CAPABILITIES AND LIMITATIONS OF BIOPLASTICS APPLICATION IN WOOD TECHNOLOGY

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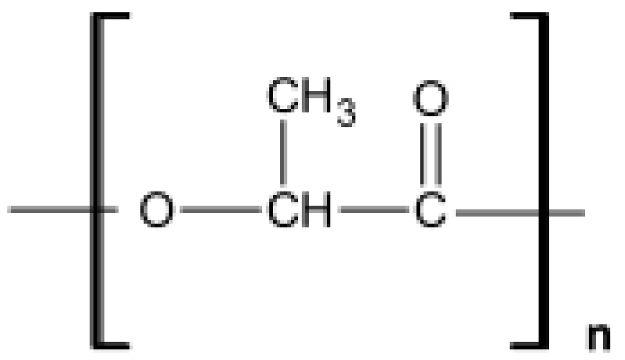
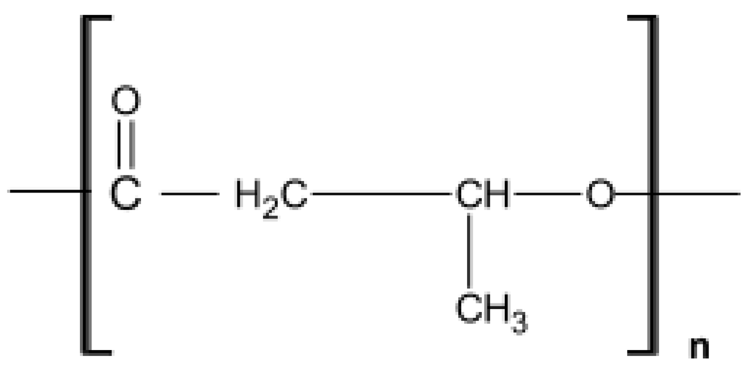
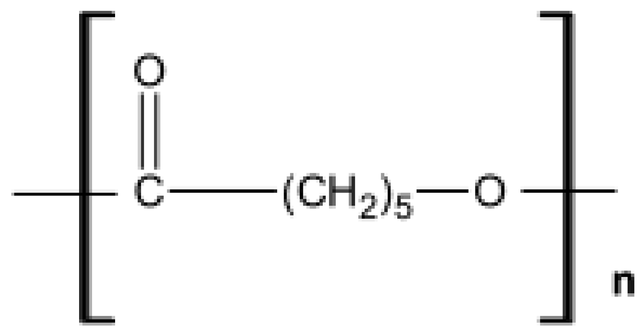
PLA – poly(lactic acid), polylactide – produced from renewable raw materials (like corn), has about 40% of the entire biopolymer market, rigid and brittle, transparent, glass temp. about 57°C, melting temp. 170-180°C, good mechanical properties, low extension when breaks, easy water absorption

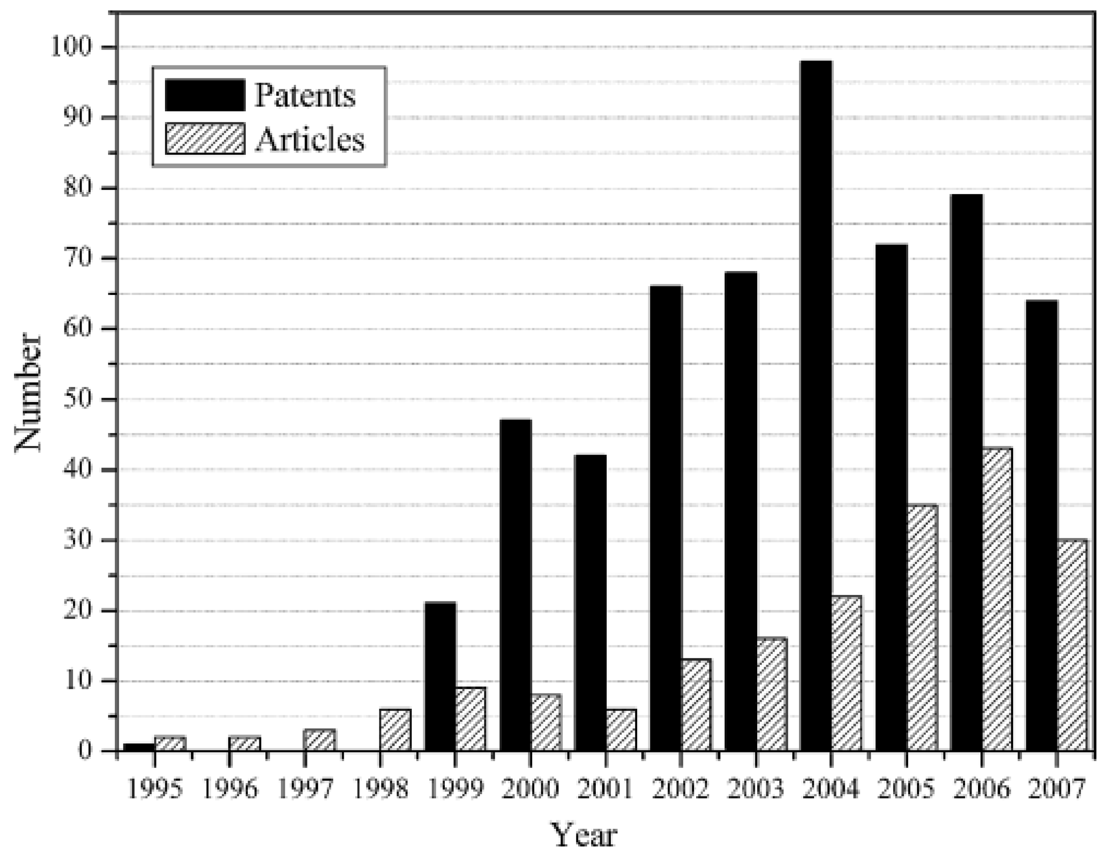


PHB – polyhydroxybutyrate – bio-derived and biodegradable, rigid and brittle, melting temp. is just 10°C lower than thermal degradation temperature



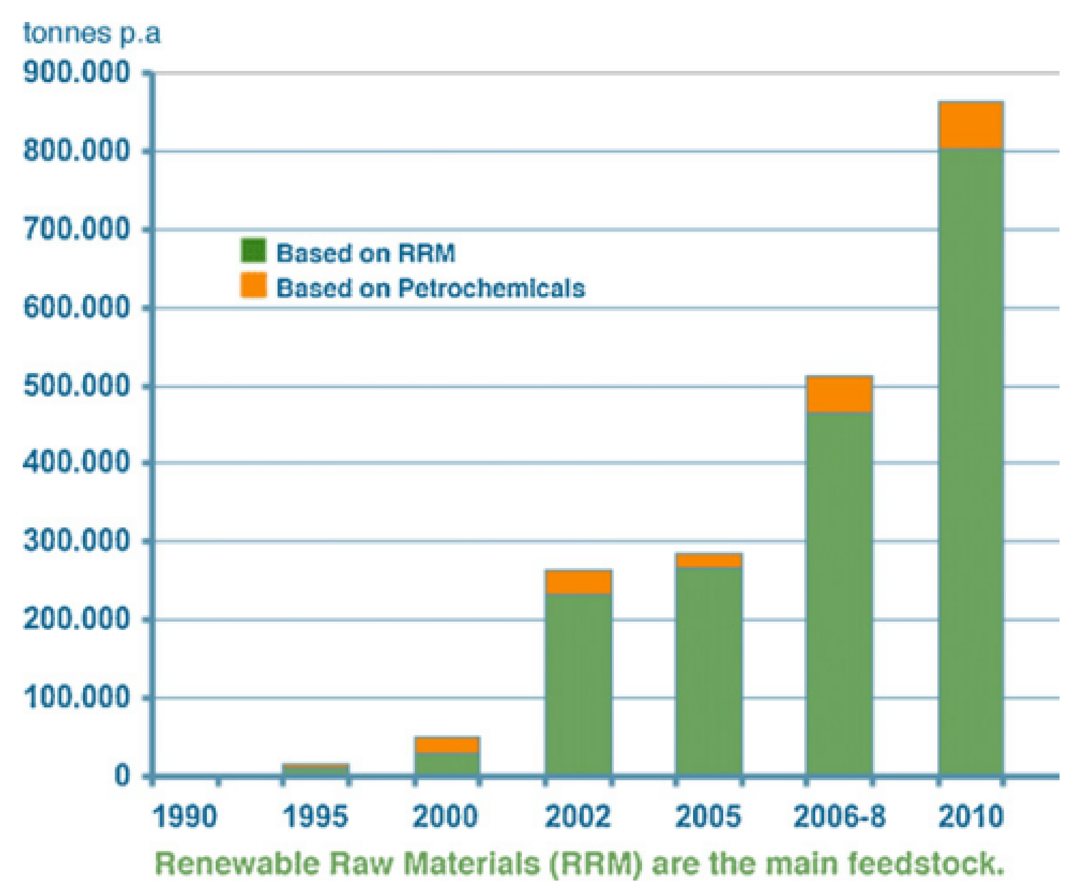
PCL - polycaprolactone, fossil-based, biodegradable polyester with a low melting point of around 60°C and a glass transition temperature of about −60°C, elastic





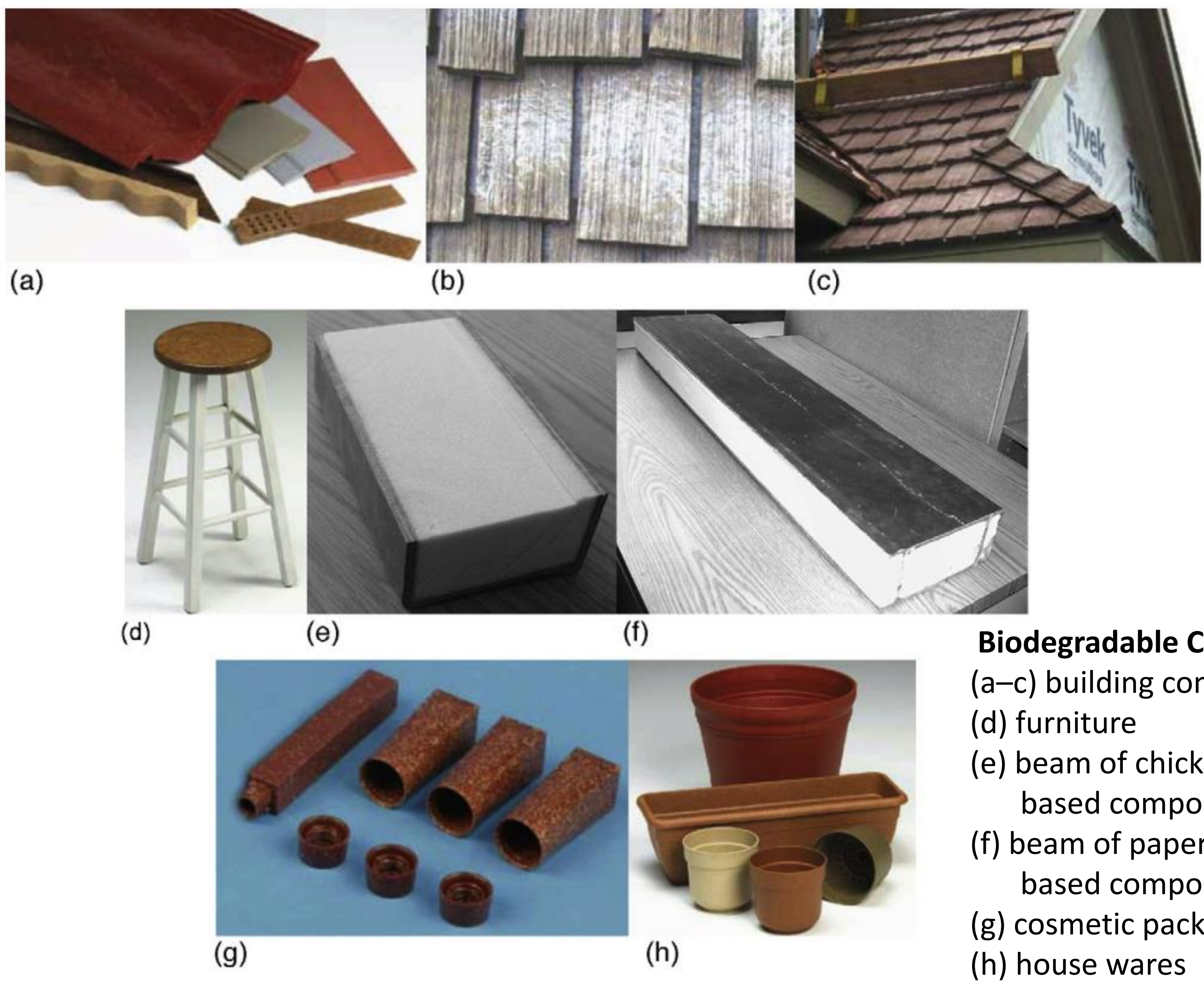
Material	Time to degrade in the environment
Cotton	1–5 months
PCL-g-MAH/starch	2 months
PCL-starch	2 months
PCL-g-MAH/starch	2 months
WG/PVA	1 month
WG/SCB	1 month
Conventional copy paper	1 month
PHB–PHB/starch	1 month
WG	1 month
WG/PVA	1 month
WG/SCB	1 month
WG/WG/SCB film	1 month
Wool stocking	1 year
Bamboo stick	1–3 years
Chewing gum	5 years
Painted wood	13 years
Plastic	450 years
Glasses and tyres	Uncertain time

PCL, Poly(caprolactone); MAH, maleic anhydride; WG, waste gelatin; PVA, poly(vinyl alcohol); SCB, sugar cane bagasse; g, grafting; *p. 281–92; **p. 51–6.



Property	Type of biopolymer		
	PLA	L-PLA	DL-PLA
Density (kg/m³)	1210	1240	1250
T.S. (MPa)	21	15.5	27.6
Y.M. (GPa)	0.35	2.7	1
Elongation (%)	2.5	3	2
T_g (°C)	45	55	50
T_m (°C)	150	170	am

Property	PGA	PCL	PHB	Starch
Density (kg/m³)	1500	1110	1180	
T.S. (MPa)	60	20.7	40	5.0
Y.M. (GPa)	6	0.21	3.5	0.125
Elongation (%)	1.5	300	5	31
T_g (°C)	35	−60	5	
T_m (°C)	220	58	168	



Biodegradable Composites:
(a–c) building components
(d) furniture
(e) beam of chicken–soybean oil resin based composite
(f) beam of paper–soybean oil resin based composite
(g) cosmetic packing
(h) house wares

Non-brittle fracture on impact
Same performance for lower weight
Stronger (25–30%) for the same weight
Low cost—less than the base resin
Fully and easily recyclable
Reduced molding cycle time—up to 30%
Non-abrasive to machinery
Natural appearance
Low thermal expansion coefficient
Good sound abatement capability
Better energy management characteristics
More shatter resistant
Low mold shrinkage
Easily colored
High flex modulus—up to 5× base resin
High tensile modulus—up to 5× base resin
High notched impact—up to 2× base resin
Lower processing energy requirements
Meets minimum recycle content requirements

The National Centre for Research and Development
BIOSTRATEG

The presented research were co-financed by The National Centre for Research and Development under Strategic research and development program „Environment, agriculture and forestry" – BIOSTRATEG agreement No. BIOSTRATEG3/344303/14/NCBR/2018

OPTI_WOOD

11th International Science Conference CHIP AND CHIPLESS WOODWORKING PROCESSES, SEPTEMBER 13– 15, 2018, TERCHOVÁ