Synthesis and characterization of hydrazine bridge cyclotriphosphazene derivatives with amide–Schiff base linkages attached to decyl and hydroxy terminal groups

ABSTRACT

New cyclotriphosphazene derivatives featuring amide–Schiff base linkages with a hydrazine bridge and different terminal ends, such as decyl alkyl chains and hydroxy groups, were successfully synthesized and characterized. Fourier-transform infrared spectroscopy (FTIR), nuclear magnetic resonance spectroscopy (NMR), and CHN elemental analysis were used to characterize the structures of these compounds. The formation of hydrazine-bridged cyclotriphosphazene derivatives with amide–Schiff base linkages was confirmed by the FTIR spectra, showing a primary amine band for the amide linkage around ~3300 cm−1 and a band for the Schiff base linkage near ~1595 cm−1 . This was further supported by NMR analysis, which displayed an amide proton (H-N-C=O) at ~δ 10.00 ppm and an azomethine proton (H-C=N) within the δ 8.40–8.70 ppm range. The 31P NMR spectra of cyclotriphosphazene compounds display a singlet at ~δ 8.20 ppm, indicating an upfield shift that suggests the complete substitution of all phosphorus atoms with identical side chains. Furthermore, CHN analysis verified the purity of the synthesized compounds, with a percentage error below 2%. The introduction of hydrazine bridges and amide–Schiff base linkages into the cyclotriphosphazene core significantly enriches the molecular structure with diverse functional groups. These modifications not only improve the compound's stability and reactivity, but also expand its potential for a wide range of applications.