Synthesis, structural and dielectric characteristics of liquid crystalline azo-based compounds with different terminal length

ABSTRACT

The research was conducted to study the chemical structure and their relationship between mesomorphic and dielectric properties. The understanding of the relationship between structure, liquid crystal and dielectric behaviour is very important in designing new liquid crystal materials with desirable properties for future applications. Thus, this study focused on the preparation of azo-based compounds with different terminal length. Diazotization reaction of pnitroaniline with phenol formed 4-(4-nitrophenylazo)phenol, 1 which was alkylated with heptyl and tetradecylbromide to give a series of nitro compounds, 2a-b. Structure elucidation of these compounds were confirmed using Fourier transform infrared spectroscopy (FT-IR) and nuclear magnetic resonance spectroscopy (NMR). Liquid crystal properties of these intermediates and compounds were determined using polarized optical microscope (POM). It was found that compounds 2a-b with nitro and alkoxy terminal chains attached to azo linking units showed a smectic A (SmA) phase in the heating and cooling cycles. The presence of mesophase(s) and transitional properties of each phase of these compounds were further confirmed using differential scanning calorimetry (DSC). Based on the DSC thermograms of compounds 2a-b, two endotherms were observed in both cycles for the transition of Crystal-SmAIsotropic phases. The dielectric characteristics showed that the relative permittivity decreased as the number of alkyl group increased. Meanwhile, the loss tangent of both compounds decreases with increasing frequency spectra.