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Identification of contemporary binders by time resolved laser induced fluorescence (TR-LIF) spectroscopy

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Since 1850, a great number of chemical and synthetic materials have been available thanks to the development of modern chemical industry. Moreover, contemporary artists have used most of them in their paintings. Acrylic and vinyl polymers undoubtedly represent the most used binders in contemporary paintings. Despite the great popularity of those polymeric binders in the field of contemporary arts, many artists still prefer to use the traditional ones, as linseed oil and dammar varnish. However, the oil binders, which are produced trough industrial processes, show many different chemical compositions with respect to the ones produced in ancient times. Because of these characteristics, contemporary artworks are often realized with multi-component materials with unknown composition, which may be subjected to an unforeseeable degradation. The use of those multi-component mixtures, whose chemical and physical properties are not well assessed to date, probably represents the major problem arising from contemporary artworks conservation.

Most of the alteration and degradation issues on painted surfaces are related to the binders used. This is the reason why their identification becomes mandatory in order to plan appropriate conservation and restoration strategies. Nevertheless, the complex nature of these multi-component mixtures makes their investigation really complicated by conventional non-destructive diagnostic techniques. In this sense, Laser Induced Fluorescence (LIF) is a non-destructive technique used for the investigation, characterization and preservation of Cultural Heritage, thanks to its peculiar advantages of high sensitivity, non-invasiveness and prompt response. In this work, a great numbers of binders employed in contemporary paintings have been studied by Laser Induced Fluorescence (LIF) spectroscopy. The emission spectra have been acquired irradiating the investigated samples with an UV laser excitation source at 220 nm. Multi-material samples main issue is related to mixing, i.e. assigning the spectral signatures of different constituents. This issue can be overcome by using Time Resolved LIF, which discriminates the emissions from different compounds analyzing the time evolution of fluorescence spectra. Experimental results confirm the capability to isolate specific contributions from the investigated constituents by a TRLIF analysis. The results presented in this work have been classified in a reference database, which is dedicated to the identification of the employed materials for contemporary artworks.