10 Selected Examples of New Applications

Over 76 000 references regarding the application of polysaccharide esters are referenced in Scifinder® (American Chemical Society, July 2005). The most numerous products are cellulose esters (about 57 500 references), compared to starch- (about 9500 references), dextran- (about 7900 references), chitin- (about 430 references) and curdlan esters (about 130 references). This pronounced importance of cellulose esters and the wide scope of "industrial applications" are illustrated in Table 10.1.

Table 10.1. Some major applications of organic cellulose esters and the amounts produced in 1985 (adapted from [94])

Cellulose ester	DP	DS		Principal application	Amount (t/year)
		Acetyl	Propyl or butyl		
Triacetate	150–360	2.8–3.0	–	Textile fibres	280 000
				Photo film, foils, insulating coatings	60 000
Diacetate	100–200	2.5	–	Filter tow	370 000
				Thermoplastic mass	
		2.4	–	Viscose silk, foils	
		2.4	–	Thermoplastic mass	60 000
		2.3	–		
Acetopropionate	150–200	0.3	2.3	Thermoplastic mass	
Acetobutyrate	100–150	2.1	0.6	Raw materials for coating and insulation, foils	5000
		2.0	0.7	Foils, films	
		1.0	1.6	Thermoplastic mass	40 000
		0.5	2.3	Melt dipping mass	
				Σ	815 000

Among recent developments are polysaccharide esters for modern coatings, controlled release applications, biodegradable polymers, composites, optical film applications, and membranes. The tailored modification of properties can be accomplished by multiple esterification, i.e. two or even more different ester moieties

are introduced where the one determines properties necessary for processing and the other ester group induces a specific product feature. This approach, for a huge variety of modified polysaccharides with focus on cellulose esters, has been excellently reviewed [447]. A selection of typical cellulose esters is given in Fig. 10.1.

The trends in polysaccharide ester utilisation are discussed by Glasser in [448], evaluating the amount of recent publications in the field of cellulose esters. The type of journals publishing the largest numbers of work recently (Table 10.2) indicates the increasing scientific interest in exploiting the high tendency of polysaccharide esters towards the formation of superstructures, the biological activity, and the biocompatibility resulting in the development of new separation techniques, biomedical devices and pharmaceuticals. Some selected developments will be discussed to illustrate the potential of new polysaccharide esters.

Table 10.2. Journals currently (last 3 years) publishing most frequently in English on cellulose esters (reproduced with permission from [448], copyright Wiley VCH)

Journal name	Number of publications (last 3 years)
Journal of Membrane Science	27
Journal of Applied Polymer Science	24
Drug Development and Industrial Pharmacy	12
Biomaterials	10
Polymer	10
Cellulose	9
Journal of Controlled Release	9
International Journal of Pharmaceutics	8

10.1 Materials for Selective Separation

Polysaccharide derivatives are well established as membrane materials and as selective stationary phases in chromatography. For a comprehensive overview of cellulosic materials for ultrafiltration, reversed osmosis, and dialysis, see Refs. [447,449]. The defined superstructure of polysaccharides and polysaccharide derivatives seems to be responsible for their high efficiency in separation processes, particularly for chiral resolution. The specific interaction of chiral molecules is observed with the pure polysaccharides and their derivatives leading to similar chiral discrimination. The reason could be a comparable superstructure of the polysaccharide and the fully functionalised ester, as has been concluded for curdlan and curdlan triacetate. The unit cell contains six RU related by 6/1-helical symmetry, which is essentially the same as the backbone conformation of one of the modifications (form I) of curdlan [450]. The chiral separation applying polysaccharide esters is not caused by hydrogen-bonding interaction with the solute, as determined for other chiral phases [451]. In contrast, the conformational regularity