Advanced superparamagnetic beads modification via hyaluronan as a tool for required properties achievement for diagnostic devices

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Recently, the utilization and the interest in superparamagnetic beads has been already increasing in biotechnological and biomedical sciences due to their numerous advantages such as for example easy of manipulation and separation. Biofunctionalized magnetic beads are efficient tool for bioaffinity separation and purification of target compounds from the complex heterogenous biological samples in high purity with low mechanical damage due to the reduced of mechanical stress compared to conventional methods [1]. Despite their proven advantages, they have some limitations caused by tendency of aggregation, abilities of nonspecific adsorption of protein, cells or other ligands, their sorption on the various surfaces or accessible iron ions limiting biomarkers detection by hydrogen peroxide biosensor. This adverse behavior rules out subsequent utilization of superparamagnetic carriers and their possible usage for diagnostic high-throughput devices.

For effective stabilization of superparamagnetic beads and suppressing of aforementioned demonstrable disadvantages, surface modification by appropriate substance like hyaluronic acid (HA) is desirable [2]. A variety of polysaccharides have been explored for use as a potential low-fouling surface modifier and HA has received much attention due to its unique properties [3].

For immobilization of hyaluronic acid was selected the covalent bond and used the carboxylic functional groups of HA. The well-known one-step carbodiimide methods with EDC and s-NHS was confirmed. Resulting HA-particles was characterized by zetapotential and microscopic technique such as optical or atomic force microscopy. Decreasing of protein adsorption has been verified using BSA, minimalization of beads aggregation and sorption on the various surfaces has been tested in microfluidic device and compactness of HA-layer by hydrogen peroxide biosensor.

Presented surface modification via hyaluronan is the efficient tool for achievement of required properties. Besides minimalization of above described adverse behavior, formed compact HA-layer on the surface of superparamagnetic beads also increases their specific surface and binding capacity and acquires nontoxic and biocompatible character.

Acknowledgement: This work was supported by the 7th FP of EU “NaDiNe” No. 246513, “LOVE FOOD” no. FP7-ICT-2011.3.2 and Czech Science Foundation P206/12/0381.

References

[1] Safarik I. et. al., BioMag. Res. Technol. 2, (2004) 7-23.
[2] Ma Z et. al., China Particuology 5 (2007) 1-10
[3] Suh K. Y. et. al., J. Biomed. Mat. Res. B, 72B, (2004) 292-298

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