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Orientation control of biopolymers and their application

Crude biopolymers like DNA are cheap and abundant in nature as they can be readily isolated from different biological sources such as plants and fish. Orientation control of biopolymers is a process that has gained significant attention in recent years due to its fundamental science and potential applications in materials science and nanotechnology. This technique involves controlled drying of a solution or dispersion of materials, forming structures with specific shapes and sizes. In particular, liquid crystal (LC) biopolymers have emerged as promising candidates due to their highly ordered structures and biocompatible properties after deposition. This talk provides an overview of recent progress in the orientation control of LC biopolymers, including DNA, nanocellulose, viruses, and other biopolymers. The underlying self-assembly mechanisms, the effects of different processing conditions, and the potential applications of the resulting structures will be discussed. For example, when randomly sequenced, DNA material shows considerable variation in length due to differences in the number of base pairs. However, it exhibits a highly regular structure resembling a helical shape with a diameter of ~2.0 nm and the space between the nucleotides being 0.34 nm. DNA is associated with varied chemical functions because of the presence of negatively charged phosphate groups in the backbone and due to the presence of well-stacked nucleotide bases with strong π–π interactions. DNA's structural and chemical features enable it to guide or control versatile guest functional materials such as biomaterials, particles, and LCs to get well-oriented gold nanorods, and the bio-organic field-effect transistor (BOFET)

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