

Novel multifunctional cyclodextrin-based nanocarriers for drug encapsulation and delivery as strategy to overcome current therapeutic drawbacks (CYCLON)

Resumen:

The CYCLON project aims, through training of young researchers within a highly competent and multidisciplinary network, to develop a new generation of multifunctional drug nanocarriers based on a family of water soluble and biocompatible oligosaccharides, the cyclodextrins. The nanocarriers will be thoroughly studied and evaluated as delivery vehicles of anticancer drugs, especially photoactive ones. The fast and extensive development in nanoscience provides great opportunity to develop the next generation of pharmaceutical nanocarriers, i.e. drug delivery nanosystems, combining a variety of properties and aiming at combating many diseases. These nano-platforms can help in targeting specific locations, in controlling the release of therapeutic compounds, in enhancing the in vivo efficiency of many drugs, in increasing drug loading capacity, and in providing multifunctionalization of a therapy. In this challenging field the network will offer to 9 Early stage Researchers (ESRs, PhD students) and 4 Experienced Researchers (ERs, post-docs) the opportunity to acquire a very wide scientific background based on both fundamental and applied research training and complementary skills, taking advantage of the differentiated scientific experience of the network group

Objetivos:

The CYCLON project aims, through training of young researchers within a highly competent and multidisciplinary network, to develop a new generation of multifunctional drug nanocarriers based on a family of water soluble and biocompatible oligosaccharides, the cyclodextrins. The nanocarriers will be thoroughly studied and evaluated as delivery vehicles of anticancer drugs, especially photoactive ones. The fast and extensive development in nanoscience provides great opportunity to develop the next generation of pharmaceutical nanocarriers, i.e. drug delivery nanosystems, combining a variety of properties and aiming at combating many diseases. These nano-platforms can help in targeting specific locations, in controlling the release of therapeutic compounds, in enhancing the in vivo efficiency of many drugs, in increasing drug loading capacity, and in providing multifunctionalization of a therapy. In this challenging field the network will offer to 9 Early stage Researchers (ESRs, PhD students) and 4 Experienced Researchers (ERs, post-docs) the opportunity to acquire a very wide scientific background based on both fundamental and applied research training and complementary skills, taking advantage of the differentiated scientific experience of the network group

Objetivos contribución:

Synthesis of new biodegradable, CD-based nanocarriers (CD derivatives) with designed properties. Physicochemical characterization and study of the interactions between drugs and CD-based nanocarriers

Entregables:

The CYCLON project expects to synthesize a family of new CD derivatives able to strongly interact with tumor cell membranes and downregulate P-gp. This can be achieved. It is expected to generate a platform of submicron particles incorporating these CD derivatives, possessing a variety of architectures (dendrimers, glycolclusters, polymers or metal nanoparticles) in order to endow these platforms with high loading capacities of anticancer and photosensitizing drugs. Furthermore, their mode of action will be assessed on a cellular level in vitro and in vivo. The CD-based nanocarriers, composed of a few or many CD molecules in a single formulation, are expected to have high drug loading capacity, protect the drugs against in vivo degradation/metabolism, have long circulation times, tunable drug release properties, possibility to evade resistance mechanisms, and ability to transport drugs inside cells. The success of the research on this topic holds promise for future industrial applications. In particular, excellent skills are present in synthesis and physicochemical characterization of various types of CD-based derivatives as well as the study of their potential as hosts for various guests and of the properties of the relevant host-guest complexes, in the preparation of nanoparticles and nanopatforms, in the pharmacokinetics and pharmacodynamics of drug complexes. The research activity will focus on anticancer drug delivery and design of new systems using innovative cyclodextrin-based nanostructures. The network will offer young researchers the possibility to acquire a multidisciplinary scientific background taking advantage of the differentiated scientific experience of the network group.

Impacto:

This network will provide a high level of training to young researchers from Europe and the Associated States at the interface of synthetic chemistry with nanotechnology/nano-pharmacy, and photophysics-photobiology. The provision of researchers with such appropriate training is vital if European industry is to capitalize on this area and respond to challenges emerging both from Asia and the USA. The training will be of benefit to a) the young researchers by enhancing their skills and knowledge (and consequently employment prospects) within the nanomedicine and pharmaceutical sectors; b) the partner laboratories of the network through skills and knowledge transfer; c) the partner institutions by enhancing their research capacity and supporting integration of their training activities in this field to enhance their individual capabilities; d) industries in the drug delivery/pharmaceutical sectors by providing them with a resource of researchers with the necessary skills and innovation and by enhancing the knowledge base with novel research and drug delivery tools. Equally importantly, the project will also serve to network and integrate the activities of the nine component research teams drawn from different, yet complementary, disciplines. Such long-term networking is essential if European researchers are to compete effectively with USA and Asia. We anticipate that the environment and collaborations built up and fostered through the network will extend to additional partners and will provide the opportunity to the involved research teams to address new challenging problems that may be the object for future grant applications. This network will have a strong focus on the dissemination and communication activities. The aim is to strengthen the public awareness of the importance of the topic of this multidisciplinary network. The network participants and the network as a whole will use different instruments for the dissemination and exploitation of the results of the training activities

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