Chapter 2
Aims and Scope of this Thesis

Thermotropic and lyotropic liquid crystals share a common state of matter with many analogies in their structural and physical properties. However, these two fields of liquid crystal research are usually treated completely separately. This is partially due to historical reasons, but also to striking differences in some aspects of these two classes of liquid crystals. One of these differences is the occurrence of thermotropic phases which do not have a lyotropic counterpart. A compelling example of this is the thermotropic ferroelectric SmC* phase. Due to its unique chirality effects, i.e. ferroelectricity and a helical configuration of the tilt-direction, this phase attracted considerable scientific interest over the last decades. However, there are no reports found in literature about a SmC* analog phase in lyotropic liquid crystals.

To bridge this gap between thermotropic and lyotropic liquid crystals, efforts were made in our research group for quite some time in the scope of the DFG project Gi243/4 to find a lyotropic analog of the SmC* phase. Now, preliminary investigations in the framework of this thesis led to a promising series of diol molecules, which might exhibit this so far unknown phase. Based on this, the present thesis deals with the first discovery and description of a lyotropic analog of the SmC* phase. Furthermore, the physical properties of this novel phase shall be investigated, especially with focus on its chirality effects. In detail, the following points will be addressed:

- Screening of promising surfactant/solvent systems for the formation of a lyotropic SmC* analog phase and selection of proper systems for further investigations. In this process, necessary structural features of the surfactants and the solvents shall be elucidated.
- Measurement of the phase diagrams of the selected surfactant/solvent systems using polarized optical microscopy and characterization of all phases observed.
- Proof of the existence of the potential lyotropic smectic C* analog phase using several independent methods.

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- Detailed investigation of structural and physical properties of the lyotropic SmC* analog phase by means of X-ray diffraction, tilt angle measurements and differential scanning calorimetry. The impact of changes in temperature and solvent concentration on the structure of the lyotropic SmC* analog phase shall be analyzed.
- Study of potential chirality effects like the helical twist of the tilt-direction and ferroelectricity in the lyotropic analog of the SmC* phase.
- Design of a first structural model of the lyotropic SmC* analog phase.

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