

The international debate on Preliminary studies regarding biocompatibility of encapsulated dopamine in a nanoporous matrix of TiO₂ as a material for store and release of dopamine

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ABSTRACT:

The development of formulations based on titanium dioxide to store dopamine (TiO₂/DA) minimizes the oxidation of it by protecting it from direct exposure to natural light and air. It also fulfills a second function that is the release of dopamine (DA) for long periods in a rat model of hemiparkinsonism. A critical point is the toxicity of these materials that has led us to perform biocompatibility tests on these TiO₂/DA implants. The first biocompatibility studies on TiO₂/DA implant are presented here. Presterilized samples of the matrix were implanted subcutaneously and intraperitoneally in male Wistar rats. Scanning electron microscopy and histological examination of implanted samples and surrounding tissues were performed; subcutaneous implant was 0.095 g/DA per 20 ml of TiO₂. Histological examination of implanted samples and surrounding tissues revealed no evidence of acute or chronic foreign body inflammatory response. The fibrous capsules surrounding the implant remained thin (<100 μm) after more than three months in situ, while the surrounding tissue remained well vascularized; intraperitoneal implant was 0.02 ml/DA per 20 ml of TiO₂. The histological analysis for the liver, heart, lung, kidney, spleen, muscles and brain did not show structural macroscopic changes. It did not show an inflammatory response either (TNF-α, IL-6 and cellular infiltration), between the control group and the experimental groups. Also, the implants lingered encapsulated on tissue after three months; intraperitoneal implant was 0.13 g/DA per 20 ml of TiO₂. It was observed that a mild inflammatory effect and the presence of mononucleocytes within the group which received the highest dose of TiO₂/DA. The results of this analysis suggest that there is no contamination across the organs due to the implants. It is possible to suggest the compatibility of the TiO₂/DA implant with the rat tissue, and thus, justify a further investigation about its potential use as biomaterial for storing and releasing drugs. Recent Publications 1. P Vergara-Aragón (2017) Is it possible to reverse the motor alterations with dopamine supply content in an amorphous matrix in a hemiparkinsonian rat model? *Pharmaceutical Reg Affairs* 6(1):53. 2. S Hernández Castro and P Vergara Aragón (2017) A PET study with [11-C] raclopride in hemiparkinsonism model: preliminary results on the effect of a TiO₂ DA matrix implanted in the caudate nucleus. *Pharmaceutical Reg Affairs* 6(1):52. 3. Blanca Meza Aupart and Vergara Aragón P (2017) Evaluation of the effects that produce a micro-implant with dopamine stabilized and inserted in the caudate nucleus in hemiparkinsonism rat model induced on motor activity and its relationship to the levels of dopamine. *Pharmaceutical Reg Affairs* 6(1):54. 4. Velázquez-Paniagua M, Ana Martínez Valázquez-Alvarez, María Guadalupe Valverde-Aguilar y and Patricia Vergara-Aragón (2016) Current treatments in Parkinson's including the proposal of an innovative dopamine micro implant. *Revista del Hospital General de México. Rev Med Hosp Gen Mex.* 79(2):79-87. 5. Valverde-Aguilar G, Prado-Prone G, Vergara-Aragón P, García-Macedo J, Santiago P, et al. (2014) Photoconductivity studies on nanoporous TiO₂/dopamine films prepared by sol-gel method. *Applied Physics A* 116(3):1075-1084.

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