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SERS sensing of plant materials

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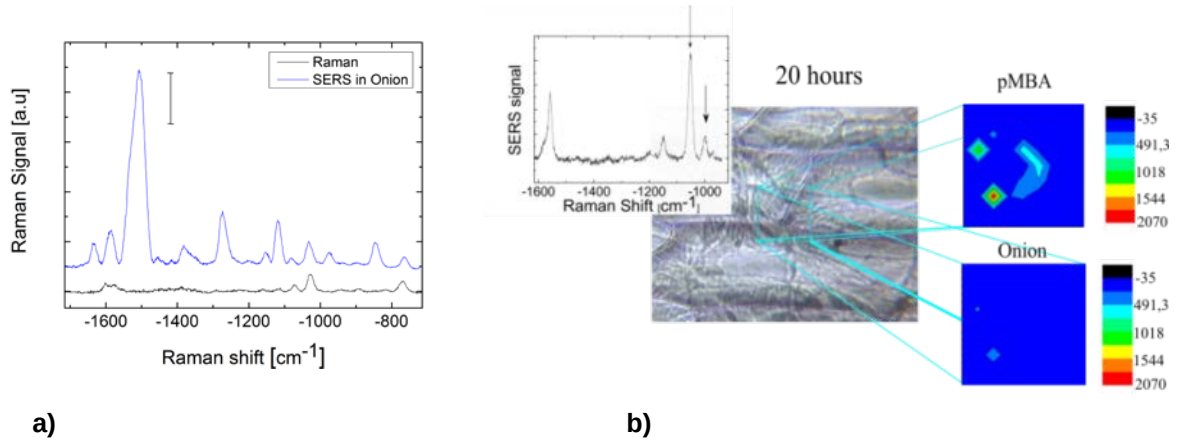
There is a strong interest in exploring and developing new methodologies in order to study complex biological structures and their functions. SERS is a sensitive technique with a great potential for probing and sensing biological objects and materials[1]. The method should be also very useful for studying plants.
Here we compare Raman and SERS spectra on onion layers using silver nanoparticles as plasmonic active structures. A pH-sensitive reporter molecule pMBA attached to the nanoparticles allows us to infer pH values in the environment of the SERS sensor [1].
SERS sensors attached to the onion layer results in SERS spectra from the wall of the layer. Figure 1a compares Raman and SERS spectrum collected under this condition. As another approach, we insert SERS sensors into the onion layer. The presence of silver nanoparticles inside the layer has been monitored by the SERS images. Figure 1b shows that even after 20 hours incubation time, only very few nanoparticles could access the inner of the layer. Since the uptake of SERS nanosensors through the wall of the layer seems to be a slow process, we explore the formation of silver nanoparticles inside the onion layer by green synthesis after delivering silver nitrate to the onion. It has been demonstrated that plant extracts can act as reducing and capping agents for the synthesis of silver- and gold NPs [2]. Strong luminescence from the onion layer in the yellow range indicates the formation of small silver clusters Ag_n^+ which can act as precursor for the formation of silver particles in sizes between 10 and 100 nm [2]. This paves the way to plasmon supported spectroscopy inside plants.



a) **b)**

Figure 1:

a) Raman and SERS spectrum taken from the wall of an onion layer.
b) SERS spectrum and image taken from inside an onion layer after uptake of SERS sensors .

References:

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