

Pearls are radiant, timeless, and elegant. For thousands of years, these unique and diverse gems have been sought out for decorative, cosmetic, and medicinal purposes thanks to the aesthetic beauty and chemical composition of their nacre. However, pearls currently do not have a standardized grading system in place to harmonize pearl evaluation across the industry and ease categorization. Instead, each producer and retailer must develop their own grading standards, leaving consumers without consistent benchmarks to guide their purchasing decisions. At a time when the online market is rapidly expanding and many pearl retailers do the bulk of their business on the internet, consumers are increasingly vulnerable to inconsistent grading systems as they select pearls sight-unseen. The advanced analytical capabilities of UV-Vis spectrophotometry presents exciting possibilities for assessing pearl quality to create more [stable grading systems for individual suppliers and retailers as well as the industry as a whole](#).

Toward an Objective Method of Quality Assessment

Currently, pearl quality assessment relies primarily on subjective visual inspection of a variety of aesthetic factors, including color and luster. Not only is [sight-based evaluation inherently unreliable](#), it is also time-consuming and dependent on the expertise and skill of the viewer. The nature of pearls themselves complicates this process due to their reflective, iridescent qualities and high level of environmental dependency. As researchers Snezana Agatonovic-Kustrin and David W. Morton note, “The colors of pearls are not merely due to the pigments that may be present in the pearl but also from the reflection and refraction of light.”¹ Diffuse reflectance UV-Vis spectrophotometry introduces a non-destructive, objective basis for color assessment that can allow for more rapid and reliable color categorization. UV-Vis instrumentation offers the ability to not only account for reflectance to produce accurate chromatic data, but to [measure light transmittance as an objective, quantifiable indicator of luster](#). This information is critical not only to purchasers of pearls, particularly those who specialize in high-quality products, but to pearl farmers seeking to optimize their culturing practices.

Spectral Identification of Diverse Parameters

In addition to color and luster, the data gathered through spectrophotometric analysis of each pearl’s distinctive spectral features can be used to identify a host of other quality parameters that impact value and marketability. These include differentiation between naturally colored and treated pearls as well as determination of pearl origin based on the unique UV-Vis absorbance properties of a pearl’s nacre. For example, a recent study published in *Marine Drugs* found that “yellow-colored pearls and yellow shell nacre from *P. maxima* showed characteristic maximum absorption between 330 and 385 nm while ‘heat-treated’ yellow pearls from *P. maxima* did not, allowing treated pearls to be distinguished from natural pearls of similar color.”² Similarly, spectrophotometric identification of chromatophores can differentiate natural Tahitian black pearls from treated pearls. Based on their findings, the researchers noted that, UV-Vis spectrophotometric analysis “could become increasingly important as the pearling industry seeks to develop less subjective methods of assessing pearl quality (grading).” Indeed, experts are currently developing assessment protocols that pair spectrophotometric instrumentation with Artificial Neural Networks for consistent and accurate identification of pearl type, treatment, and quality and reflectance spectrophotometry is already an integral part of assessment protocols at the Pearl Science Laboratory in Japan, an independent grading body that certifies Hanadama, the highest quality Akoya pearls.

Cosmetic and Pharmaceutical Quality Pearls

When a pearl doesn’t have the aesthetic qualities consumers are looking for in jewelry, it can remain a valuable commodity for cosmetic and medicinal use. Crushed and powdered pearl nacre has been used in beauty products around the world for thousands of years and continues to be a highly sought-after ingredient in high-end product lines, particularly in Asian countries. Not only can the iridescence of nacre lend a beautiful sheen to cosmetics such as face powders and foundations, but the composition of the nacre is said to have important anti-aging, brightening, and skin-lightening properties that make it ideal for integration in skincare products. Pearl powder is also used therapeutically in traditional Chinese medicine to

treat a variety of ailments ranging from inflammation to anxiety to pain. In the West, pearl powder is added to toothpaste to provide both whitening, gum health, and anti-sensitivity benefits. A more stable grading system would ease identification of pearls deemed inappropriate for gem use and allow them to be used in ways that maximize their functionality and value in other industries.

Full article with photos available here:

<https://www.hunterlab.com/blog/color-measurement-2/new-frontier-in-pearl-assessment-utilizing-uv-vis-spectrophotometry-for-quality-standards/>