Smart Copolymeric Nanohydrogels: Synthesis, Characterization And Applications

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One of the most promising strategies in anticancer therapies is the targeted delivery through malignancy-associated cellular markers. The design of new synthetic devices with enhanced stimuli-responsive sensitivity and targeting ligands is a promising field for the development of cancer-specific delivery systems. A nanohydrogel is a crosslinked polymeric networks ranging in size from 10 to 1000 nm that is swollen by a good solvent [1]. In recent years, colloidal hidrogel particles have attracted a lot of attention because of their reversible and fast swelling in response to external stimuli [2]. Synthetic nanohydrogels have a wide range of applications in different areas of the industry. Coating and cosmetic industrial processing have paid attention to these novel materials in their formulations in order to achieve mechanical toughness, flexibility, good durability, chemical resistance, and improved reological properties, in their commercial products [3]. Due to the colloidal dimensions of nanohydrogels these interesting properties can be achieved. The new devices would lead to a reduction in the minimum effective dose of the drug required for each target. Polymeric nanoparticles can act as reservoirs to encapsulate active substances in order to isolate them from the surrounding environment and then to release them as required. Biopharmaceutical industry also employs them as carriers and substrates because of their large surface area, rapid stimuli-response and potential functionality for different biomedical and diagnostic purposes [4-6].

When ionisable groups are incorporated within the polymer network of hydrogels, these ones could show a selective swelling in response to external ph changes. The physical dimension of these ph-sensitive hydrogels results from a balance of the electrostatic interactions of charged polymer chains and network elasticity. There are also many examples of ph-sensitive microgels. However, there have been relatively few studies of acid-swellable microgels. Hydrogels that are sensitive to ph are obtained by incorporating ionisable functional groups into the polymer network. It has been previously shown that different complexes of folic acid with polymers can interact selectively with membrane folic acid receptors and be subsequently internalized by endocytosis. Smart nanohydrogel copolymers were prepared by inverse microemulsion polymerization using different systems with several hbl values and after a transamidation reaction were functionalized with folic acid.

We report here the synthesis, characterization and the influence of several synthetic parameters in copolymer hydrogels obtained by microemulsion copolymerization of 4-nitrophenyl acrylate (NPA) with methacrylamide (MeAM), *N*-isopropylacrylamide (NIPA), and acrylic acid.

Our results indicate that these functionalized smart nanohydrogel polymers could be internalized via folic acid receptors and might be used to transport and selectively deliver active drugs. The particle diameter of the different nanohydrogels were determined using quasielastic light scattering. The obtained values ranging between 28 to 45 nm.

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