AHMED M. OMAR

Polymer Institute SAS

Project number
1381/03/02

Project duration
12/2022 - 5/2025

"SASPRO2 Programme gives an excellent opportunity to perform independent research topics and work with scientific experts at the Polymer Institute SAS during the project implementation.
My expectations from this programme are to extend my research activities on research interests, gain new scientific skills in diverse research environment, and publish high quality research results in highly ranked peer-reviewed journals. Additionally, the SASPRO 2 project is expected to improve my collaboration with the biomaterials group for building my professional research network, and increase my visibility and recognition in the field of drug delivery systems for future scientific project ideas. "

SASPRO2

BIOGRAPHY

Ahmed M. Omar received his PhD (2013) in polymer chemistry, Al-Azhar University (Egypt) with a topic focused on development of smart polymeric hydrogels for advanced drug delivery applications. He holds the position of associate professor in polymeric materials research department, City of Scientific Research and Technological Applications (SRTA- City), Egypt. He has awarded several postdoctoral fellowships at Polymer institute (Bulgarian Academy of Science 2014), Institute of Experimental pharmacology and toxicology (SAS, 2014)); Zhejiang Ocean University (China 2017) and The University of Queensland; Australia (2019)). Moreover, he has awarded several projects as a principal investigator funded by STDF-Egypt. He focused his research on development of polymeric materials based on natural biopolymers via grafting, crosslinking, Schiff base and composite formation for controlled/sustained drug delivery systems and wound dressings with specific bio-characteristics including antimicrobial, antioxidant, and anti-inflammatory activities. Likewise, he developed several polymer composites as efficient adsorbents for removing pharmaceutical residues and other pollutants from aquatic systems. He also supervised about 30 PhD and MSc. thesis. He is serving as a guest editor, editorial board member and reviewer for many peer reviewed Journals. Omar has published about 108 SCI publications in ranked journals with a total H-Index 37. Recently, he was listed in World's Top 2% Scientists 2022 according to Stanford University. Currently, Omar is a postdoctoral researcher at Biomaterials department, the Polymer Institute, SAS, through the SASPRO 2 programme 2022 for a project focused on construction of smart polymeric composite systems for controlled and targeted drug delivery.

PROJECT SUMMARY

Construction of smart polymeric composite systems for controlled and targeted drug delivery

Recently, excessive attention has been given to the development of drug delivery systems (DDSs). These systems have been designed to alleviate the limitations of conventional therapeutics, since they have the aptitude to enhance the drug solubility, prolong biological activity and improve the therapeutic efficiency. Smart polymeric hydrogels have been potentially designed for controlled and targeted drug delivery owing to their appealing features such as biodegradability, ease of modification, biocompatibility and non- toxicity. Metal-organic frameworks (MOFs) have found potential appliances as drug carriers owing to their remarkable characteristics including their well-defined structure, ultra-high surface area and porosity, and ease of functionalization. An attempt in this project will be made to develop new biopolymer composites as smart Nano/micro hydrogel carriers for controlled and targeted drug delivery. Herein, varies single and binary MOFs will be firstly constructed and combined with smart sensitive chitosan derivatives through surface coating and functionalization processes. In addition, new bioactive composite hydrogels will be constructed to develop smart pH-sensitive core-shell carriers based on functionalized chitosan (such as aminated chitosan), Cellulose derivative (CMC) and Graphene Oxide (aminated/carboxylated derivatives). Furthermore, new smart hydrogel composites will be developed through grafting of β-cyclodextrin (β-CD) with chitosan derivative and MOFs. Factors affecting the synthesis and formulation process will be optimized. The developed smart bio-composites will be characterized using several physicochemical characterization tools Such as FTIR, TGA, TEM, SEM, XRD, Zeta potential, BET and particle size analyzer. pH sensitivity, drug-loading efficiencies and in-vitro drug release profiles will be studied. Cytotoxicity, biocompatibility and biodegradibility of the constructed smart biocomposites will be evaluated.

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PUBLICATIONS

Mohamed A. Hassan, Tamer M. Tamer, Ahmed M. Omer, Walid M.A. Baset, Eman Abbas, Mohamed S. Mohy-Eldin, Therapeutic potential of two formulated novel chitosan derivatives with prominent antimicrobial activities against virulent microorganisms and safe profiles toward fibroblast cells, International Journal of Pharmaceutics, 2023, 122649.
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Abdelazeem S. Eltaweil, Maha S. Ahmed, Gehan M. El-Subruiti, Randa E. Khalifa, Ahmed M. Omer. Efficient loading and delivery of ciprofloxacin by smart alginate/carboxylated graphene oxide/ aminated chitosan composite microbeads: In vitro release and kinetic studies. Arabian Journal of Chemistry. Volume 16, Issue 4. 2023. 104533.
https://doi.org/10.1016/j.arabjc.2022.104533

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Sun X., Liu C., Omer A.M., Lu W., Zhang S., Jiang X., Wu H., Yu D., Ouyang X.-K. pH- sensitive ZnO/ carboxymethyl cellulose/chitosan bio-nanocomposite beads for colon-specific release of 5-fluorouracil(2019) International Journal of Biological Macromolecules, 128, pp. 468 – 479.
https://doi.org/10.1016/j.ijbiomac.2019.01.140

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