Title

Young´s Moduli of Gelatin Nanoparticles and how their Mechanical Properties Influence the *in vitro* Fate

Keywords (up to 5)

Gelatin Nanoparticles, Mechanical properties, Scanning Probe Microscopy, Particle-Cell-Interaction,

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Abstract

For hydrophilic macromolecular drugs hydrogel NPs, such as gelatin nanoparticles (GNPs), are a promising tool in terms of drug delivery as they exhibit outstanding characteristics. For the design of a suitable particle system physico-chemical properties, like NPs size, surface characteristics and shape, are well known to be crucial. They highly influence the behavior in *in vitro* test systems and *in vivo* after application.[1] In recent years the mechanical properties of NPs gained importance in research. The particle hardness showed to be an important factor regarding the cellular interaction *in vivo* and furthermore, influence the distribution into organs, the half-life time of the carrier system and the distribution into cancer tissues.[2] Here softer particles act in an advantageous manner.

This study aimed to develop a protocol to determine the elastic characteristics of GNPs as Young´s modulus by nanoindentation in scanning probe microscopy under liquid conditions. Subsequently, different crosslinking times and the impact of storage on the mechanical properties have been examined. Therefore, GNPs have been crosslinked with glutaraldehyde for 3 h, 6 h and 18 h. The elasticity was determined after preparation and after a storage period of 4 weeks at 4°C. Furthermore, the influence of the elasticity on the interaction of GNPs with cells was investigated to obtain insights in the biological relevance.

The investigated crosslinking times did not show an effect on the mechanical properties. In contrast to this, during the storage a significant hardening took place. The particle-cell-interaction was highly dependent on this. GNPs after storage showed a nearly fivefold increased interaction in comparison with the freshly prepared particles.

References

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