Cholesteric lyotropic phases are obtained by doping lyotropic mixtures, presenting the nematic phases, with chiral agents. Similarly to the nematic phases, three types of cholesteric lytopics were identified: cholesteric biaxial (ChB), cholesteric discotic (ChD) and cholesteric calamitic (ChC). New lyotropic cholesteric liquid crystalline phases were prepared by doping the quaternary mixture of potassium laurate/potassium sulphate/alcohol (n-OH)/water with the chiral agent brucine. Different long chain alcohols whose alkyl chains (n) vary from 8 (1-octanol) to 16 (1-hexadecanol) were used. Phase transitions were investigated by measuring the birefringences via polarizing optical microscopy and the phase diagram were constructed as a function of the alcohol alkyl chain length. We observed that as the alkyl chain length of the alcohols increases the cholesteric uniaxial-to-cholesteric biaxial phase transitions is shifted to the higher temperatures, and the cholesteric biaxial domain got smaller. Measurements of the biaxial order parameter in the vicinity of the transition ChD-to-ChB showed that this transition is continuous. Moreover, we observed that the chiral elastic field imposes a chirality-induced biaxiality in the ChD phase. The order of magnitude of this chirality-induced biaxiality in the ChD phase agrees with the estimations for the magnetically induced biaxiality in the uniaxial discotic nematic to biaxial nematic phase transition. The bare correlation length calculated from our data agrees with that evaluated by light-scattering measurements in lyotropic nematics. This parameter was shown to be larger than the typical micellar dimensions. This result suggests that the structural changes responsible for the transitions occur in a length-scale bigger than the micellar dimensions, supporting the Intrinsically Biaxial Micelle model. Interestingly, mixtures with alcohols of n = 8 and n = 13 carbon atoms presented a first-order phase transition between the ChD-to-ChC. This result may be interpreted as a consequence of the nano segregation of the alcohol molecules in the micelles with respect to the main amphiphile molecules (in our case, the potassium laurate), or even an increase of the shape anisotropy of the micelles may be present.

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* presenting author; E-mail: afigueiredo@if.usp.br