

Energy Dispersive X-Ray (EDX) Microanalysis in Biomedical Research

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Editorial

EDX microanalysis is a technique associated to both transmission and scanning electron microscopy that is based on the detection of characteristic X-rays generated by atoms of the specimen interacted with electrons beam^[1]. Each element is able to release specific X-ray which contain information about their chemical nature^[2]. The minimal detectable elemental concentration relivable with EDX apparatus is about 10^{-4} mol per kg of dry specimen, where as spatial resolution ranges from approximately 10^{-3} μm to 3 - 4 μm ^[3].

In the last years, the EDX method is involved in different biomedical fields due to its high sensitivity to detect the elements in pathological tissues increasing the knowledge about many human diseases. In fact, EDX technique is useful in the study of drugs delivery in which it is an important tool to detect chemotherapeutic agents or the nanoparticles commonly used as specific drugs carriers^[4]. EDX technique is also used to detect bioaccumulation of toxic element such us heavy metals due to environmental pollution^[4]. In a recent paper, we demonstrated existence of important differences between lung cancer lesions and benign lesions about bioaccumulation of heavy metals, such as Co, Cr and Pb. The identification of toxic elements involved in lung carcinogenesis can provide additional evidence on strictly association between cancer and environmental pollution^[1].

The EDX microanalysis was also used to add more information about the link between calcium deposition and human diseases^[5,6]. In these fields, we applied EDX microanalysis to demonstrate a different elemental composition of calcifications associated to benign or malignant breast lesions. Notably, we detected for the first time magnesium-substituted hydroxyapatite, never found before, in benign lesions but frequently present in breast cancer^[5]. In the last years, the study of asbestos became very interesting and the characterization of the asbestos fibers was better defined thank to EDX microanalysis. In fact, EDX made possible to separate asbestos into six distinct types of fibrous silicate minerals, based on following characteristics: long, thin, flexible fibers and elemental composition. This technique was used to demonstrate the tightly association of asbestos nano-fibers and lung cancer cells. Recently, using EDX microanalysis, we unmasked nano-asbestos fibers starting from lung histological samples (paraffin blocks) of patients with possible occupational exposure to asbestos^[7]. Through this method, we could unequivocally associate the fibers present into lung with the real occupational exposure of the patient and in addition this opportunity can offer exposed workers the chance to ask for re-evaluation of their case.

Despite EDX microanalysis is a technique it can represent a useful tool in all study of biomedical research that require determination of endogenous or exogenous elements deposits in the tissue, cell or any other sample. In addition, EDX microanalysis can be used in diagnostic approach of the main human diseases.

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