	P.S	P.S	V.S	V.S

v.s = very solube
p. s = parsial solube

Table(4) ^{1}H-NMR spectra of selected Copoly (vinyl chloride- vinyl alcohol)

Comp. No.	^{1}H-NMR parameters (ppm) δ-H
Copoly (vinyl chloride- vinyl alcohol)	3.2 (t, 2H, -CH2);2.5 (m, 1H, -CH), 10.1 (OH)

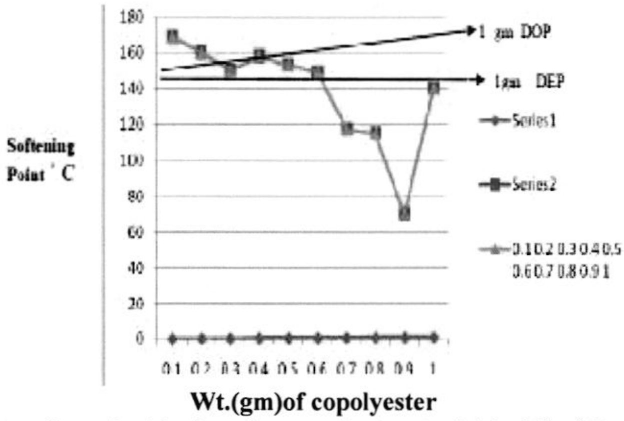


Fig (1) shows plasticization of copoly (vinyl carboxy maleate- vinylchlorid) with poly vinyl chloride (PVC)
DEP 132-142 C
DOP135-150 C

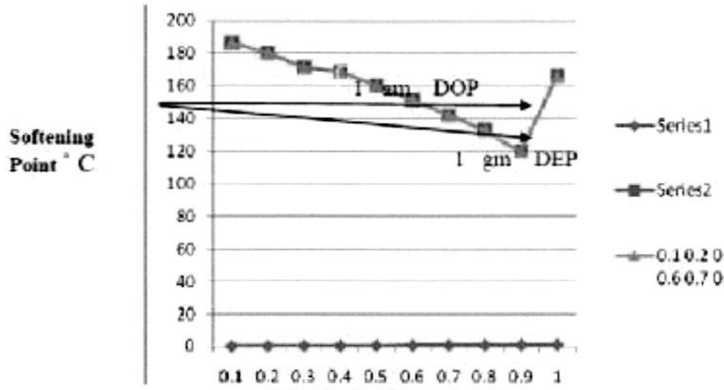


Fig (2) shows plasticization of copoly (vinyl carboxy phthalate- vinylchlorid) with poly vinyl chloride (PVC)

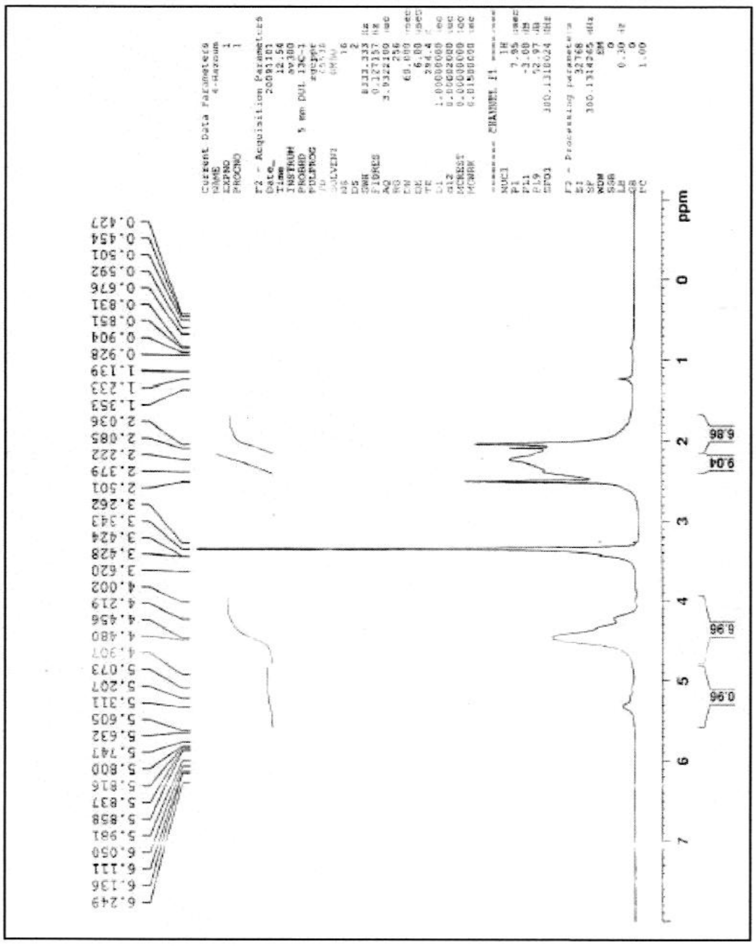
DEP 132-142 C
DOP135-150 C

Table(1) Relationship between Copoly ester and Softening Point

Plasticizer	Weight %	Softening Point C
Copoly (vinyl chloride-vinyloxy-maleate).which is used with PVC	0.1 gm	169-161
	0.2 gm	160-175
	0.3 gm	159-171
	0.4 gm	158-162
	0.5 gm	153-160
	0.6 gm	149-160
	0.7 gm	117-144
	0.8 gm	115-135
	0.9 gm	70-92
	1 gm	140-162

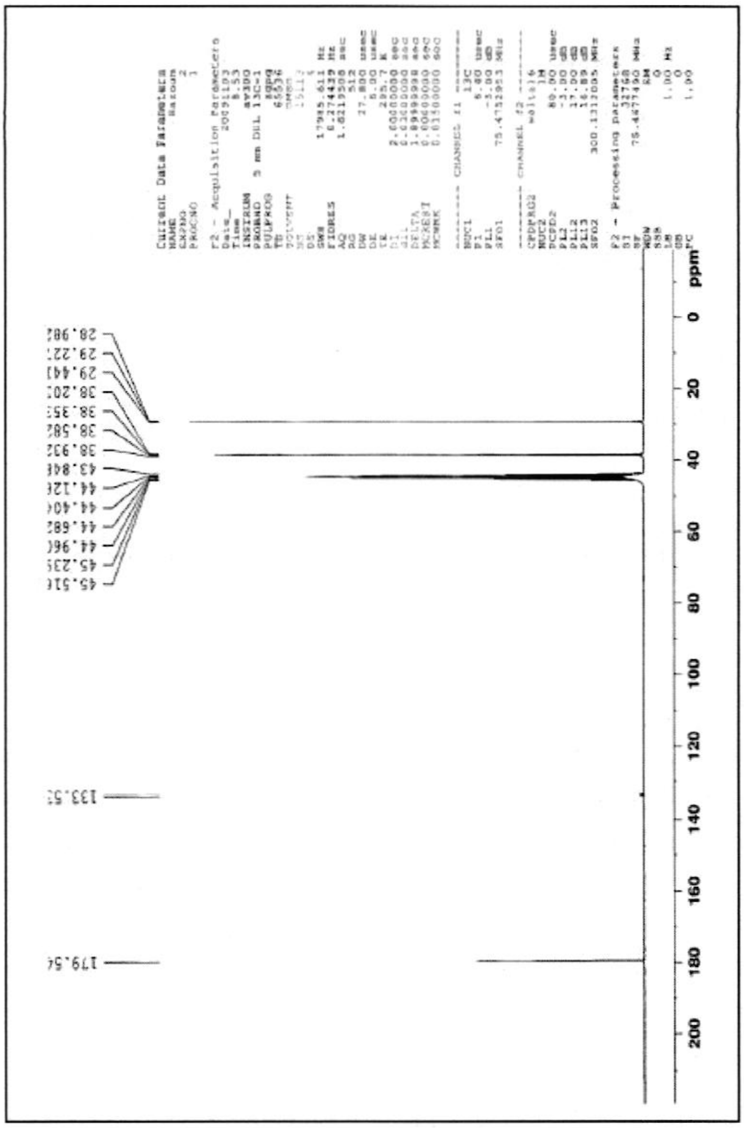
Table(2) Relationship between Copoly ester and Softening Point

Plasticizer	Weight %	Softening Point C
Copoly (vinyl chloride-vinyloxy-phthalate).which is used with PVC	0.1 gm	186-170
	0.2 gm	180-168
	0.3 gm	171-162
	0.4 gm	169-153
	0.5 gm	160-150
	0.6 gm	151-144
	0.7 gm	142-135
	0.8 gm	133-126
	0.9 gm	120-110
	1 gm	166-162



Copoly (vinyl chloride- vinyl alcohol)

Fig(1) ʹH -NMR



Copoly (vinyl chloride- vinyl alcohol)

Fig(2) -^{13}C

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تلدين بوليميرات جديدة مشتقة من بولي كحول الفاينل

هزوم مولى المياح

قسم الكيمياء ، كلية العلوم ، جامعة بغداد ، بغداد ، العراق

الملخص

تم في هذا البحث تلدين بوليمرات استرية جديدة محضرة مع بولي كلوريد الفاينل . تم تحضير هذه الاسترات من بولي كحول الفاينيل مع انهدريدات الحوامض اللامائيه في محيط حامضي مع التصعيد في درجة حراره 62 °c لمدة 6 ساعات شخصت هذه البوليمرات الاسترية المحضره بالطرق الطيفية ودراسة قابلية هذه البوليمرات الاسترية الجديدة على التلدين مع بولي كلوريد الفاينيل PVC ومتابعة تأثير التلدين على الخصائص الفيزياوية ودرجات التلدين ودرجات الانصهار وقابلية الذوبان في المذيبات العضويه مختلفة .