Cellulose and chitin are the most abundant biopolymers in nature. They are found as semicrystalline microfibrils comprised of amorphous and crystalline regions. Plants are the most important source of cellulose whereas chitin is found in the shell of crustaceans, the cuticle of insects and other creatures. In some cases, the biopolymer microfibrils form a helicoidal arrangement producing metallic shine. Thus, the cuticle of some beetles selectively reflects left-handed polarized light. On the other hand, the reflection of both left- and right-handed polarized light has been reported in *Poilia fruit*. In recent years, this type of structural color has been a source of inspiration for optical biomimeticism using sustainable resources.

In this work we discuss the optical performance of nanocrystalline cellulose and chitin films processed from filter paper and crab shells, respectively. The amorphous domains in the microfibrils were removed by acid hydrolysis enabling the extraction of rod-like nanocrystals of lengths in the range of 200-300 nm and widths of 8-15 nm. Further processing of the biopolymer nanocrystals at appropriate conditions promote the self-assembly of liquid crystal phases in aqueous suspensions. Of particular interest are the nematic and cholesteric (chiral nematic) phases because they might be retained in the solid state. Biopolymer films with nematic order on glass substrates are obtained by the dipping technique. The birefringence of nanocrystalline chitin films in nematic order is discussed in detail. Also, the results for nanocrystalline cellulose films are presented. The selective reflection (transmission) of left- (right-) handed polarized light from nanocrystalline cellulose films in a chiral nematic liquid crystalline phase is discussed. The optical performance of the films is based on measurements of Mueller-matrix spectroscopic ellipsometry. This technique provides a complete description on the degree of polarization, ellipticity and other polarization properties of light reflected and/or transmitted for any incident polarization state.

**Keywords:** Nanocrystals, Chirality, Optical properties

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