Integrated microfluidic magnetic immunosensor for quantification of human serum IgG antibodies to Helicobacter pylori

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Abstract: In this paper, we have developed and characterized a microfluidic magnetic immunosensor coupled to a gold electrode for the rapid and sensitive quantification of human serum IgG antibodies to Helicobacter pylori. This microorganism cause peptic ulcers and chronic gastritis, affecting around the 10% of the world population. The sensor was completely automated and the antibodies detection in serum samples was carried out using a non-competitive immunoassay based on the use of purified H. pylori antigens that are immobilized on magnetic microspheres 3-aminopropyl-modified. The magnetic microbeads were injected into microchannel devices and manipulated for an external removable magnet. The IgG antibodies in human serum sample are allowed to react immunologically with the immobilized antigens, and the bounded antibodies are quantified by alkaline phosphatase (AP) enzyme-labeled second antibodies specific to human IgG. The p-aminophenyl phosphate (p-APP) was converted to p-aminophenol (p-AP) by AP and an electroactive product was detected on gold layer electrode at 0.250 V. The response current obtained from the product of enzymatic reaction is directly proportional to the activity of the enzyme and, consequently, to the amount of IgG antibodies to H. pylori in serum samples. The electrochemical detection can be done within 1 min and total assay time was 25 min. The calculated detection limits for electrochemical detection and the ELISA procedure were 0.37 and 2.1 U mL-1, respectively, and the within- and between-assay coefficients of variation were below 5%. Our results indicate the potential usefulness of our fabricated microbiochip for the early assessment of human serum immunoglobulin G (IgG) antibodies to H. pylori.

Author Keywords: Alkaline phosphatase; Enzyme immunoassays; Flow injection analysis; Helicobacter pylori; Microfluidic; Paramagnetic beads

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