

# ***In situ* spectrofluorimetric analysis of red & blue colours on 19th century Japanese engravings (Torralba collection, Zaragoza Museum).**

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The study of fragile objects kept in museums requires mobile devices, short time of analysis and a minimal of disturbance to preserve the works of art. *In situ* spectrofluorimetric studies are mostly developed for organic pigments identification. The LED microspectrofluorimeter (LED $\mu$ SF) is a mobile device dedicated to *in situ* measurements that uses UV-light emission diodes (LED) excitation sources. It has proven to be an effective device for the study of binders, pigments and dyes in fragile paintings as some of these materials can be identified from their UV-fluorescence emission. The interpretation of the *in situ* fluorescence emission spectra can be rather difficult because of the variety of pigment mixtures, natural aging of colorants and fluorescence of the support (paper) that can lead to spectral changes or band shifts. One solution to interpret the data is to apply mathematical treatments to distinguish the pigments in case of mixture.

The colours of five Japanese engravings (woodblock prints with pigments) from the Torralba collection in the Zaragoza Museum were studied by the combination of hyperspectral imaging in the visible range (HSI), fibre optic reflectance spectroscopy in the near infrared range (FORS-NIR), colorimetry and ultraviolet fluorescence emission. This paper focuses on the red & blue colours analysis obtained using the LED $\mu$ SF on 5 engravings by Koryusai, Utamaro and Eisen (18th-19th). In the Japanese Prints, red, blue and purple colours were mostly used to illustrate various facts of the city of Edo (Tokyo) and scenes of everyday life (famous courtesans, kabuki theater, sumo, nature...). A lot of inorganic and organic red (vermilion, cochineal...) and blue (indigo...) pigments were used alone or as a mixture to obtain, for example, a purple colour. The fluorimetric spectra obtained *in situ* were compared with those obtained in laboratory on model samples. Red, blue and mixtures were studied to build a database of fluorescence emission spectra.

*Keywords: LED spectrofluorimetry, pigments, colorants, engravings.*

