48. Electron microscopy characterization of natural polymers

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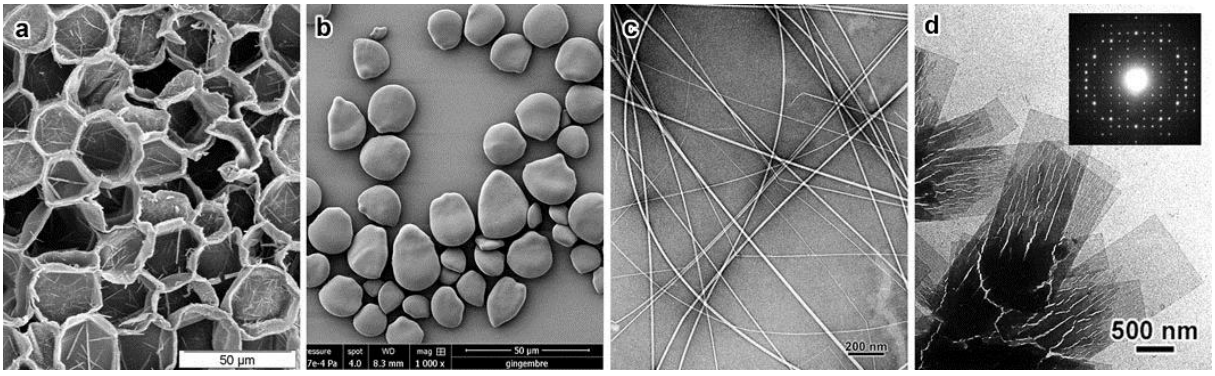
Electron microscopy is an important tool to characterize the morphology and structure of natural polymers extracted from biomass or recrystallized *in vitro*, at various length scales. Scanning electron microscopy (SEM) is generally used to characterize the surface topography of large / bulk samples and fractured materials, while transmission electron microscopy (TEM) allows visualizing the projected volume of small / ultrathin specimens. Each technique thus has specific constraints in terms of sample preparation and observation.

For SEM, one of the main limitations is the non-conductivity of most samples which has been generally solved by coating their surface with metal. In the recent years, different approaches have been developed, such as low-voltage, low-pressure or low-temperature observation.

For TEM, the limiting factors are the poor intrinsic contrast of the smaller objects and their very high sensitivity to the electron beam that rapidly generates radiation damage and sample degradation, particularly in the case of crystalline materials. The specimens thus have to be observed under low-dose illumination and / or at low temperature in order to limit / slow down the damage. They can also be stained with heavy atoms to increase the contrast.

The proposed practical will be divided into three parts. During the first one, we will summarize important information about the specificities of each microscopy technique and related equipment. We will describe the main sample preparation methods, the strategies to observe radiation-sensitive materials, and explain how to interpret the contrasts in the images. In the second part and third parts, demoes will be carried out on a variety of specimens using the two microscopes (SEM and TEM, respectively) located at CERMAV.



SEM micrographs of cork cells (a) and ginger native starch granules (b), and TEM images of negatively stained algal cellulose microfibrils (c) and lamellar crystals of amylose complexed with isopropanol (d - inset: corresponding electron diffraction pattern)