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Preliminary studies regarding biocompatibility of encapsulated dopamine in a nanoporous matrix of TiO_2 as a material for store and release of dopamine

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The development of formulations based on titanium dioxide to store dopamine (TiO_2/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 TiO_2/DA implants. The first biocompatibility studies on TiO_2/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 TiO_2. 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 TiO_2. 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-a, 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 TiO_2. It was observed that a mild inflammatory effect and the presence of mononucleocytes within the group which received the highest dose of TiO_2/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 TiO_2/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 amorphuous matrix in a hemiparkinsonian rat model? Phamaceutical Reg Affairs 6(1):53.
2. S Hernández Castro and P Vergara Aragón (2017) A PET study with [11-C] raclopride in hermiparkinsonism model: preliminary results on the effect of a TiO_2 DA matrix implanted in the caudate nucleus. Phamaceutical 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. Phamaceutical Reg Affairs 6(1):54.
4. Velázquez-Paniagua M, Ana María Vázquez-Álvarez, 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 TiO_2/dopamine films prepared by sol–gel method. Applied Physics A 116(3):1075–1084.

Biography

P Vergara-Aragón is an MD and PhD in Psychological Research and has worked in the Faculty of Medicine, UNAM in Mexico for more than 30 years. She collaborates with the Physics Institute of the National Polytechnique Institute. Her research is focused in the field of Parkinson's disease (PD), study of the nigrostriatal pathway degeneration, and involved mechanism caused by rotenone and 6-OHDA; stabilization of dopamine and its use as treatment for PD; the study of the effects produced *in vivo* of a TiO_2 amorphous matrix as a reservoir for dopamine in a PD model in rats; description of the cognitive implications of PD in patients; toxicity and biological implications of rotenone exposure in animal models.

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