A20L-021

THE USE OF CAPA® POLYMERS AS PLASTICISERS

INTRODUCTION

The low Tg of polycaprolactones, -60°C, leads to their use in a wide variety of polymers where the Capa® polymer is reacted with other products to produce an internally plasticised polymer.

Capa® Polycaprolactones when blended with compatible polymers, such as PVC, act as external plasticisers. The data presented here details the plasticising effect of Capa® PL1000 and Capa® 6500, and compares their performance with other commonly used non-migrating or polymer plasticisers with DOP as a reference.

Capa® PL1000 is a 1000 molecular weight soft waxy polymer at 20°C and Capa® 6500 is a hard crystalline thermoplastic, molecular weight 50,000 and is supplied as a granule.

PROCESSING

A standard formulation based on Solvic 271GC was used in all cases. The blends were mixed for 10 minutes at 180°C on a Brabender and pressed into sheets.

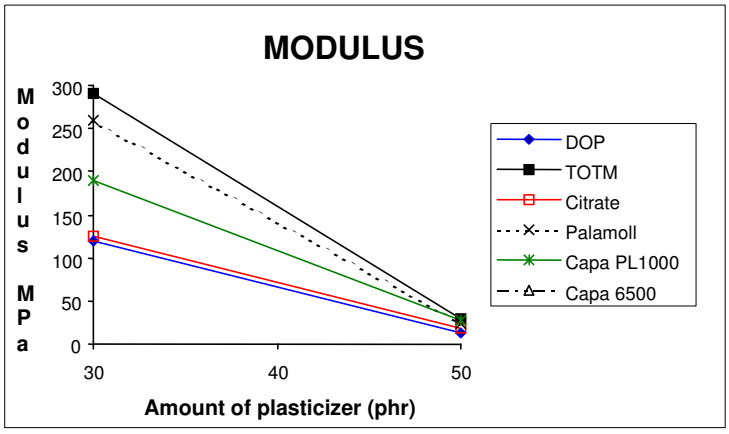
The comparative plasticisers were:

DOP:	Dioctyl phthalate
TOTM:	Tri octyl trimellitate
Citrate:	n butyl tri n hexyl citrate
Palamoll 651:	Polyadipate

ELASTIC MODULUS AT ROOM TEMPERATURE

The elastic modulus was measured at 1 mm/minute. The distance between the bits was 50 mm and the segment modulus considered was 0.05% and 0.25% of deformation.

Rigid PVC was the reference and gave a modulus of 2000 MPa.



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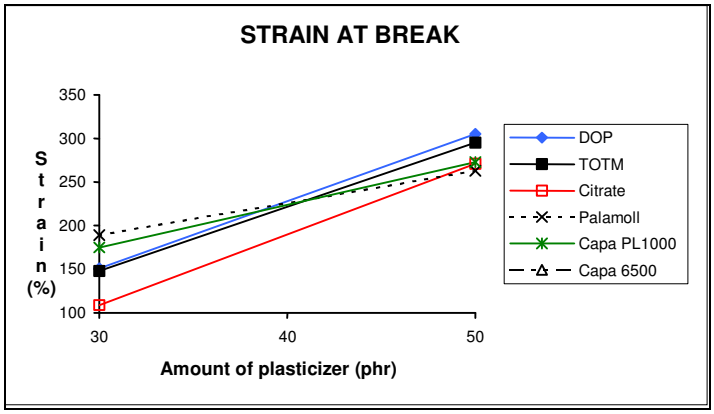
STRAIN AT BREAK

The values were measured at 100 mm/minute.



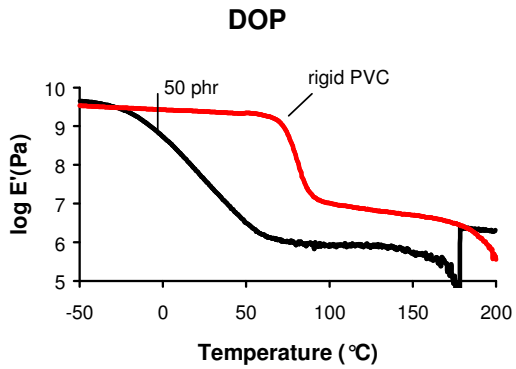
DMTA

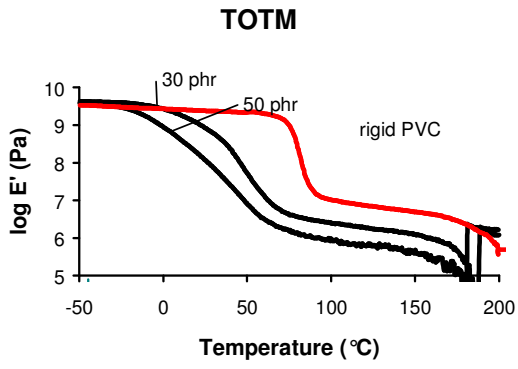
DMTA is used to show the evolution of elastic modulus (E^{I}) against temperature and also to compare the glass transition temperature, Tg, of the different formulations.

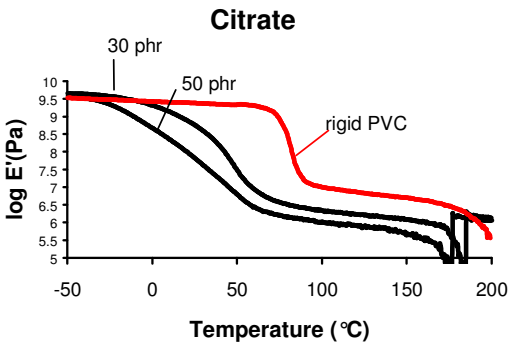
The values were generated with a bending frequency of 1 Hz in the temperature range –50°C to 200°C.

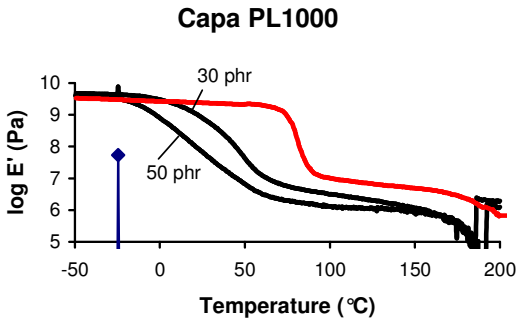
The effect of Tg on E^{I} is clear with values for all blends being relatively constant below the Tg. Above the Tg the behaviour of E^{1} is dependent on the plasticiser.

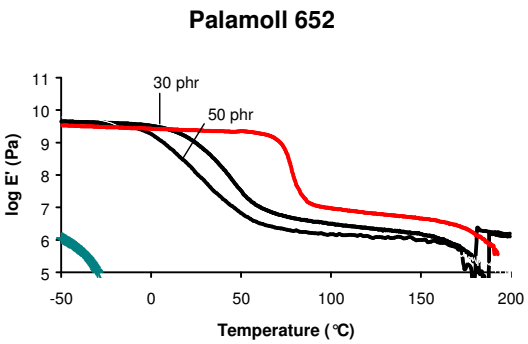
For all plasticisers E^{I} decreases with increasing plasticiser content unless there is a separation issue, such as crystallisation of the plasticiser.

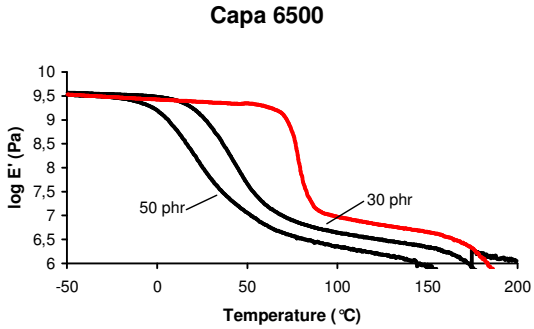


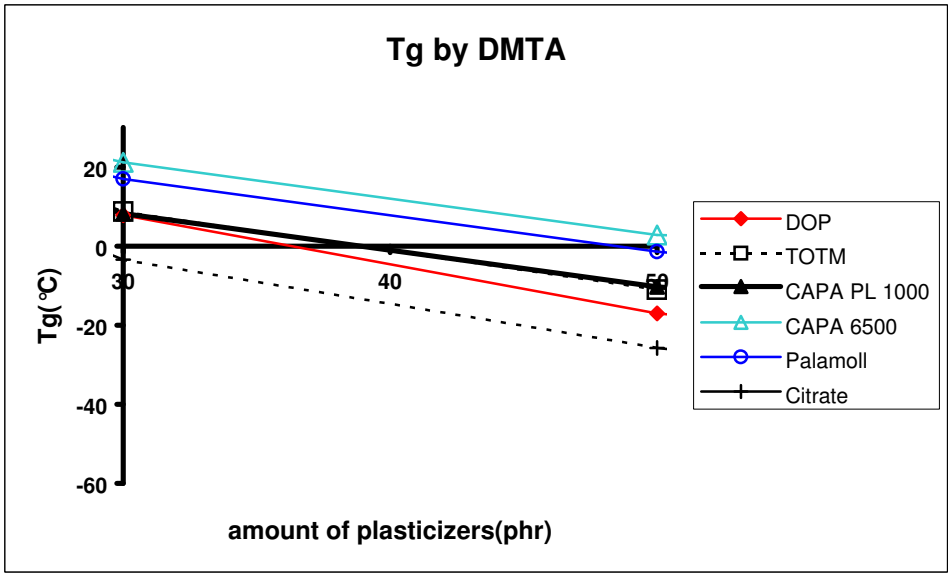



Citrate
30 phr
50 phr
rigid PVC
log E'(Pa)
Temperature (°C)


Capa PL1000
30 phr
50 phr
log E' (Pa)
Temperature (°C)


Palamoll 652
30 phr
50 phr
log E' (Pa)
Temperature (°C)


Capa 6500
50 phr
30 phr
log E' (Pa)
Temperature (°C)


Tg by DMTA
Tg(°C)
amount of plasticizers(phr)
DOP
TOTM
CAPA PL 1000
CAPA 6500
Palamoll
Citrate

In general, the characteristics of polycaprolactones offer a range of options for plasticisation of polymer resins and particularly PVC. The low Tg of Capa® polymers, compatibility with PVC across a wide range of addition levels and molecular weights, enables a formulation of resins based on Capa® polycaprolactones with varied modulus and viscosity.

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