ZEOLITIC MATERIALS-BASED *IN VITRO* DIAGNOSTICS FOR CANCER AND VIRUS DETECTION: A CRITICAL REVIEW

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ABSTRACT

Early detection and effective treatment rely on the development of improved diagnostic laboratory techniques and equipment [1]. In the last decade, the exploration of new functionalized materials for diagnostics is providing novel tools to support disease diagnosis and treatment. One of the most promising class of materials for advanced *in vitro* diagnostics is zeolitic materials. This work critically reviews the currently explored zeolitic materials towards the development of advanced *in vitro* diagnostics, with a special focus on the detection of cancer and viruses. Zeolitic materials refer to both conventional zeolites, i.e. microporous inorganic aluminosilicate crystal structures, and new zeolitic imidazolate frameworks, i.e. a new family of metal-organic crystalline materials based on framework types that resemble zeolites. They exhibit high chemical and thermal stability, structural diversity, high apparent surface areas, versatile surface functionalities, large pore sizes, and a chemically active interior, which provide them with exceptional properties as sorbents capable of hosting large amounts of sorbate molecules of a broad span of sizes [2,3]. Besides their conventional use in industrial applications, such as in separation, storage, and heterogeneous catalysis, the biocompatible members have been recently investigated for a wide range of biomedical applications. The review of published work lead to the selection of the most promising biocompatible zeolitic structures that could be employed in biomacromolecules (nucleic acid and protein) sensing, harvesting secretory proteins in conditioning cancer cell culture media, and separating surface-adhered cancerous cells from mixed cell population. The above applications are discussed based on key properties (e.g. chemical functionality, geometry structure, size, porosity, stability) of the specific zeolitic materials, revealing the relationship between the performance of the diagnostic tool and the properties of the selected materials. Furthermore, the hurdles that need to be overcome for improved performance in cancer and virus detection are identified and discussed, whereas perspectives for zeolitic-based diagnostic platforms that could integrate diagnosis and therapy in a single system are highlighted.

KEYWORDS: *in vitro* diagnostics, cancer, virus detection, zeolitic materials, biomaterials

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