Allergy Diagnostics Using Magnetic Beads in a GRAVI™-Cell Microfluidic Device

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Allergy is a widespread immunological disorder often related with Western lifestyles in which sterile environments deprive the immune system of factors stimulating its proper development. Allergic diseases, for example allergic rhinitis and asthma, are mediated by histamine (and other substances) released from mast cells due to their interaction with special type of antibody, so-called IgE antibodies, in response to normally harmless substances, allergens. IgE antibodies recognize allergens and activate mast cells, thus a high level (>200 µg/L for adults) of IgE in blood serum is an allergy indicator.

Measurement of total IgE concentration is one of the methods of allergy diagnostics in clinics. Analytical techniques employed for such routine analysis should therefore be fast and cheap. Herein, a fast immunoassay of IgE antibodies in human blood serum was developed using magnetic beads and the commercial device GRAVI™-Cell from DiagnoSwiss (Monthey, Switzerland).

A GRAVI™-Chip placed inside the device at an angle of 30° allows introduced liquids to flow under gravity and capillary forces only. It comprises of eight microchannels and each microchannel possesses two reservoirs and a microelectrode for electrochemical detection. IgE quantification is performed as one-step sandwich ELISA (enzyme-linked immunosorbent assay) with the immunocomplex formed on the surface of the magnetic beads which are trapped inside the microchannels by integrated permanent magnets.

The developed analysis shows good sensitivity (limit of detection 17.5 µg/L) suitable for effective allergy diagnosis.