Application Note

Monitoring Nanoparticles distribution in rats organs with Alliance Chroma System.

01. Introduction

Nanomedicine is the "application of nanotechnology for treatment, diagnosis, monitoring and control of biological systems" (Moghimi SM, et al. FASEB J. 2005) which has risen great expectations (Rawat M, et al. Biol. Pharm. Bull. 2006). Therapeutic and diagnostic nanoagents (nanotheranostics) may improve therapy efficacy while reducing side-effects (Jain KK. Med. Princ Pract. 2008) thanks to extensive multiple functionalization.

Nanoparticles (NPs) are particles between 1 and 100 nanometers in size. In nanotechnology, a particle is defined as a small object that behaves as a whole unit with respect to its transport and properties. Drug delivery is the most immediate and promising test for the actual solidity of the new nanomedical paradigm, since properly designed and multifunctional nano-theranostics are expected to drastically improve drug efficacy, selectivity, biodistribution and biocompatibility. Cardiovascular diseases are a major human health problem, being still the leading cause of deaths worldwide. These pathologies are characterized by an enhanced oxidative stress in vascular walls, heart, kidney and brain. Treatment of heart failure with nano-materials would diminish the expression of inflammatory mediators and molecules that are involved in the cardiac remodelling. NPs disassembly would ensure their biodegradability, diminishing the risk of undesired long-term secondary effects.

In this project we want to test a nanomedical approach to protect cells and heart tissue from oxidative stress. The goal of this work was to test a new nanoparticles platform which could be useful for a therapeutic action in heart.

02. Evaluation of "in vivo" distribution of NPs

18 male health Sprague-Dawley rats were injected with 10 mg/Kg of NPs via vein tail. 7 male healthy rats were taken as controls. Rats were sacrificed 1 day, 3 days, 7 days and 2 months after NPs injection and blood and organs were collected. Images of sections of 5-7 mm of lung, heart, liver, kidney and spleen were acquired and analyzed by Alliance Chroma system and Alliance Software (UVITEC Ltd, Cambridge, UK) to identify and quantify NPs-rhodamine conjugated.

03. Conclusion

Epi-fluorescence with Alliance Chroma system useful instrument for monitoring and evaluating nanoparticles distribution in different rat organs.

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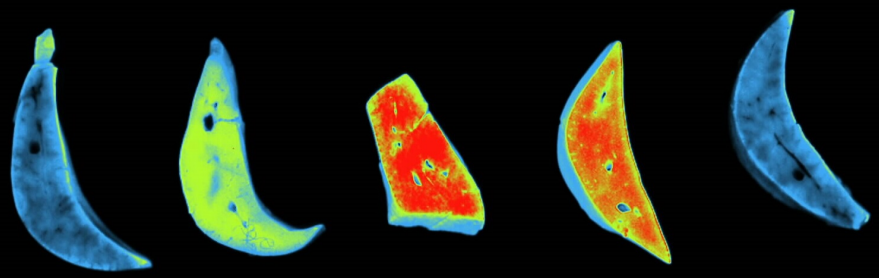
UVITEC CAMBRIDGE

Figure 1



(a) (b) (c) (d) (e)

Signal intensity: from Blue color (lowest intensity) to Red color (highest intensity)

Figure 1

Evaluation Of “In Vivo” Distribution Of NPs In The Liver.

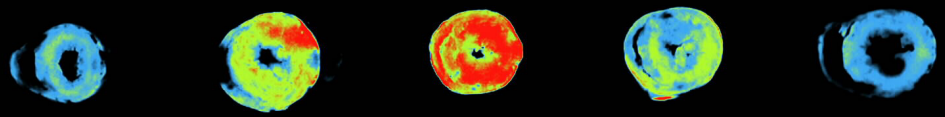
Image shows hepatic tissue samples observed under Alliance Chroma in order to detect the ex-vivo fluorescence imaging differences. Intravenous administration of NPs is followed by a liver uptake between 3 and 7 days after NPs injection (c and d), as demonstrated by rhodamine fluorescence. Liver at 2 month in (e) has the same signal intensity if compared to control in (a), indicating that 2 month is the time for NPs clearance in the liver.

Figure 2

Evaluation Of “In Vivo” Distribution Of NPs In The Heart.

Image shows heart tissue samples observed under Alliance Chroma in order to detect the ex-vivo fluorescence imaging. NPs intravenous injection is followed by an important NPs uptake in the heart up to day 1 as demonstrated by rhodamine fluorescence signal in (b). Note as NPs-rhodamine fluorescence signal decreases from 3 days after injection to 2 months in (e) where the rhodamine fluorescence signal is compared to the control in (a).

Figure 2



(a) (b) (c) (d) (e)

Signal intensity: from Blue color (lowest intensity) to Red color (highest intensity)