

## **Synthesis of New Star-Shaped Liquid Crystalline Cyclotriphosphazene Derivatives with Fire Retardancy Bearing Amide-Azo and Azo-Azo Linking Units**

### **ABSTRACT**

Two series of new hexasubstituted cyclotriphosphazene derivatives were successfully synthesized and characterized. These derivatives are differentiated by two types of linking units in the molecules such as amide-azo (6a–j) and azo-azo (8a–j). The homologues of the same series contain different terminal substituents such as heptyl, nonyl, decyl, dodecyl, tetradecyl, hydroxyl, carboxyl, chloro, nitro, and amino groups. All the intermediates and final compounds were characterized using Fourier transform infrared spectroscopy (FT-IR), nuclear magnetic resonance spectroscopy (NMR), and Carbon, Hydrogen, and Nitrogen (CHN) elemental analysis. Liquid crystal properties for all compounds were determined using polarized optical microscope (POM). It was found that only intermediates 2a–e with nitro and alkoxy terminal chains showed a smectic A phase. All the final compounds with alkoxy substituents are mesogenic with either smectic A or C phases. However, other intermediates and compounds were found to be non-mesogenic. The study on the fire retardancy of final compounds was determined using limiting oxygen index (LOI) method. The LOI value of pure polyester resin (22.53%) was increased up to 24.71% after treating with 1 wt% of hexachlorocyclotriphosphazene (HCCP). Moreover, all the compounds gave positive results on the LOI values and compound 6i with the nitro terminal substituent showed the highest LOI value of 27.54%.