NEW HORIZON OF ADSORPTION THERAPIES BASED ON MICRO- AND NANOPARTICLES

D. Falkenhagen
Department of Clinical Medicine and Biotechnology, Danube University Krems, Austria

Adsorption therapy has been applied in clinical medicine since more than 50 years based on different technologies such as haemoperfusion alone or in combination with membrane-based systems.

Those adsorptions devices were based on columns filled with particles sized more than 100-200 micrometers. The use of micro- and eventually also nanoparticles in suspensions opens a new horizon for adsorption technologies especially for very complex diseases such as acute liver failure as well as sepsis/multiorgan failure. But the use of microparticles requires high safety standards to avoid the transfer of microparticles into the blood of the patient in case that the microparticles are able to cause microembolism.

The MDS (microsphere based detoxification technology) developed in our department reflects these safety standards. This technology is based on a combined membrane (first step for safety) – adsorption system which involves an optical sensor in the blood circuit (second step of safety) for the detection of less than 0.5 ml of adsorbent volume before entering the blood of the patient. As a third safety step the last version of the MDS is designed only for adsorbents particles less than 5 μm in order to avoid any acute clinical symptoms due to micro-embolism in case of a transfer of microparticles into the blood circuit.

Using optimized pore sizes of neutral microadorbents we are now able to avoid any use of charged particles enabling a high degree of biocompatibility of the MDS especially in combination with optimal anticoagulation.

Having the high safety standards in mind – the newly version of MDS will enable high flexibility, complexity and efficiency of the therapy of liver failure but also sepsis. Of course, also for immune adsorption but also rheological and metabolic diseases MDS offers excellent possibilities of clinical application.

In the future also nanoparticles which are not forming aggregates should be used in the MDS: Those nanoparticles offer also other possibilities for an intracorporal detoxification especially in case of biodegradable polymers.