Cellulose photonics: from nature to applications

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Nature's most vivid colours rely on the ability to produce complex and hierarchical photonic structures with lattice constants on the order of the wavelength of visible radiation [1]. A recurring strategy design that is found both in the animal and plant kingdoms for producing such effects is the helicoidal multilayers [2]. In such structures, a series of individual nano-fibers (made of natural polymers as cellulose and chitin) are arranged parallel to each other in stacked planes. When distance between such planes is comparable to the wavelength of light, a strong polarised, colour selective response can be obtained. These helicoidal multilayers are generally structured on the micro-scale and macroscopic scale giving rise to complex hierarchical structures.

Biomimetic with cellulose-based architectures enables us to fabricate novel photonic structures using low cost materials in ambient conditions [3,4]. Importantly, it also allows us to understand the biological processes at work during the growth of these structures in plants. In this talk the route for the fabrication of complex bio-mimetic cellulose-based photonic structures will be presented and the optical properties of artificial structures will be analysed and compared with the natural ones.

Figure: Picture of *Margaritaria nobilis* fruits, the intense blue coloration is the results of the helicoidal architecture of cellulose in the cell wall in the epidermis of the fruits.

References

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