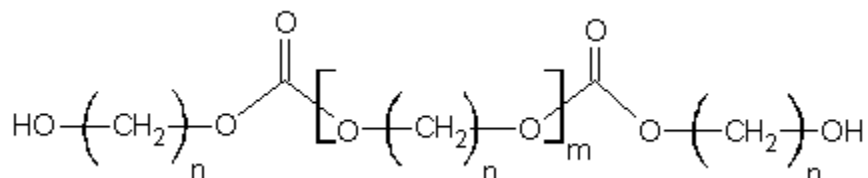




Ravecarb



❖ Generality:

“Ravecarb” are aliphatic polycarbonate glycols used as intermediates for the production of high performances POLYURETHANES (PUR).

When used in PUR formulations, Ravecarb provide superior resistance to hydrolysis and to degradation by ultraviolet light, oxygen and solvents.

❖ Product line:

Ravecarb 102: n=6; m=6

Ravecarb 106: n=50% 6; 50% 5; m=12

Ravecarb 107: n=6; m=6

Suggested Uses

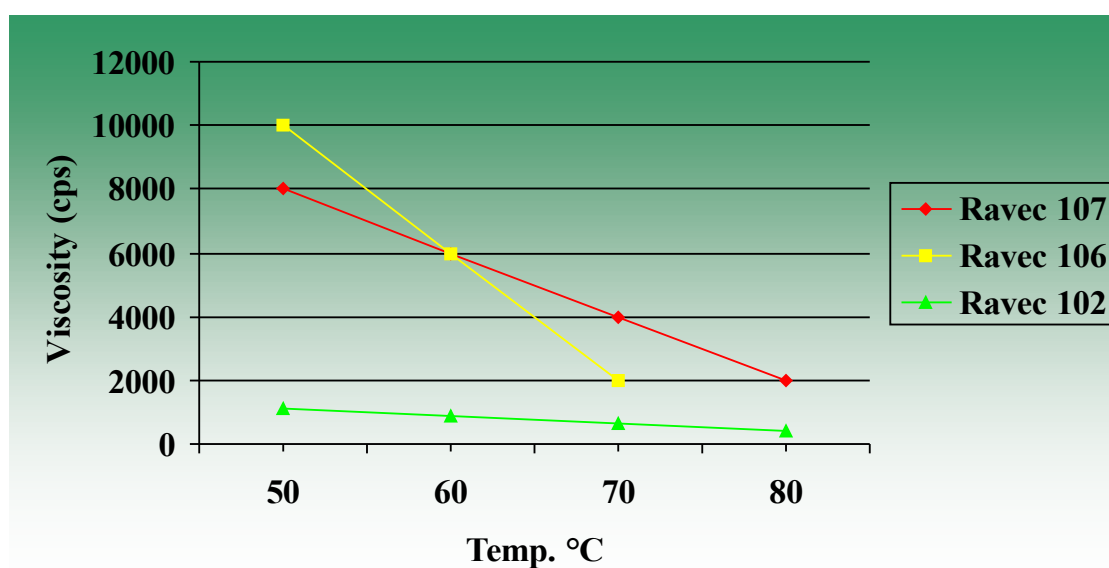
RAVECARB 102	Polyurethane adhesives and sealants, suitable for car industry and in all applications where durability is key factor. Special kind of coatings and extrudible grains can also be formulated.
RAVECARB 106	Polyurethane coatings suitable for special uses, high resistance to hydrolysis, heat, U.V., radiation and atmospheric agents, high modulus and high mechanical resistance
RAVECARB 107	The liquid stætus makes very easy the use of Ravecarb 107 to prepare polyurethane emulsions suitable for inks, leather finishing and in general everuwhere high resistance to ageing is requested. Polyurethane coatings, sealants and adhesives with high performance can also be formulated with Ravecarb 107



❖ Chemical -physical properties

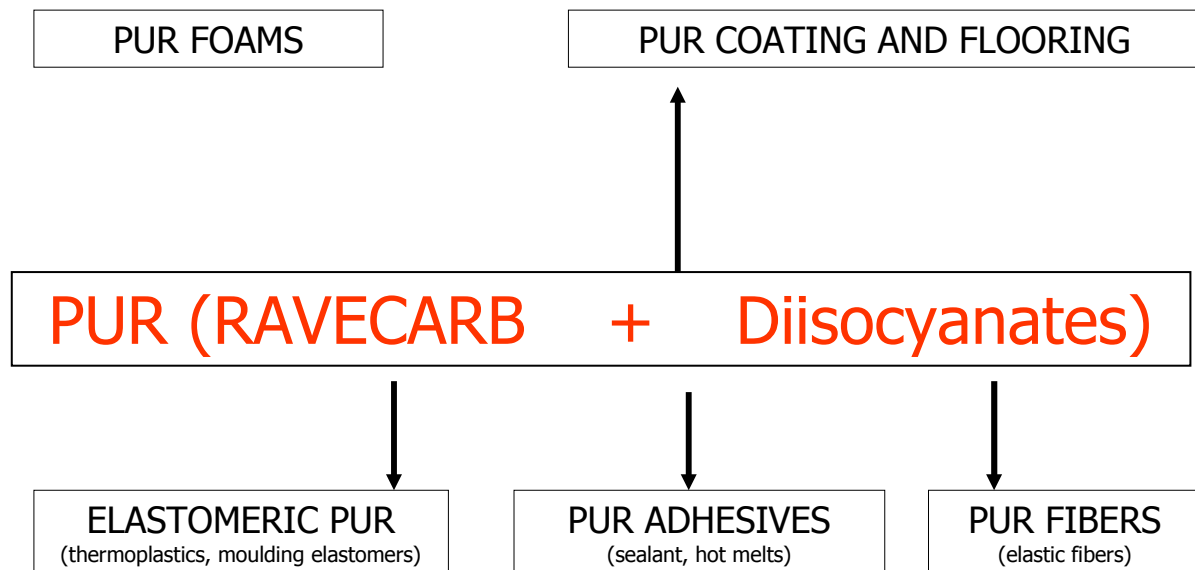
	Ravecarb 102	Ravecarb 106	Ravecarb 107
Chemical Structure	Homopolymer from hexandiol	Homopolymer from hexandiol	Copolymer from hexandiol and pentandiol
Appearance	White solid	White solid	Liquid
Theoretical OH functionality	2	2	2
OH number (mg KOH/g)	106 – 118	53 – 59	58 – 64
Average molecular weight	1000	2000	1850
Acidity number (mg KOH/g)	0,1	0,1	0,1
Color APHA	200	200	200
Water %	0,1	0,1	0,1
Melting range °C	33-43	36-50	-----
Viscosity (cps at 50°C)	1100	10000	8000

Viscosity vs. temperature





❖ GENERAL FORMULATIONS



❖ Ravecarb and Elastomeric “PUR”



A urethane polymer is the reaction product of a high molecular weight polyol, a short difunctional chain extender, and an aliphatic or aromatic diisocyanate (here is no difference in the formulation technique between Ravecarb and polyols of different nature).

It produces a (AB) type polymer composed of alternating hard and soft segment:



The soft segment is the high molecular weight polyol chain, and the hard segment is the reaction product of the chain extender and the diisocyanate.

As the concentration of the hard segment increases, the modulus of the urethane increases, and the opposite when the soft segment increases.

In addition, the nature of the hard segment can be modified by the choice of an appropriate crosslinker,

FORMULATION EXAMPLE



AROMATIC PUR		SYNTHESIS CONDITIONS			
Ravecarb® 106	72.43 pars	MDI		+ 80°C	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> NCO/OH 1.03 O -NHCO 15% </div>
Extender (1.4 - BD)	10.00 "			6 hrs then add DMF to 46% solids	
Diisocyanate (MDI)	37.57 "	DMF (54% solids)	(Tin)		<div style="border: 1px solid black; padding: 5px; display: inline-block;"> NCO/OH 1.03 O -NHCO 15% </div>
Solvent (DMF)	223.00 "	Polyol BD 1,4	+ 60°C		
NCO/OH = 1.03 no catalyst					
ALIPHATIC PUR		SYNTHESIS CONDITIONS			
Ravecarb® 106	88.00 pars	Polyol + HMDI	Mix 70°C		<div style="border: 1px solid black; padding: 5px; display: inline-block;"> NCO/OH 1.03 O -NHCO 15% </div>
Extender (1.4 - BD)	12.74 "		30'	130°C 5 hrs	
Diisocyanate (HMDI)	49.74 "				<div style="border: 1px solid black; padding: 5px; display: inline-block;"> NCO/OH 1.03 O -NHCO 15% </div>
Catalyst (Sn DBL)	10 ppm	BD 1,4	(Tin)		
NCO/OH = 1.03					

POLYOLS (POLYMER GLYCOLS)

- A) **POLYETHER GLYCOLS** : PPG (Poly(oxypropilene)glycol // PTMG
(Poly(oxytetramethylene)glycol
- B) **POLYESTER GLYCOLS**: PCL (Poly(caprolactone)glycol // PHC
(Poly(hexamethylene)carbonate glycol // PBA (Poly(buthylene adipate)glycol // PHA
(Poy(hexamethylene adipate) glycol
- C) **POLYCARBONATE DIOLS (RAVECARB)**

Thermoelastomeric PUR: Synthesis conditions comparison between generic Polyol and Ravecarb

Polyol (Parts)	Ravecarb (Parts)	Extender (Parts)	Catalist (Parts)	Diisocyanate (Parts)	NCO/OH	Conditions
Aliphatic	-	BD 1,4 (*)	Tin	HMDI (**)	1,03	1. Mix at 70° for 30' 2. 130°C 5 hrs
Aromatic	-	BD 1,4 (54% sol in DMF)	Tin	MDI (***)	1,03	1. Mix 80°C for 6 hrs 2.
-	(88)	BD 1,4 (12,74)	Tin DBL (****)	HMDI (49,74)	1,03	-
-	(72,43)	BD 1,4 (10)	-	MDI (37,57)	1,03	Solvent DMF 223 parts

- * 1,4 Butane diol
 ** Hexamethylene Diisocyanate
 *** Methylene Diphenyl Diisocyanate
 **** Tin Dibutyl laurate



COMPARATIVE TEST ON THERMOELASTOMERIC PUR

TEST	FORMULATION/Test CONDITIONS
Thermal Stability	Thermoplastic PUR / Heating in stove 120°C
Hydrolysis Resistance	Thermoplastic PUR, Reactive Hot Melt / Dipping in water at 50/85°C
Radiation +Moisture Resistance	Sealant cured room condit. / UVCON apparatus

Thermoelastomeric Aliphatic PUR Tensile properties

RAVECARB	102	106	107	PCL (*)	PTMEG (**)
Molecular weight	1000	2000	1850	2000	2000
Tensile strength (N/nm)	61,6	62,1	61	58,2	63,3
Sec, Modulus (100%)	3,75	10,2	8,5	4,68	4,2
Elongation (%)	935	1009	1100	1300	1480

(*) Polycaprolactone

(**) Polytetramethylene glycole

Thermoelastomeric Aromatic PUR Tensile properties

RAVECARB	102	106	107	PCL (*)	PTMEG (**)
Molecular weight	1000	2000	1850	2000	2000
Tensile strength (N/nm)	61,3	61,6	62,8	43,7	Degr.
Sec, Modulus (100%)	6,1	9,3	9,5	7,1	Degr.
Elongation (%)	850	1200	1200	1380	Degr.

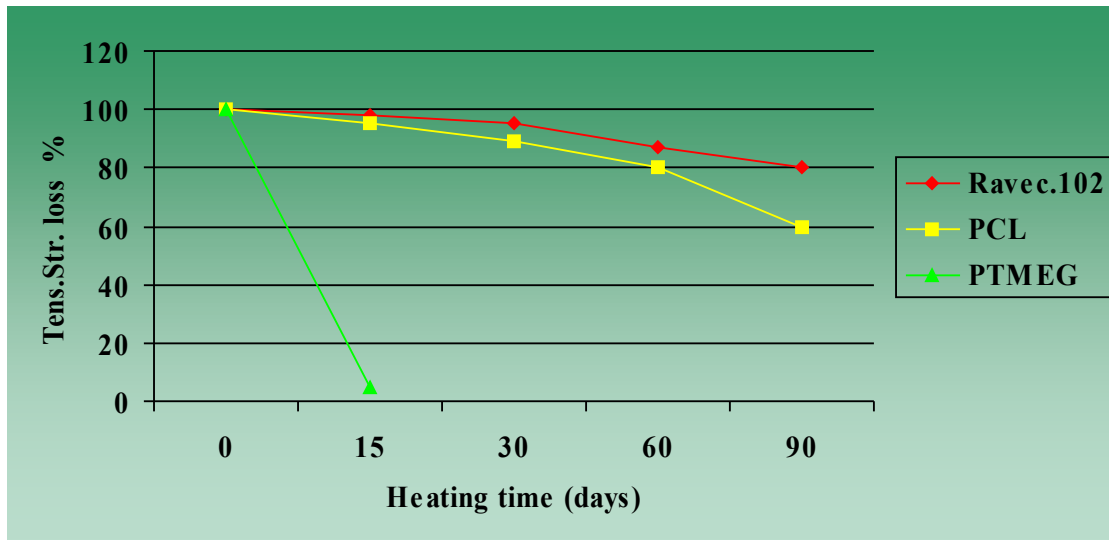
(*) Polycaprolactone

(**) Polytetramethylene glycole

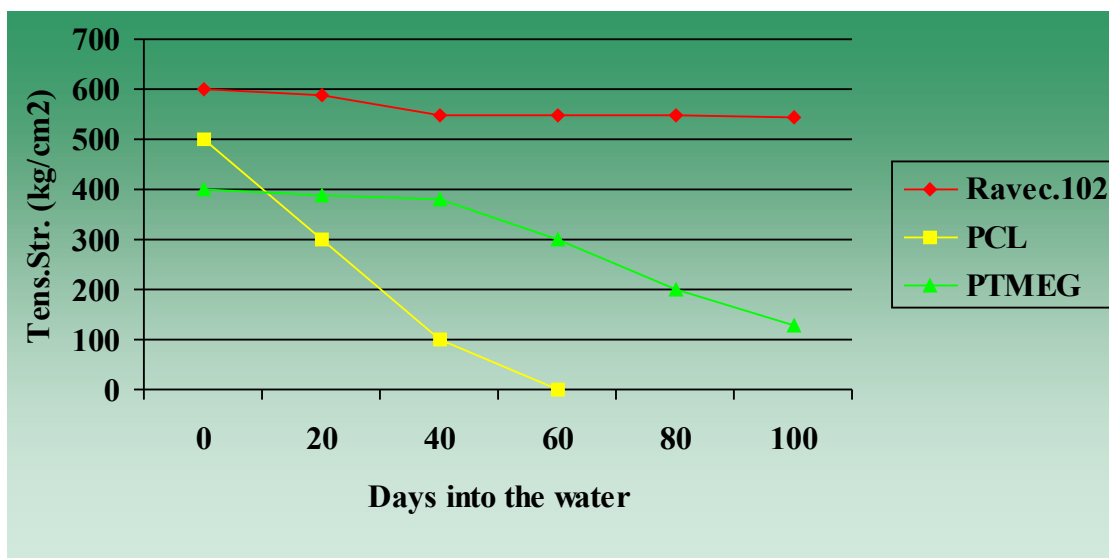
Thermal resistance on a PUR film



Tensile Str. Loss during the time, at 120°C

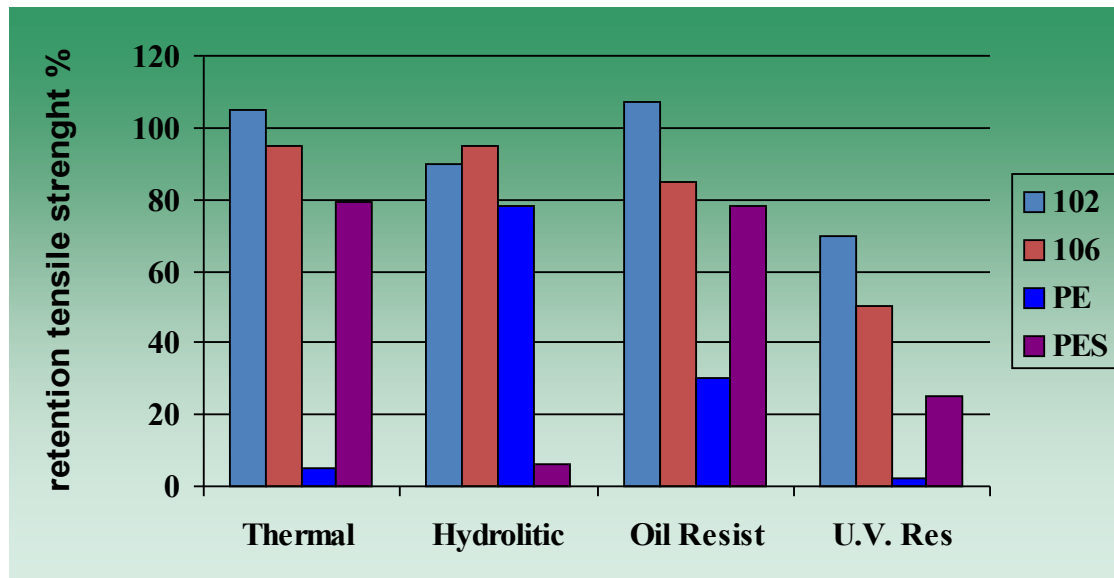


Hydrolysis resistance of PUR film Tensile str. Loss in the time (water at 85°C)





Ravecarb PUR film resistance



PE: Polyethers
PES: Polyesters

❖ RAVECARB AND SEALANTS

CURING CONDITIONS

Curing Agent: BIS-OSSAZOLIDINE

Catalist: Di-Butyl Tin Laurate

Curing: In avon at 25°C and 70% u.r.

Curing level has been determined measuring the hardness and the gel %.

Samples: The components are mixed at 50°C and with the mixture we make a film of 2 mm thickness.

RECEIPE

Polyols: Ravecarb 102
Ravecarb 106

Polymer preparation:

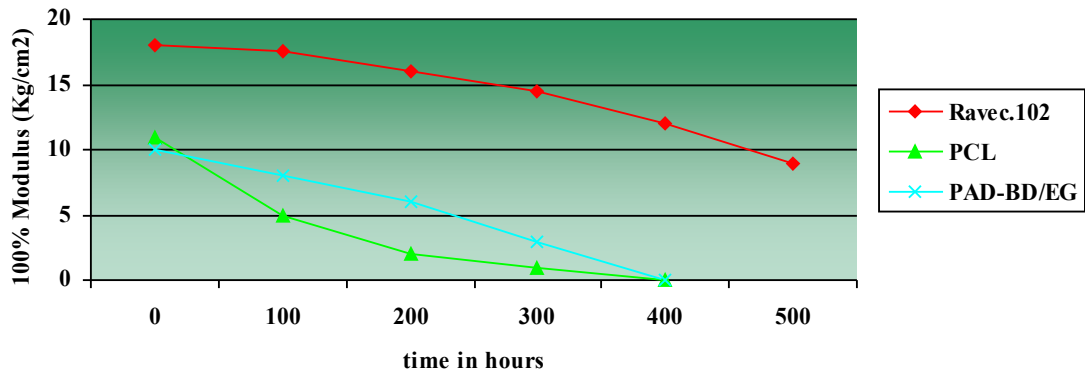
Diisocyanate : IPDI

-NCO/-OH : 1,025

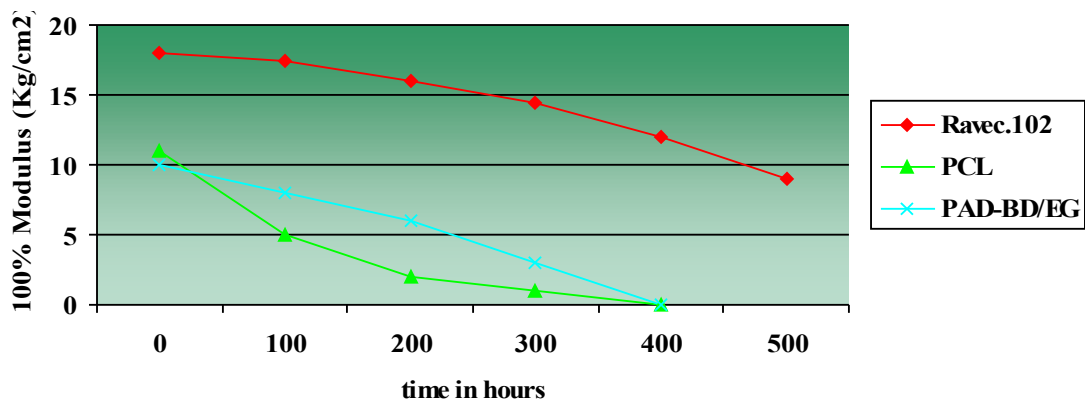
Temperature : 70-80°C



TEST UV ON SEALANT Variation of modulus 100% in the time

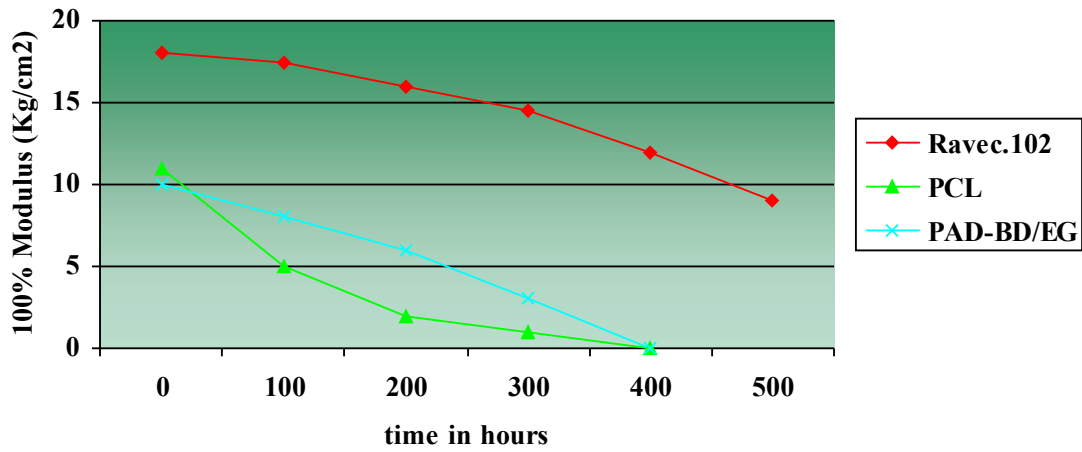


Variation of modulus 100% in the time

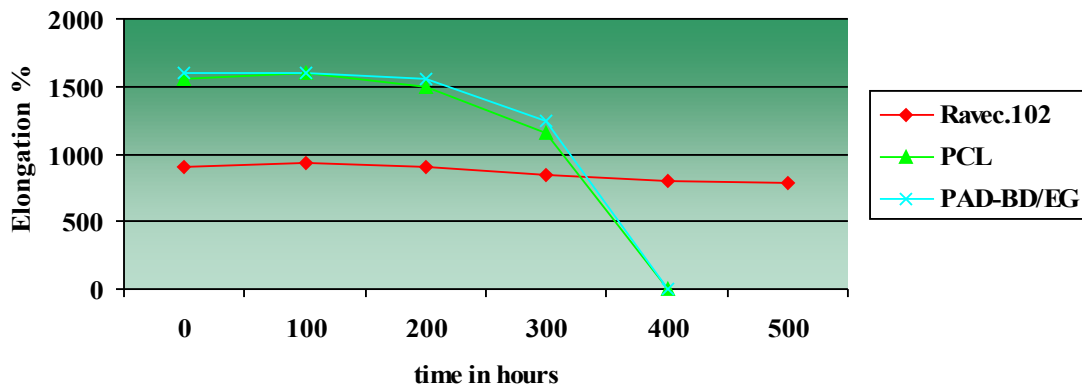




UV RESISTANCE ON SEALANTS Tens. Str. Loss in the time

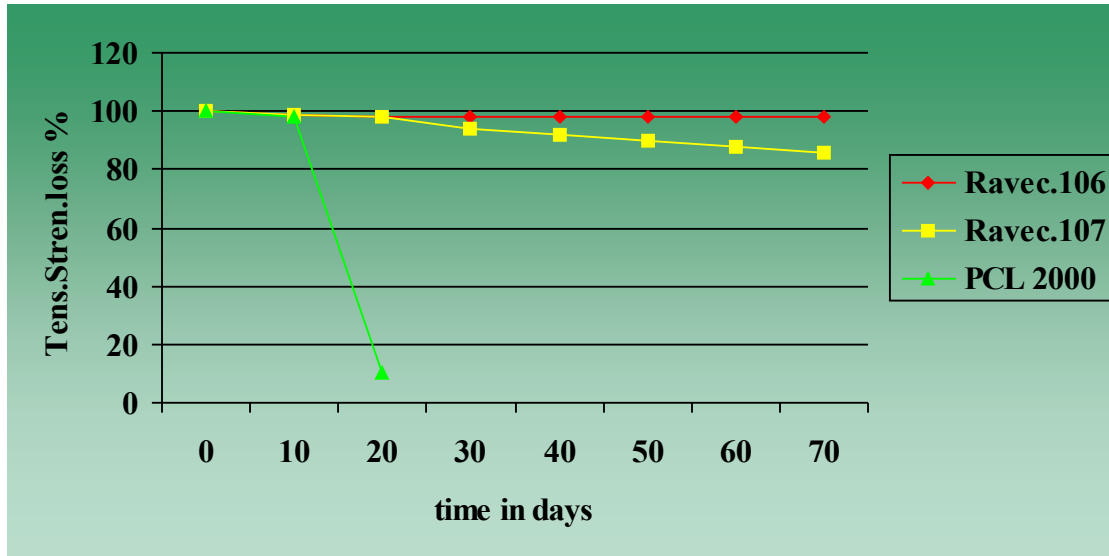


UV RESISTANCE ON SEALANTS Elongation variation in the time





HYDROLYSIS RESISTANCE
Tensile Strength loss (water at 85°C)



❖ **RAVECARB and REACTIVE HOT-Melts**

RECEIPE

Polyol :RAVECARB 106

Reacting Conditions: Melted at 95°C

Curing: 7 days at 25°C and 60% u.r.

Mechanical properties of hot melts

Proprietie	Modulus 100%	Elongation %	Tensile S. (kg/cm ³)
s			
Polyols			
RAVECARB 106	85	469	270
PAD-Hex 2000	80	500	150
PAD-Hex 3000	138	700	210
PTMEG	45	740	318



Hydrolysis resist. Hot-Melts

