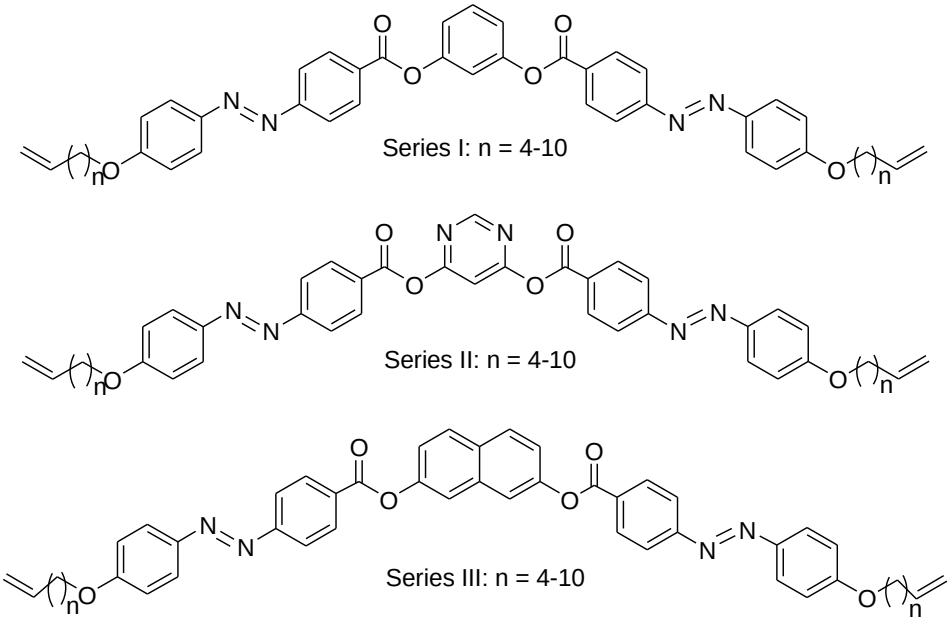
Synthesis of Bent-shaped Liquid Crystals for Photoswitchable Properties

Md Lutfor Rahman[1], Mashitah Md Yusoff[1], Shaheen Md Sarkar[1], Sandeep Kumar[2] and Carsten Tschierske[3]

[1]Faculty of Industrial Science & Technology, Universiti Malaysia Pahang, 26300Gambang, Pahang, Malaysia
Tel: +6-016-9399011, E-mail: lutfor73@gmail.com
[2]Raman Research Institute, C.V. Raman Avenue, Sadashivanagar, Bangalore 560080, India
[3]Institute of Organic Chemistry, Martin-Luther-University Halle, KurtMothes Str.2, HalleD06120, Germany

Three series of liquid crystalline compounds comprised of bent-shaped molecules derived from some cores molecules such as resorcinol (series I), pyrimidine (series II) and naphthalene (series III) cores incorporating azobenzene in the side arms, and having terminal double bonds as polymerizable functional groups, were synthesized and characterized by polarized-light optical microscopy (POM), differential scanning calorimetry (DSC), X-ray diffraction analysis and UV-vis spectroscopy. Series I having bent core compounds exhibited intercalated smectic (B_6) phase and rectangular columnar (B_1) phases. Series II also having bent core compounds with lower homologues compounds are crystalline in nature whereas higher homologues compounds display stable enantiotropic B_6 phase. Series III have bent-shaped shaped compounds with lower homologues compound show nematic phase while higher homologues compounds exhibit B_6 phase. These bent-shaped molecules exhibited strong photoisomerisation behaviour in solutions and solid state. The photoswitching properties of compounds of series I and III show *trans* to *cis* isomerization ranging 9 - 15 seconds, whereas reverse process takes place around 160 - 380 min in solutions. In case of solid film, *E-Z* photoisomerization takes around 4 sec and the reverse transformation to original *Z-E* state takes about 70 min. In case of series II, they exhibit fast photoisomerization effect in solution and relatively slow photoisomerization effects in liquid crystals cells. In solution both *trans-cis* and *cis-trans* occurs around 3 s and 200 s, respectively whereas in solids it occurs around 10 s to 200 min. These are one of the first examples of azobenzene liquid crystals which gave very fast switching property in solutions. Thus, the photoswitching behaviour of these materials may be suitably exploited in the field of optical data storage device and in molecular switches which needs appropriate switching times.



Acknowledgements
This research was supported by PRGS Research Grant (no. RDU 130803)