THREE-DIMENSIONAL RENDERING OF BIOCHAR SURFACES FROM THEIR FESEM IMAGES

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As explained in [1], the design and functionalization of new materials, such as the biomaterials for instance, relies heavily on the ability of having an accurate measure and visualization of the three-dimensional surface architectures. Here we present a method for producing a three-dimensional surface model, obtained from the map of the brightness tones in a microphotography. In particular, in our work we are using the maps we can obtain from a two-dimensional analysis made by means of the field emission scanning electron microscopy (FESEM). This microscopy is providing topographical information of the surface [2].
The investigated material is the biochar, widely recognized as an efficient tool for carbon sequestration and soil fertility but also for new applications like composites [3]. Biochar chemical and physical properties are strongly linked to the initial material used and to the pyrolysis conditions. For instance, high- temperature pyrolysis led to biochar with a large surface area and high adsorption characteristics [4]. From the FESEM image of a biochar sample (see Fig.1, left), a three-dimensional mesh is obtained. The data of the mesh, the vertices and faces of which are given in a .obj file, can be easily visualized by 3D software, such as in the Fig.1, right panel.

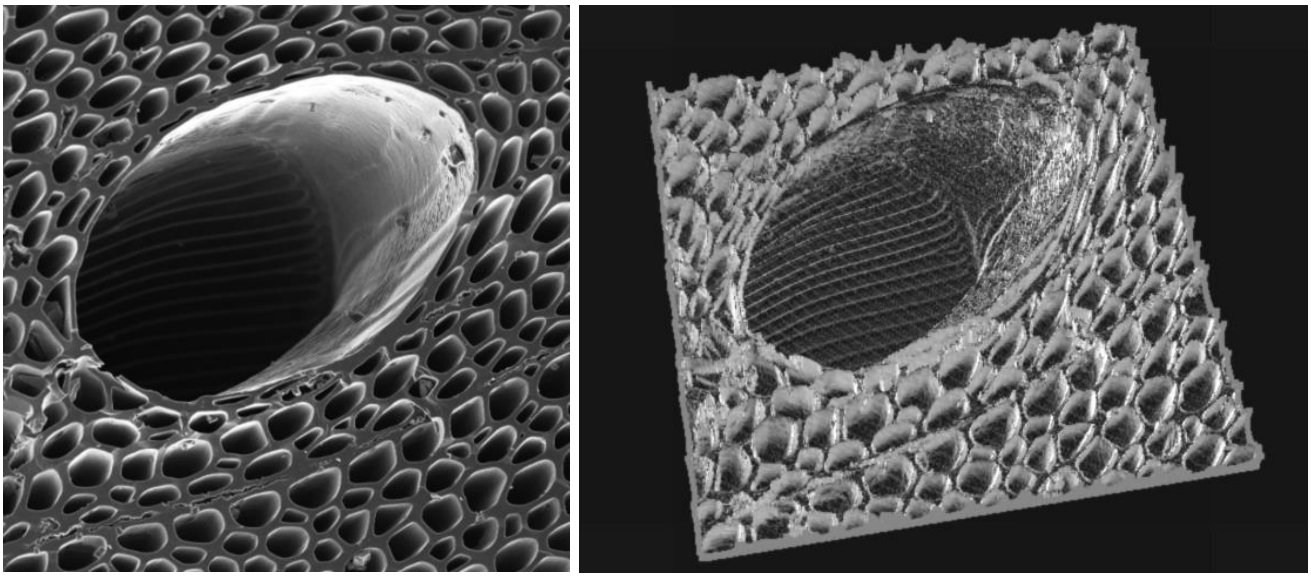

Figure 1 – On the left, a FESEM image of biochar and, on the right, a possible three-dimensional rendering of it.

References

[1] Boshkovikj, V., Webb, H. K., Pham, V. T. H., Fluke, C. J., Crawford, R. J., & Ivanova, E. P. (2014). Three-dimensional reconstruction of surface nanoarchitecture from two-dimensional datasets. AMB Express, 4, 3. http://doi.org/10.1186/2191-0855-4-3
[2] Castle, J. E., & Zhdan, P. A. (1997). Characterization of surface topography by SEM and SFM: problems and solutions. Journal of Physics D: Applied Physics, 30(5), 722.
[3] Biochar-Polymer composites and thin films: characterizations and applications. S. Quaranta, P. Savi , M. Giorcelli, A. A. Khan, A. Tagliaferro, C. Q. Jia. 2016 IEEE 2nd International Forum on Research and Technologies for Society and Industry Leveraging a better tomorrow (RTSI)
[4] Jindo, K., Mizumoto, H., Sawada, Y., & Sonoki, T. (2014). Physical and chemical characterization of biochars derived from different agricultural residues. Biogeosciences, 11(23), 6613.