Immu*Speed*™: Novel Automated Platform for Fast ELISA in Microchips

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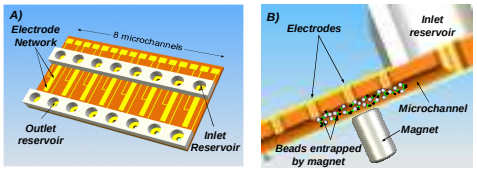
Immu*Speed*™ is an automated microfluidics-based platform, designed for running **bead-based ELISA** tests with standard immunology reagents. The instrument works with a microfluidics chip, harboring biosensor channels, in which all assay steps, from sample introduction through signal detection, are performed automatically. Programming of sequential assays in **8 parallel channels** and regeneration loops allows running **96 tests in 1-1.5 h, fully unattended**. Various assays are available by DiagnoSwiss including : **TSH, T3, T4, LH, FSH, hCG, AFP, Testosterone, Progesterone, Prolactin** .

Principle of magnetic bead based ELISA

20µL sample — *20µL beads (coated with capture Ab) and 20µL conjugate (ALP-labeled detection Ab) incubated in 96-well plate* — *Transfer to immuSpeed™ chip for pre-concentration and wash* — *Substrate addition & electrochemical detection*

- Samples distributed in 96-well plate and automatically processed in batch
- Possibility to run multi-menu assays according to choice of antibody

Immu*Speed* Chip: 8-microchannel biosensor



Schematic of immuSpeed™ chip showing electrode network (A) and magnetic bead capture in microchannel (B)

- Beads trapped within ~300 nL channel, with large pre-concentration
- >10-fold reduction in consumption of ELISA kit reagents

Immu*Speed* Instrument

Picture of immuSpeed™ instrument in its 4 micro-titer plate configuration

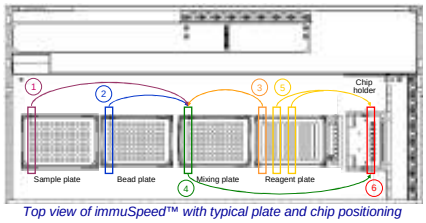
Microfluidic platform for automated ELISA comprising:

- 2, 3 or 4 positions for 96-well plates
- Slide-in immu*Speed*-Chip holder
- Shakers for sample & mixing plates
- Robotic station for sample & bead mixing, reagent dispense and assay performance
- Multichannel amperometric reader
- Temperature control
- Integrated software Immu*Speed*-Soft with dedicated assay protocols

Footprint: 80 x 40 x 45 cm³
Operating temperature: 37°C
Feedback control of automation

Software: Immu*Speed*-Soft, integrated in the instrument, to control the robotics and to run dedicated protocols experiments and to treat the measurement data.

Process Workflow in Immu*Speed*



Top view of immuSpeed™ with typical plate and chip positioning

Typical procedure for sandwich-type immunoassays:

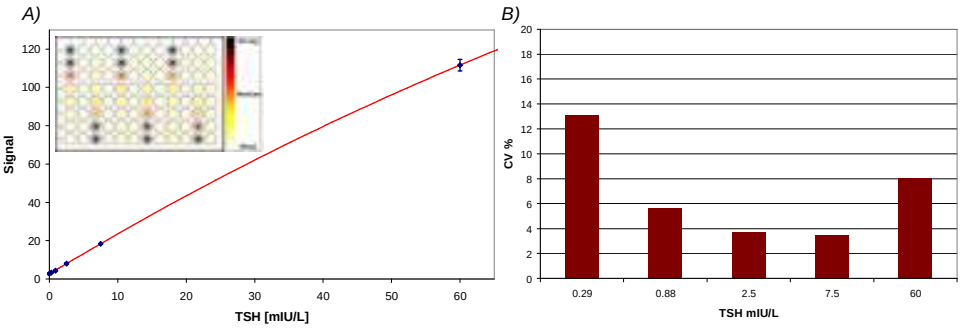
1. Samples of Row 1 dispensed in mixing plate
2. Beads of Row 1 mixed with samples in mixing plate
3. Conjugate mixed with samples & beads in mixing plate
4. Complex dispensed in microchip
5. Washing and substrate addition
6. Electrochemical detection in chip

Example of Application: TSH tests

The convenience and benefits of the immu*Speed* platform are demonstrated here by the detection of Thyroïd Stimulating Hormone (TSH) in plasma samples.

The samples and antibody-coated magnetic beads are dispensed in 96-well plates and placed in the instrument, along with a clean mixing plate and a deep plate containing the washing buffer and the enzymatic substrate solution. Immu*Speed*™ then drives the assay automatically according to the above workflow (with 25 minutes of bead-conjugate-sample incubation for each assay).

After the incubation, 20 uL of the mix are dispensed in the chip for bead capture, washing and electrochemical detection. After each series of 8 tests, the beads are washed out of the biosensor channels and the chip is regenerated using substrate solution.



Calibration curve (A) and standard deviation (B) for the detection of TSH in plasma samples using antibody-coated superparamagnetic beads (MyOne Dynabeads, Invitrogen, at 0.1 mg/mL), ALP conjugated detection antibodies (bioMérieux at 1:100), washing buffer and substrate solution (p-aminophenyl phosphate, DiagnoSwiss, at 5 mM pH 9.8)
(Insert: color plate representation for repeated assays as dispensed in the microtiter plate)

Assay Characteristics:

- Throughput of 1 plate / hour, incl. chip regeneration
- LOD in the low pg/mL range
- CV < 10; ,Dynamic range: >3 orders of magnitude
- Hands-on time: 10 min (sample & bead dispense only)
- Sample volume: from 10 uL
- Calibration: standards provided for each type of assay
- Reagent shelf-life: 12 months
- Automatic, all-in-one solution (incl. mixing, incubation, washing, detection, and ev. dilution)

Conclusion: immu*Speed*: an automated platform for rapid ELISA in small volume

Immu*Speed*™ is a robotized microfluidic analytical platform dedicated to fast ELISA in low volumes. By dramatically reducing hands-on time and analysis, significantly decreasing sample/reagent consumption and cost, this novel biosensor system enables to perform multi-menu immunoassays with easy-to-use robotics and laboratory infrastructure.

References

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