

BIOCATALYTIC ATRP AS DIAGNOSTIC TOOL FOR THE DETECTION OF BLOOD-RELATED DISEASES

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ABSTRACT

Blood-related diseases such as malaria and haemolytic anaemia represent major healthcare problems world-wide. Classical diagnostic methods rely either on the direct observation of biological samples, on sophisticated analytical methods or molecular developers such as antibodies, allowing for a wide variety of molecular sensing techniques. These techniques can be, however, time-consuming and often require trained and experienced personnel. More sophisticated methods include bioassays based on PCR. However, these tests involve complex instrumentation and expensive chemicals. As an alternative, portable, low cost and easy to use molecular methods have been developed that allow patients or healthcare workers to carry out diagnostics. Examples are malaria rapid diagnostic tests. However, their sensitivity is often not sufficient for the detection of trace amounts of certain disease-marker molecules, e.g. to detect and quantify malaria at low parasitemia levels or to detect and quantify trace quantities of haemoglobin in body fluids. We have developed a new assay for the detection and amplification of trace amounts of non-nucleic acid metabolites (e.g. hemozoin from malaria parasites). The assay is based on biocatalytic precipitation polymerizations of N-isopropylacrylamide carried out under conditions of atom transfer radical polymerization (ATRP). In such reactions, the metabolite to be detected acts as the catalyst of the initiation and polymerization reactions. The rate of turbidity formation during the polymerization scales with the concentration of the analyte. Haemoglobin quantification could be carried out with high sensitivity e.g. in plasma and urine. Similarly, diagnosis of malaria is possible with the assay at a sensitivity that outperforms conventional malaria rapid diagnostic assays.

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