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When Microfluidics Meets Magnetic Nanomaterials: Recent Approaches in Bioanalysis

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Summary

In bioanalysis, the advantages of microfluidics and superparamagnetic materials have been demonstrated many times in practice. It is therefore not surprising that attempts have been made to combine these two systems and multiply these advantages. In a short time, the magnetic particles have been adopted as the intelligent carriers in microfluid devices. The versatility of magnetic particles allows them to be easily integrated into the microchannels or microchambers of microfluidic devices. Appropriately adjusted magnetic field enables static or dynamic self-assembly of magnetic particles. Their parameters are the basis for the magnetic field modeling, so the equilibrium or motion of the particles, their torque, orientation, and angular velocity can be easily controlled. Thanks to these flexible properties, we have several options how to manipulate with magnetic particles. It is worth mentioning at least magnetic fluidized bed or magnetic bead chains, magnetic droplets and magnetophoresis. As a result, the highly efficient systems finding wide application have been achieved. Most of such microfluidic devices were developed for searching of clinically important targets, for specific capturing and isolation of cells or biomolecules, for controlled catalysis, and finally for the synthesis, control and sensing of magnetic nanoparticles. One of the most interesting magnetically active nanomaterials are TiO_2 nanotubes decorated by Fe_3O_4 nanoparticles (TiO_2NTs@Fe_3O_4NPs) [1] whose unique properties and versatile applicability will be commented [2,3].

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References

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