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Species identification and treatment detection in dark coloured pearls

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In the jewellery market, dark-coloured pearls vary in colour range from grey to brown and black, with blue, green or purple orients considered highly desirable (George 1971). These naturally coloured dark pearls may belong to several different saltwater pearl oyster species but have very similar appearances. *Pinctada margaritifera*, *Pteria sterna* (Kiefert et al. 2004), *Pteria penguin* (*P. penguin*) and also black pearls from Abalone are common types found in the trade. Meanwhile, some light coloured pearls can be also treated to obtain dark coloured pearls (Komatsu & Akamatsu 1978). Gemmological observation and examination along with UV-VIS spectrometry, Raman spectrometry and energy dispersive X-ray fluorescence (ED-XRF) are useful methods to distinguish pearl species mostly based on differnces of their colour pigments (Britton 1983, Iwahashi & Akamatsu 1994, Karampelas 2011). Identification of treated dark pearls is also possible using these techniques.

Figure 1 shows the UV-Vis reflectance spectra of studied pearl samples from different oyster species (*P. margaritifera, P. sterna, P. penguin*) and a silver (Ag) treated dark pearl. In figure 2, typical Raman spectra of natural-coloured pearl species from *P. margaritifera, P. sterna* and *P. penguin* are presented. The spectra (Fig. 2) were recorded using an argon-ion laser (514nm). Energy dispersive X-ray fluorescence analyses of Abalone pearls reveal, that they contain iodine (I) as minor constituent, in contrast to the other investigated species. In the case of silver-treated pearls of artificial dark colour a distinct Ag concentration can also be detected using ED-XRF.

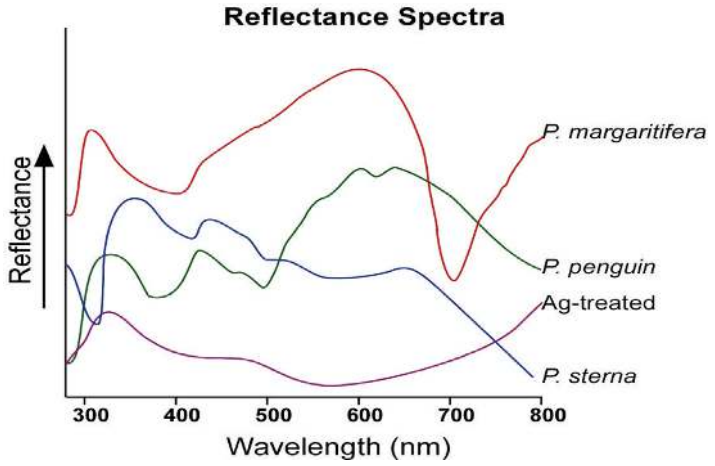

Figure 1. UV-Vis reflectance spectra of pearls from *P. margaritifera, P. penguin, P. sterna* and a silver (Ag)-treated pearl.

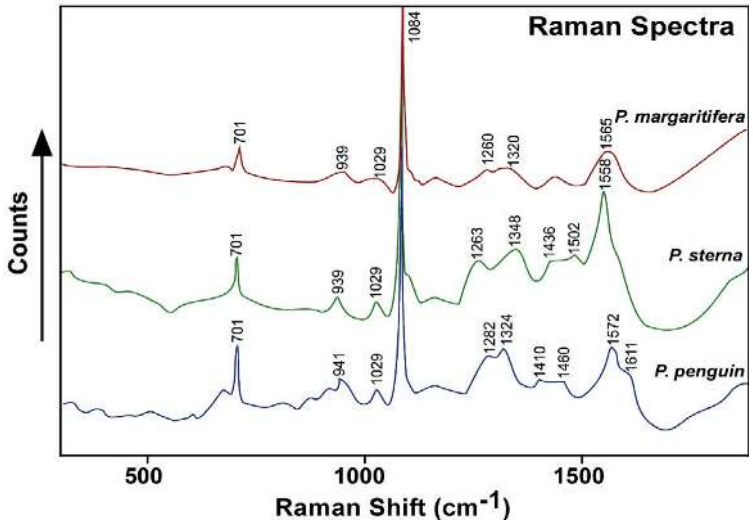

Figure 2. Raman spectra of a black pearl from *P. margaritifera*, a dark grayish brown natural pearl from *P. Sterna* and a brown pearl from *P. Penguin*.

In summary, UV-Vis spectroscopy offers the possibility to distinguish *P. margaritifera* pearls from other dark coloured species (based on their absorption band at approximately 700nm) (Huang 2006, Karampelas et al. 2011) and to detect Ag-treated pearls. Raman spectroscopy then provides further option to distinguish *P. margaritifera, P. sterna* and *P. penguin* pearls based on their specific Raman shift peak positions. Finally, the ED-XRF reveals the chemical composition of Abalone pearls and Ag-treated pearls, which have distinct iodine (I) and silver (Ag) content, respectively.

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