Supplementary Electronic Information

Submicron Polyacrolein Particles *in situ* Embedded with Upconversion Nanoparticles for Bioassay

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Supplementary Information 1

Surface tension of acrolein oligomers

Surface tension of acrolein oligomers was measured by using the instrument PAT1 (SINTERFACE Technologies, Germany) based on the drop profile analysis tensiometry. The main principle of this technique.is to determine the surface tension of a liquid from the shape of a pendent drop.[1]

Dry sample of oligomer was obtained from supernatant after centrifugation of polyacrolein dispersion with following desiccation. Pluronic F-168 is commonly used surfactant poly(ethylene oxide-propylene oxide), Mw 8.750, ratio 5/1, which was purchased from "Polyscience, Inc" (USA).

The surface tension of water was 71,2 mN/m. Concentration of oligomer as well as the concentration of pluronic F-168 in water was 10 mg/ml. After forming the drop of the solution via the syringe dosing system 5 min were required to ensure a stability of drop. We used water/air conditions. The experimental temperature was controlled at 22°C.

Figure S1 demonstrates that the acrolein oligomers have weak effect on the surface tension at the water/air interface (decreases to 60 mN/m) in comparison with pluronic F-168.

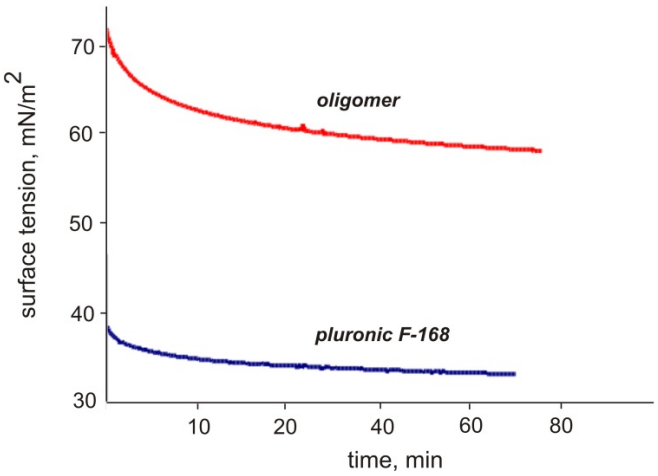


Figure S1. Dynamic surface tension of acrolein oligomers and pluronic F-168.

Supplementary Reference 1

1. A.V. Makievski, R. Miller, G. Czichocki and V.B. Fainerman, *Colloids Surfaces A*, 1998, **133**, 313 S.

Supplementary Information 2

MTT assay for evaluation of polyacrolein particle biocompatibility

To evaluate cytotoxicity of polyacrolein particles embedded with UCNPs (PA-UCNPs) standard colorimetric MTT assay has been performed, as described in[1] with minor modifications. The spontaneously immortalized human keratinocytes of HaCaT cell line were cultured under standard conditions (37° C, humidified, 5% CO_2: 95% air) on Dulbecco's Modification of Eagles Medium (DMEM/F12 medium, #11960044, Gibco, and #21765029, Gibco) containing 10 % FetalClone III serum (#SH3010903 Thermo Sci Hyclone) and 20 mg/l gentamicin. Cells were cultured until they reached a confluence of 80–90% and then trypsinized. Approximately 50000 HaCaT keratinocytes per well were seeded onto 96-well plates. 25 µl of PA-UCNPs or UCNPs-TMAH were diluted in 75 µl of culture media, sonicated and then added to the wells for the next 24 h or 120 h incubation. Cells incubated with the 100 µl of the culture medium were used as a control.

After incubation for 24 or 120 h, the medium with the particles as well as control growth medium were removed, then the cultures were washed triple with PBS, and, finally, the 3-[4,5-dimethylthiazol-2-yl]-2,5-diphenyltetrazolium-bromide (MTT) reagent (Sigma-Aldrich) in cell culture medium (100 µl) was added to each well and incubated at 37 °C for 4 h to allow precipitation of insoluble purple formazan crystals by the action of mitochondrial succinate dehydrogenase of the viable cells. Then the supernatant was carefully collected and 100 µL of dimethyl sulfoxide was added to each well and left for 10 min in dark at room temperature. The absorbance of the resulted dye solution was evaluated in comparison with the control culture by measuring the optical density at 540 nm by a multiwell reader UNIPLAN (Pikon Ltd, Russia). Since the absorbance was proportional to the viable cell number, and survival value was calculated, as the percentage of the staining values normalized to that of the control cultures.

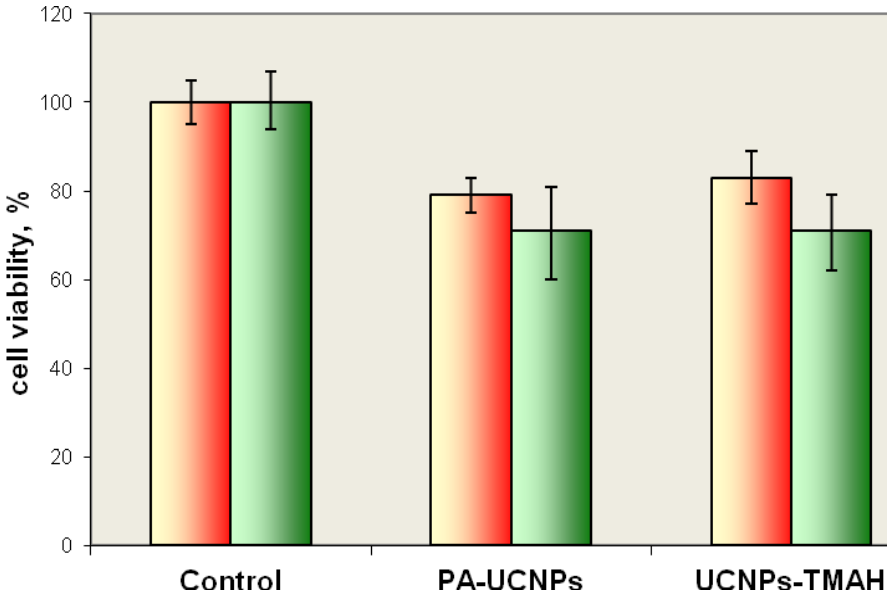


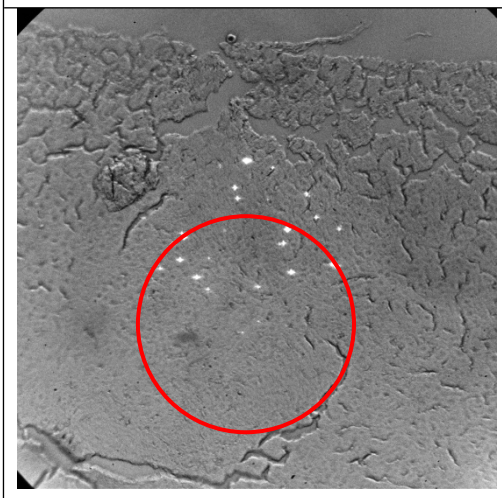
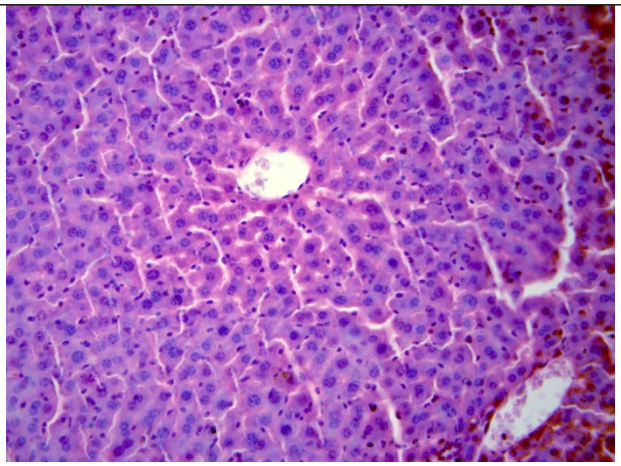
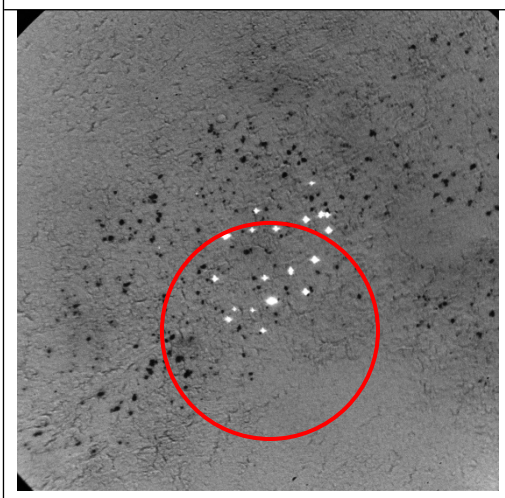
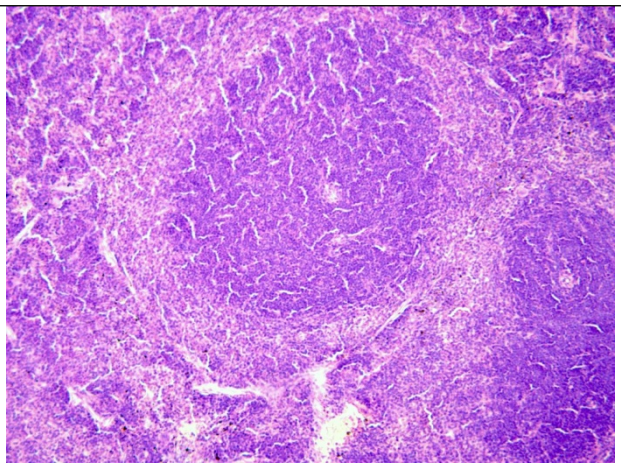
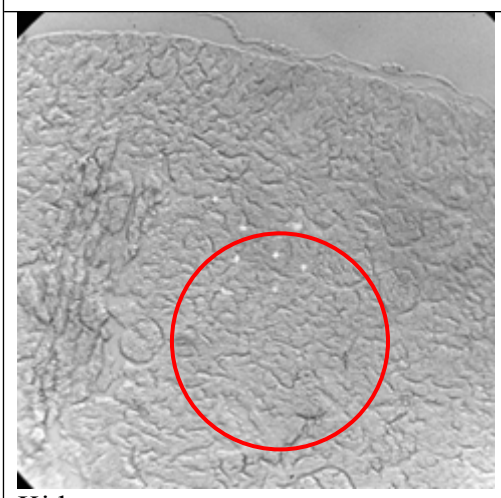
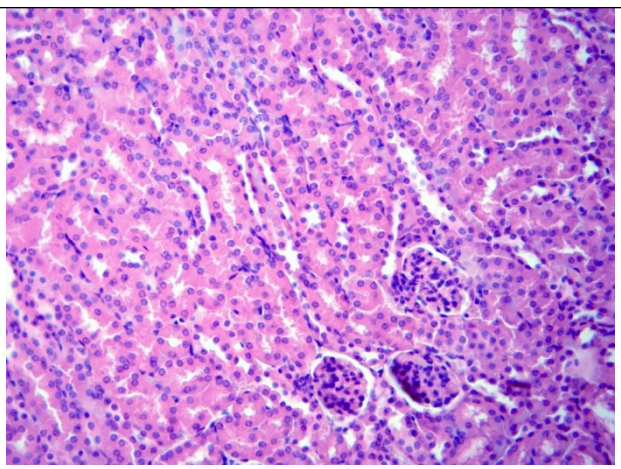
Figure S2. Mean viability (%) of human keratinocytes HaCaT co-cultured with polyacrolein particles (PA-UCNPs) and UCNPs modified with TMAH (UCNPs-TMAH) materials for 24 h (red bars) or 120 h (green bars).

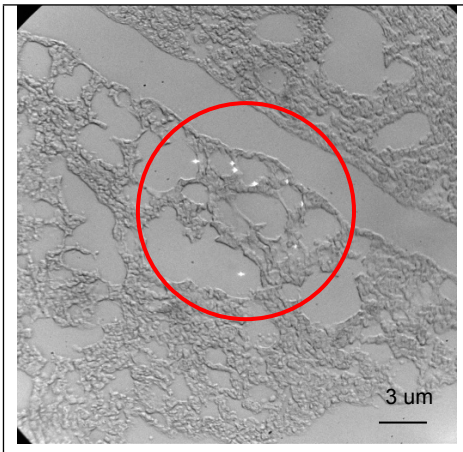
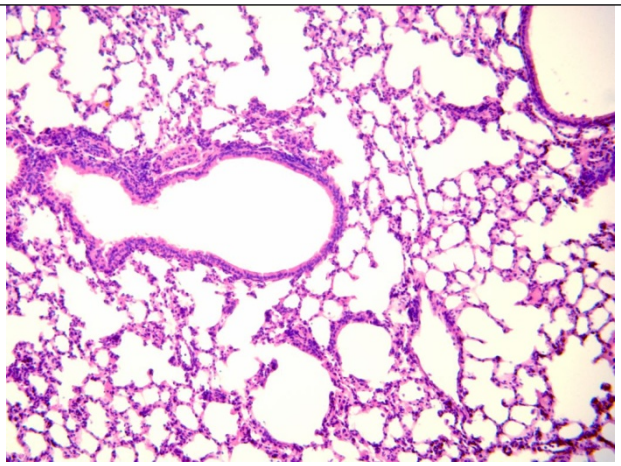
The exposure of HaCaT keratinocytes to PA-UCNPs caused, in average, 20% or 30% reduction of cell viability after 24 and 120 hours of incubation, respectively, as benchmarked against that of the control. The innate cytotoxicity of UCNPs hydrophilized with TMAH was also at the same levels, implying no significant changes in cell viability induced by embedding of these type of nanocrystals into the polymer particles.

Supplementary Reference 2

1. Mosmann T., *J. Immunol Methods,* 1983**, 65**, 55-63.

Table S2. Epi-luminescent microscopy and histological examination of organ tissue slices

Epi-luminescent microscopy	Histological examination
 Liver	 Magnification 400X
 Spleen	 Magnification 200X
 Kidney	 Magnification 400X

 Lung	 Magnification 200X

Note: red circle shows the field of microscope view.