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# Benzoate liquid crystals with direct isotropic–smectic transition and antipathogenic activity

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ABSTRACT

A smectogen liquid crystal based on benzoate units has been synthesized and structurally characterized by FTIR and $^{1}$H NMR spectroscopy. Besides, its structure and supramolecular arrangement in the crystalline state was demonstrated by single crystal X-ray diffraction measurements. The thermotropic behaviour, monitored by differential scanning calorimetry and polarized light microscopy, consists in the formation of an enantiotropic smectic mesophase with a direct first order transition from the isotropic to smectic mesophase, and with its thermal stability range superposed on human body temperature. The smectogen liquid crystal has moderate wettability – suitable for biocompatible materials and presents good antipathogenic activity against gram positive and gram negative bacteria and fungus.

All these properties recommend the understudied liquid crystal to be used in biochemical and biological applications.



## 1. Introduction

Liquid crystals (LC) based on ester units are an interesting class of compounds which combine the anisotropic properties of the liquid crystals with the biological characteristics of the esters, promising to be a new class of biological relevant materials for surface functionalization [1], drug delivery systems [2], protein sorption/desorption [3], biological sensors [4], wound healing [5] membranes [6], gene therapy [7] and so on. A significant number of ester based liquid crystals have been mainly synthesized with the aim of being applied in optoelectronics and photonics as LC displays [8], field effect transistors [9], organic light emitting diodes [10], optical data storage devices [11], or photovoltaic cells [12]. Their application field is further enlarged by incorporating them into a polymeric matrix when systems known as polymer dispersed liquid crystals (PDLCs) are obtained [13]. The PDLC systems combine valuable properties of the two components and are designed for a wide range of applications, those in high performance biomedical field being especially envisaged in the last years, as artificial iris [14], blood sensors or sperm testers [15], smart packaging, and so on [16]. To be applied in such biological applications, liquid crystals must have the mesophase stability range at low temperature, eventually superposed on human body temperature. Moreover, speaking about the particular case of smectic liquid crystals, a direct isotropic–smectic transition is required, in order to reach a monomorphic stable mesophase capable of bistability [17].

Having all these in mind, we designed an ester based liquid crystal with a benzoate core and two aliphatic end groups which bring the benefits of the low temperature mesophase stability and of the direct isotropic–smectic transition. Besides, the ester groups provide the advantage of a potential biologically friendly compound, with real possibilities to be used in biochemistry and biological applications.

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