Physicochemical and Optical Properties of Mesoporous Anodic Alumina Particles and Their Use in Biotechnology

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Nanometric and micrometric particles have recently been used for the development of a wide range of applications, being biotechnology the area with the greatest social impact nowadays. Particles that respond to variables in specific tissues in the human body are a novel and promising strategy in health care and quality of life. Excellent results have been obtained in recent studies with particles in the micrometric and nanometric size range in vitro and in vivo [1].

Mesoporous anodic alumina (MAA) is a nanostructured material, excellent for developing porous particles. It is characterized by hexagonally-ordered straight nanometric pores that provide an exceptionally large effective surface area (hundreds of m^2/cm^3) [2]. Its porous morphology (pore size, interpore distance, porosity, and thickness) can be molded by the anodization conditions (voltage and time of anodization, temperature, and acid used as electrolyte), with a cost-effective and precise control fabrication [3]. Moreover, the surface of MAA can be chemically modified with organic compounds [1] and its compatibility with biological tissues has been demonstrated with its use in orthopedic prosthetics, dental and coronary stents, cell culture scaffolds, and immunoisolation devices [4].

MAA particles with a porous surface and porous body present large effective surface area and large pore volumes, which make them excellent candidates for drug delivery systems and sensing [5]. Another singular characteristic that distinguishes MAA particles from particles made of other materials is their inherent photoluminescence in the visible spectrum range (Figure 1).

In this work, we present different MAA particles with a micrometric and nanometric size and we study and evaluate their physical, chemical and optical properties for a wide range of applications in the biomedical and biotechnological fields

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Figures

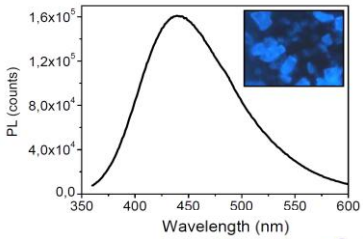

Figure 1: Photoluminescence of MAA particles (excitation wavelength 340 nm). Inset: Blue fluorescence field image of MAA particles