Liquid Crystals, Vol. 33, No. 2, February 2006, 205–211

Synthesis, physical and mesomorphic properties of Schiff's base esters containing *ortho*-, *meta*- and *para*-substituents in benzylidene-4′-alkanoyloxyanilines

GUAN-YEOW YEAP*†, SIE-TIONG HA†, PHAIK-LENG LIM†, PENG-LIM BOEY†, MASATO M. ITO‡, SHIGEKI SANEHISA‡ and YAMASHITA YOUHEI‡

†Liquid Crystal Research Laboratory, School of Chemical Sciences, Universiti Sains Malaysia, 11800 Minden, Penang, Malaysia

‡Department of Environmental Engineering for Symbiosis, Faculty of Engineering, Soka University, Hachioji, Tokyo 192-8577 Japan

(*Received 9 June 2005; in final form 19 September 2005; accepted 2 October 2005*)

Three series of Schiff's base esters, 2-hydroxy-4-methoxybenzylidene-4′-alkanoyloxyaniline, 2-hydroxy-3-methoxybenzylidene-4′-alkanoyloxyaniline and 3-methoxy-4-alkanoyloxybenzylidene-4′-alkanoyloxyaniline, which possess mono- and di-substituted moieties at both ends of the molecules have been synthesized and their mesomorphic properties investigated along with physical characterization (elemental analysis, mass spectrometry, Fourier transform IR and high resolution NMR). The effect of lateral methoxy and polar hydroxy groups on the mesomorphism of the title compounds was studied, based on the thermal properties and textural analysis. The results indicate that compounds with the larger number of carbons in the alkyl chain prefer smectic phase formation and possess higher transition temperatures and molecular polarizability along the long axis. Further analysis shows that the greater shielding effect (through the formation of intramolecular interaction) leads to lower molecular broadening and results in higher clearing points. Increase in melting point due to the lengthening of the alkyl chain is associated with the increase in van der Waals attraction between the molecules. These compounds exhibit nematic, smectic (SmA and SmC) phases depending on the type and position of the substituents.

1. Introduction

The mesomorphic behaviour of an organic compound is basically dependent on its molecular architecture in which a slight change in the molecular geometry brings about considerable change in its mesomorphic properties. Detailed studies by liquid crystal researchers have led to empirical rules which include the effect of chemical constitution in the nematogenic and smectogenic mesophases [1]. Most of these studies have been focused on Schiff's bases ever since the discovery of 4-methoxybenzylidene-4′-butylaniline (MBBA) which exhibits a room temperature nematic phase [2]. Over the past few decades, low molar mass Schiff's base esters have been investigated extensively. In these studies the influence of a terminal alkyl chain upon the liquid crystalline properties [3, 4] and the possibility of enhancing the rigidity of the Schiff's base core system through metal complexes formation [5–7] have been claimed as favourable pathways to improve the mesogenic properties.

We have recently reported the synthesis and mesomorphic properties of Schiff's base esters, *p*-*n*-octadecanoyloxybenzylidene-*p*-subtituted anilines [8] and *o*-*n*-hydroxy-*p*-*n*-hexadecanoyloxybenzylidene-*p*-subtituted anilines [9] derived from the esterification of fatty acids of palm oil with 4-hydroxybenzylideneanilines. The introduction of a lateral polar hydroxyl group into the aldehyde fragment has subsequently been studied and is known as an essential parameter leading to an increase in molecular polarizability as well as to an increase in the clearing temperature [9].

In order to explore further the factors which govern the thermal stability of liquid crystals with a Schiff's base core, and the relationship with its molecular structures, we are prompted to carry out the investigation in a more comprehensive manner wherein lateral methoxy and polar hydroxy groups are introduced into the aldehyde fragment of benzylideneaniline

*Corresponding author. Email: gyyeap@usm.my or gyyeap_liqcryst_usm@yahoo.com

Liquid Crystals
ISSN 0267-8292 print/ISSN 1366-5855 online © 2006 Taylor & Francis
http://www.tandf.co.uk/journals
DOI: 10.1080/02678290500450584