

Preparation and characterization of imidacloprid nanoribbons by laser fragmentation/exfoliation in liquid media

Luz M. Vidal-Escobar¹, L. Escobar-Alarcón^{2,*}, D. A. Solis-Casados³, S. Romero²,
E. Pimentel¹, E. Haro-Poniatowski⁴

¹ Departamento de Biología, Instituto Nacional de Investigaciones Nucleares, Carr. México-Toluca s/n La Marquesa, Ocoyoacac, Edo. de México C.P. 52750, México.

^{2,*} Departamento de Física, Instituto Nacional de Investigaciones Nucleares, Carr. México-Toluca s/n La Marquesa, Ocoyoacac, Edo. de México C.P. 52750, México.

³ Universidad Autónoma del Estado de México, Facultad de Química, Paseo Colon esq. Paseo Tollocan S/N, CP 50120, Toluca, Estado de México, México. Centro Conjunto de Investigación en Química Sustentable, UAEMex-UNAM

⁴ Departamento de Física, Universidad Autónoma Metropolitana Iztapalapa, Apdo. Postal 55-534, México City, México.

*Corresponding author email: luis.escobar@inin.gob.mx

Imidacloprid (IMD) is a moderately toxic nicotinoid insecticide. In the present investigation nanoribbons produced by laser induced fragmentation/exfoliation of micrometer sized powders suspended in water is reported. Samples were prepared at different low laser fluences and different amounts of IMD. The prepared nanostructures were characterized by scanning (SEM) and transmission (TEM) electron microscopies, Raman spectroscopy and X-Ray Photoelectron Spectroscopy (XPS). SEM images showed that the produced nanostructures are formed by lamellar structures with sizes in the micrometric scale with some dispersed quasi-spherical nanoparticles in the samples prepared at the lowest fluence. Transmission Electron Microscopy (TEM) showed that nearly spherical nanoparticles were obtained at the lowest fluence whereas at the highest fluence two dimensional nanostructures with widths from 500 to 1000 nm and thickness of a few atomic layers were produced. Raman Spectroscopy showed the vibrational features characteristics of Imidacloprid for all samples revealing that in the obtained nanostructures the organic molecule of imidacloprid is preserved. The XPS characterization confirms and supports the Raman results revealing that the obtained nanostructures are formed by the IMD organic molecule.