

ABSTRACT

The present work deals with the synthesis of Polyphosphazenes which are inorganic polymers composed of alternating nitrogen and phosphorus backbone structures [N=P]. polyphosphazenes have various advantages due to elasticity of back bone and flexibility in synthesis work. The high molecular weight polyphosphazene derivatives are generally prepared by thermal ring opening polymerization of hexachlorocyclophosphazene (HCCP), followed by macromolecular substitution reactions. In this type of reactions halogen atoms are replaced by different organic and inorganic moieties such as alkoxy, aryloxy, amines and esters etc to impart desirable properties in these polyphosphazenes. In recent work ten polyphosphazene derivatives were synthesized and characterized to determine their potential as biodegradable materials that would be used in various biomedical applications. After successful synthesis hydrolytic degradation was studied. In first step polydichlorophosphazene (PDCP) was synthesized from hexachlorocyclophosphazene (HCCP) under inert atmosphere using Schlenk line system. AlCl_3 was used as catalyst and reaction proceed at 250°C . Synthesis of PDCP was controlled by reaction time and the amount of catalyst. In second step chlorine atoms of PDCP were replaced by different side groups. Para cresol and diethylamine was substituted to synthesize Poly[bis(paracresoldiethylamino)phosphazene] (T1) and Poly[bis(paracresol)phosphazene] (T2). Nicotinamide and diethylamine were used as side groups for Poly[bis(nicotinamide)phosphazene] (T3) and Poly[bis(nicotinamidediethylamino)phosphazene] (T4) respectively. Similarly diethylamine along with methyl glycolate, ethylglycolate, 2(2-methoxyethoxyethoxyethanol and 4-hydroxybenzalaniline were used to synthesize Poly[bis(methyl glycolate diethylamino)phosphazene] (T5), Poly[bis(ethyl glycolate diethylamino)phosphazene] (T6), Poly[bis(2(2-methoxyethoxyethoxydiethylamino)phosphazene] (T7) and Poly[bis(4-hydroxybenzalaniline diethylamine)phosphazene] (T8) respectively. Tyramine was grafted to synthesize Poly[Bis(tyramine)phosphazenes] (T9) and nephthyl amino propane was used to synthesize Poly[bis(nephthylaminopropane)phosphazenes] (T10). All synthesized polymers were characterized by using FTIR, $^1\text{HNMR}$, $^{31}\text{PNMR}$, elemental

analysis, Gel Permeation Chromatography and thermal analysis. After successful synthesis of compounds T1-T10 in vitro hydrolytic degradation behaviour was investigated by shaker bath method. Compounds were studied for 42 days at body temperature (37°C) and three different pH levels i.e. acidic (4.5), basic (10) and neutral (7.4). Overall degradation was much observed in acidic medium, intermediate in basic medium and less in neutral medium. Results of degradation were expressed in terms of percentage weight loss. Rate of degradation depends upon bulkiness of side groups, hydrophobicity and hydrophilicity combinations. T2 was found to be most fastly degraded among all synthesized polyphosphazenes. T9 and T10 had least rate of degradation due to bulky aromatic side groups.