5. FREE TOPIC

Developing lipid-based nanodevices from *Pyrocystis lunula* and *Arthrospira platensis* for biomedical applications

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Photosynthetic microorganisms represent an important source of biological material to develop innovative and biocompatible nanodevices for different medical applications. In particular, liposomes and solid lipid nanoparticles are effective drug carriers due to their versatility of formulation and scalable production. In this project we aim to prepare nanovectors starting from two different microalgae.

The dinoflagellate *Pyrocystis lunula* (fig.1) is a bioluminescent marine unicellular alga. Light emission origins from a chemical reaction that takes place in the scintillons, the organelles responsible for bioluminescence[1].

Figure 1. *P.lunula*

Our aim is the extraction of the scintillons[2] from this alga to use their content to create biocompatible and light-harvesting lipid-based nanodevices as new instruments for photodynamic therapy and medical imaging.

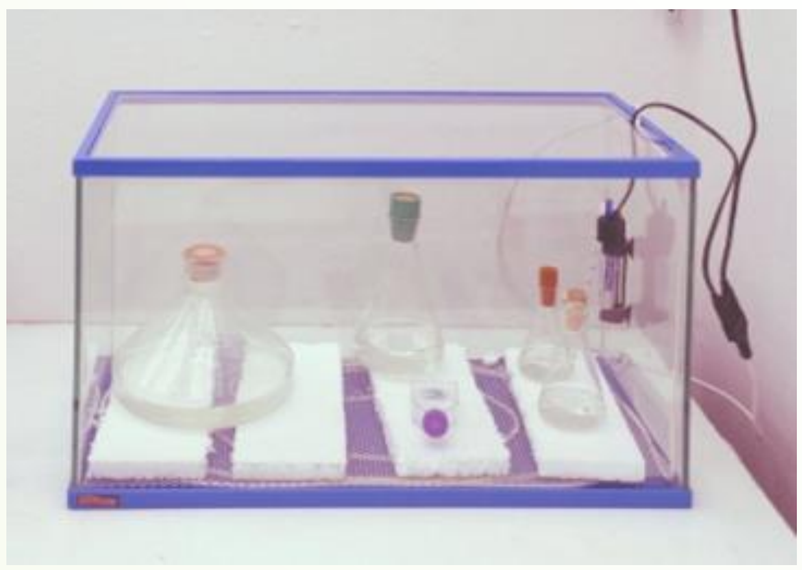

Figure 2. Cultures of *P. lunula*

P. lunula is being cultivated in Fernbach and Erlenmeyer flasks containing F/2-Si medium (fig.2).
White-cool light is provided on a 12hr-light/12hr-dark cycle, mimicking the natural circadian rhythm. Temperature is kept at 22°C. We are periodically monitoring our dinoflagellate's growth by counting the cells using a sedimentation chamber.

The cyanobacteria *Arthrospira platensis* (commonly called "spirulina") is well known as a food supplement and its easiness of cultivation leads to a large biomass availability.

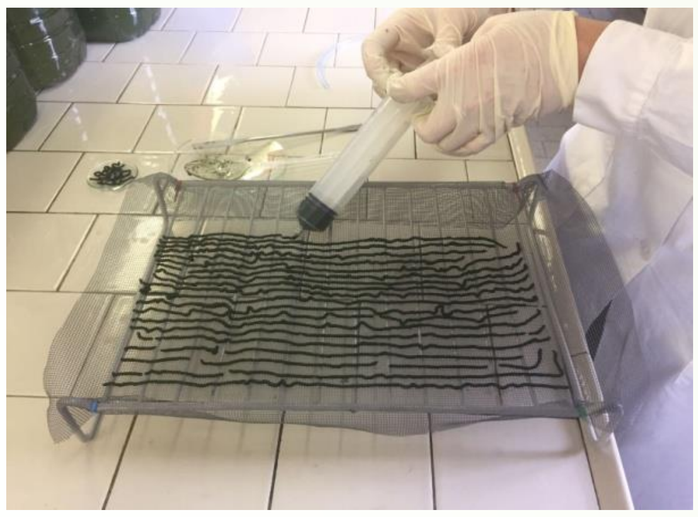

Figure 3. Exsiccation of Spirulina

We aim to develop Spirulina-derived lipid nanovectors to increase the effectiveness of commonly used antibiotics (such as Nalidixic Acid, NA) by encapsulating them into these nanoparticles[3].

Spirulina was used as dry material after exsiccation (fig.3). The lipid content was extracted following the Folch method. Two types of lipid-based formulations were prepared, one containing only Spirulina's material and the other made of Spirulina's lipids mixed with DOTAP, a cationic amphiphile known for its antibacterial properties. Lipid particles were then downsized by sonication, until a mean diameter of 100-200 nm was obtained (fig.4).

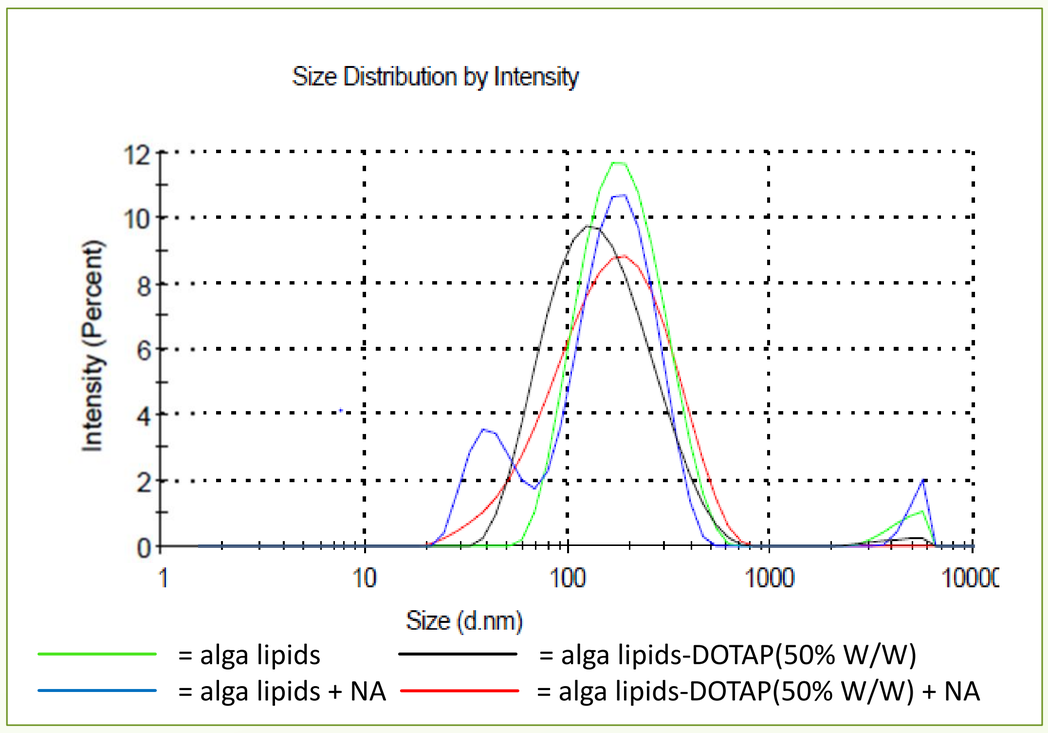

Figure 4. Lipid particles' mean diameter

References:

1) Valiadi, Martha, and Debora Iglesias-Rodriguez. "Understanding bioluminescence in dinoflagellates—how far have we come?." Microorganisms 1.1 (2013): 3-25.

2) Hastings, J. Woodland, and Jay C. Dunlap. "[28] Cell-free components in dinoflagellate bioluminescence. The particulate activity: Scintillons; the soluble components: Luciferase, luciferin, and luciferin-binding protein." Methods in enzymology 133 (1986): 307-327.

3) Colzi, Ilaria, et al. "Antibiotic delivery by liposomes from prokaryotic microorganisms: similia cum similis works better." European Journal of Pharmaceutics and Biopharmaceutics 94 (2015): 411-418.