Sociedad Argentina de Microbiología General

XIX CONGRESO DE LA SOCIEDAD ARGENTINA DE MICROBIOLOGÍA GENERAL

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Centro cultural y Pabellón Argentina de la Universidad Nacional de Córdoba, Córdoba, ARGENTINA.

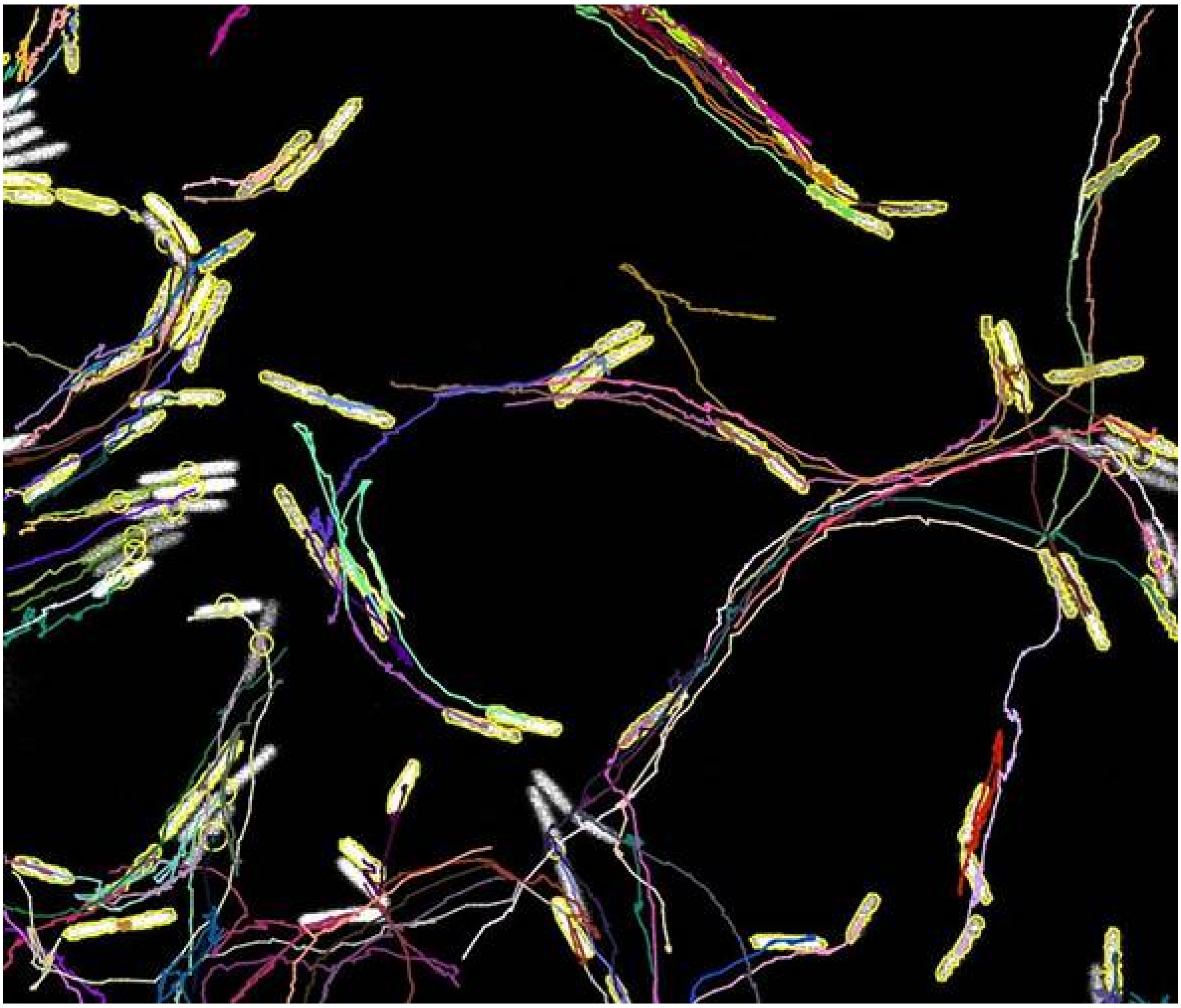

Foto: Se hace camino al andar. Celeste Dea. 1er puesto. Concurso fotográfico SAMIGE 20 años.

PHOTOLUMINESCENT PROPERTIES OF SELENIUM NANOPARTICLES (SeNPs) PRODUCED BY BACTERIAL CULTURES

Aparicio, Francisca[1,2] - Rivas Aiello, M. Belén[2,3] - Cacciari, Daniel[2,3] - Micaela Pescuma[1,2] - González Mónica C.[2,3] - Ordoñez F. Omar[1,2]

1) Centro de Investigación y Extensión Forestal Andino Patagónico (CIEFAP), Ruta 259 Km 16,24 - CC 14 (9200) Esquel, Chubut.
2) CONICET Consejo Nacional de Investigaciones Científicas y Técnicas, Buenos Aires, Argentina.
3) Instituto de Investigaciones Fisicoquímicas Teóricas y Aplicadas (INIFTA) CONICET-UNLP, Calle 64 y Diag 113 s/n. La Plata, Bs. As.
Contacto: omarordonez@ciefap.org.ar

Microbial communities capable of resisting and biotransforming selenite salts into selenium nanoparticles (SeNPs) remain largely unexplored in Argentinean soils. This study aimed to investigate SeNPs production by rhizosphere bacteria (isolated from three sites within Los Alerces National Park, Chubut) and assess SeNPs' photochemical and photophysical properties, given selenium's intrinsic photoluminescence. Prospecting across different locations led to the screening and isolation of various bacterial strains exhibiting varying degrees of tolerance to increasing concentrations of sodium selenite, up to 640 ppm. Of the twelve strains that withstood high sodium selenite levels while producing SeNPs, seven were selected based on the percentage of selenium biotransformation. The optimal selenium concentration (as sodium selenite, Na_2SeO_3) was determined to be 100 mg L^{-1}. Each strain was cultured in 50 mL of LB with the optimal Na_2SeO_3 concentration. After 48 h, SeNPs were harvested by centrifugation, purified, and characterized using various techniques to elucidate their surface chemistry, size distribution, and photoluminescent (PL) properties. Dynamic Light Scattering (DLS) analysis determined the average hydrodynamic diameter varied among strains, with the smallest diameter of 174 nm and the largest of 586 nm. Attenuated total reflectance Fourier transform infrared spectroscopy (ATR-FTIR) identified organic functional groups on the nanoparticle surfaces, primarily from carbohydrates, proteins, and polypeptides. The PL emission of biogenic SeNPs was collected at different excitation wavelengths (?exc) based on their absorption spectra, in the range of 300 to 500 nm. The highest emission intensity was achieved at 380 nm excitation. PL contributions were detected in the blue-green region (400–600 nm), with two maxima centered at 460 and 520 nm, with small deviations depending on particle size. Increasing the excitation wavelength produced changes in the photoluminescence emission spectra, indicating the existence of different contributions to the emission. These contributions could stem from particles of varying sizes and morphologies (broad size distributions, high polydispersity index), or from different functional groups in the surface organic coating being excited at different wavelengths. These results are promising, suggesting that bacteria isolated from Patagonian soils can resist and biotransform high Na_2SeO_3 concentrations into SeNPs with interesting photochemical properties. Given their blue-green emission and the identified surface functional groups, these SeNPs could be particularly suitable for applications such as environmental sensing, where they can be used to monitor contaminants, or in the development of biosensors. Additionally, their unique optical properties may be leveraged in photonic devices or in vitro diagnostic tools, where deep tissue penetration is not required but robust and tunable photoluminescence is advantageous.

Palabras clave: Selenium nanoparticles – Patagonian bacteria – Green technology – Bioactive nanoparticles – Photoluminescence