



NANO GEL: A MINI REVIEW

Ngieng Hsern Wei

Research student, Asian Institute of Medicine, Science and Technology (AIMST)
University, Bedong 08100, Kedah, Malaysia

INTRODUCTION

Nanogel is known as a nanoparticle which is composed of a hydrogel with a cross linked hydrophilic polymer network. [7]. Nanogels possess 3-dimensional structure which formed by cross-linked polymer. [2]. In addition, nanogels are well-known in novel drug delivery systems for delivering hydrophobic and hydrophilic drugs. The term “nanogels” was defined as the nano-sized particles that swell in presence of a good solvent which formed by physically or chemically cross-linked polymer networks. [3]. Besides that, nanogels generally range from 20-200 nm. Nanogels can be administered through different type of routes. These routes are including oral, parenteral, pulmonary, nasal and also intra-ocular. They possess a high degree of drug loading capacity and also excellent permeation capabilities because of their small size. [10]. Nanogels release the drug when triggered by various stimuli such as pH, temperature, photochemical internalization, volume change and photoisomerization. Nanogels can be classified as stimuli responsive nanogels, non-responsive nanogels (based on behaviour) and also type of linkages present in the gel structure. In addition, nanogels are used to treat certain condition such as for the treatment of cancer, diabetes, inflammation, bone regeneration etc. [9]

PROPERTIES OF NANOGELS

Permeability and particle size:

A little changes made in particle size, surface charge, hydrophilicity and hydrophobicity can greatly influence and improve permeability. Nanogels were formulated to possess a diameter of 20-200 nm. The benefit of this size range is it is small enough for nanogels to cross BBB which is known as Blood Brain Barrier. Besides that, this particle size range also avoids rapid clearance mechanisms.

Address for correspondence:

Ngieng Hsern Wei,
Research student in pharmacy,
AIMST University,
Bedong- Semeling,
Kedah. Malaysia 08100

Swelling property in aqueous media:

Nanogels are known as very small and soft materials; hence, they are expert to swell in presence of an aqueous medium. Nevertheless, the swelling feature of nanogels depend on :

The structure of Nanogels: e.g. Polymer chain's chemical nature, cross-linking degree Environmental parameters: e.g. pH, ionic strength, ions' chemical nature, temperature to trigger swelling.

Biocompatibility and degradability:

Nanogels are highly biocompatible and biodegradable. Hence, nanogels may have the possibility to accumulate in organs. In order to overcome this problem, Chitosan, ethyl cellulose, methylcellulose and various polysaccharide-based polymers such as dextran, pullulan and dextrin were used to prepare nanogel. [12]

CLASSIFICATION OF NANOGELS

Based on their behavior towards a specific stimuli:

1. *Stimuli-responsive nanogels*

Triggered by environmental conditions, suchlike pH, magnetic field, temperature and ionic strength. All these factors determine whether swelling will occur or not and also the extent of swelling. [5]

2. *Non-responsive nanogels*

When they are come in contact with water, they will absorb water into it. Then, this cause swelling of nanogels and consequently drug release. [1]

Based on the type of linkages present in polymeric gel structure:

1. Physically cross-linked nanogels_Or called as pseudo gels. They are greatly impressed by the feature of the polymer such as polymer composition, concentration of the polymer, temperature and also ionic strength of the medium. [15]
2. Liposome Modified Nanogels
3. Micellar Nanogel
4. Hybrid Nanogels [14]

Routes of administration of nanogels in drug delivery:

- ✓ Oral
- ✓ Parenteral
- ✓ Topical
- ✓ Intra-ocular
- ✓ Pulmonary [8]

Advantages of Nanogels:

- ✓ Good permeation capability
- ✓ High biocompatibility
- ✓ High biodegradability

- ✓ Inert in the blood stream
- ✓ Inert in internal aqueous environment
- ✓ Do not induce immunological responses in the body [6]

Disadvantages of Nanogels:

- ✓ Expensive to remove the surfactant and solvent in final stage of the preparation process
- ✓ Adverse effects may occur if any traces of polymers or surfactant found to be remained in the body [6]

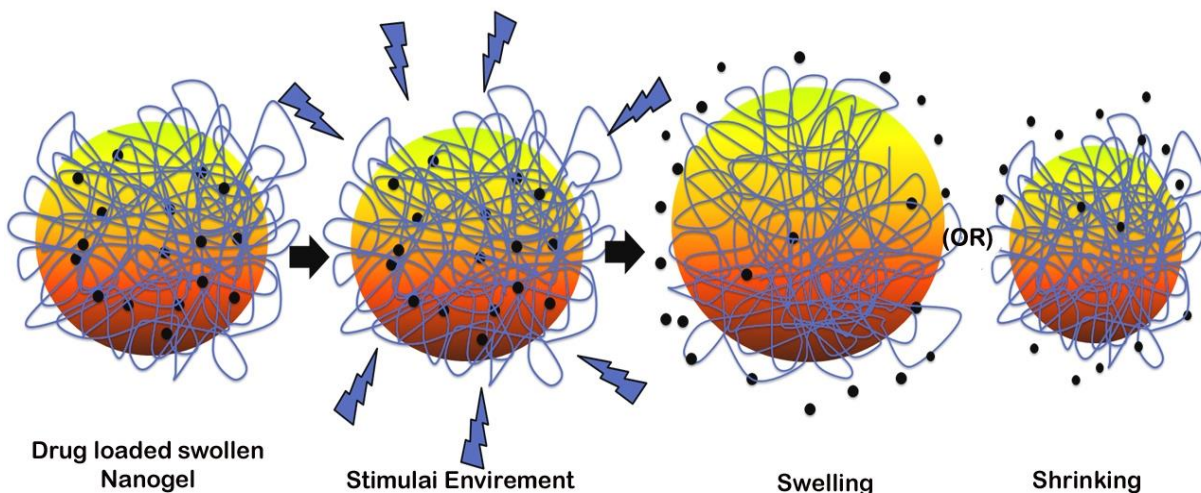


Figure 1: Nanogels act as carrier for drug delivery and applications

CONCLUSION

Nanogels have been known to be discovered as the one of the foremost and primary compromising nanoparticle for medical application. Nanogels have possess the criteria of hydrogel system as nanoparticles. [11]. In addition, the interesting characteristics of nanogels which able to respond to stimulant for like: temperature, light, enzymes, pH, redox and magnetic field, made nanogels attractive and well-known in the aspect of drug delivery. Nanogels improve the efficiency of the carrier system and also solved many problems occurred related to delivery of cargo molecules [4]. Besides that, Nanogels are considered and accepted as an ideal choice of nanosystem drug delivery by reason of their special physicochemical properties that is antibody conjugation. [13]

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