IN VITRO DEGRADATION RATES OF BIODEGRADABLE POLY-N-ALKYL CYANOACRYLATES

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The poly-alkyl and poly-aryl cyanoacrylates, being biodegradable, may be considered as possible polymer formulation materials for long-acting drug preparations. (Florence, Haq & Johnson, 1976). Previous studies by Leonard & others (1966) on methanol precipitated samples of these polymers have shown that in-vitro degradation rates in buffer solutions depends upon the hydroxyl ion concentration and on the nature of the alkyl or aryl side chain.

At fixed values of pH, poly-n-alkyl cyanoacrylates of varying n-alkyl side chain length as films cast from acetone solution onto poly-methyl methacrylate backing plates, or as narrow size distribution powder samples, prepared by comminution of cast films, were placed in contact with a range of buffer solutions. Degradation was measured over periods of days or weeks by monitoring total formaldehyde production during continuous replacement of buffer. In supplementary experiments scanning electron microscopy of degraded polymer samples was carried out. It was shown that degradation takes place at the polymer surface, and is independent of any esterase present. The reaction rate and order depend upon polymer molecular weight, as well as side chain structure, pH, and concentration of reaction products.

Table 1. Degradation rates of cyanoacrylate polymers at 37°C;

Poly-alkyl cyano acrylate side chain	M_n	Degradation rate 10^{-10} kg m^{-2} sec^{-1}	pH
Ethyl	1332	10.56	7.88
"	"	7.96	7.40
"	"	5.33	6.81
"	"	3.27	5.97
n-Butyl	894	1.507	7.88
"	"	0.686	6.99
"	"	0.176	5.97
n-Hexyl	1017	1.105	7.88
"	"	0.384	6.99
"	"	0.071	5.97

The figures shown, with the dependence of degradation upon polymer molecular weight, are thought to reflect the increasing protection to the OH^- labile ends of the polymer molecular chain, provided by increasing the length of the n-alkyl side chain.

Florence, A.T., Haq, M.E. & Johnson, J.R. (1976). J. Pharm. Pharmac., 28, 539-43.
Leonard, F., Kulkarni, R.K. & others (1966). J. Appl. Polymer Sci., 10, 259-72.

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