Advances in Polymeric Membrane Materials Synthesis for Hemodialysis and Osseointegration

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Since the beginning of their use in selective separation processes, polymeric membranes have proven their effectiveness in a wide range of applications. They became extensively used and studied after the Second World War, in Germany, where the newly founded Millipore company, through the Marshall Plan of the United States, transformed huge quantities of nitrocellulose (used as an explosive powder for bomb production) into microfiltration and ultrafiltration membranes [1]. Although the largest volume of membranes currently produced is dedicated to water filtration, the applications of these materials extend to the food, electronics, chemical and petrochemical industry. Because of these materials' remarkable properties, namely, selectivity, membranes are also used in a wide range of biomedical applications that require separations. Considering the fact that most organs (apart from the heart and brain) have separation processes associated with the physiological function (kidneys, lungs, intestines, stomach, etc.), technological solutions have been developed to replace the function of these organs with the help of polymer membranes [2].
Two membrane processes are essential at present, not for development, but for everyday life – desalination and hemodialysis. Another growing biomedical field for polymeric membranes is related to osseointegration – membranes that are usually used at the interface between bone and implant with primary role to facilitate the integration of implant into the bone. This presentation is focused on the latest developments in the field of membrane materials for hemodialysis and improved osseointegration. A short introduction to the field of membrane materials will open this fascinating journey, the main subject being the synthesis and applications of these materials in hemodialysis and osseointegration, as well as these processes combined with controlled drug delivery. Surface treatment or preparation of composite polymeric membranes, in vitro and in vivo tests, controlled release of antibiotics, anti-inflammatory or cytsostatic drugs will be presented and discussed. Some future trends and actual scientific projects will end this presentation.

1. M. Oprea, S.I. Voicu, *Industrial Crops and Products*, 2023, **206**, 117716.
2. M. Oprea, S.I. Voicu, *Carbohydrate Polymers*, 2020, **247**, 116683.