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THE QUEST FOR BEAUTY

Created by human aid, cultured pearls are well-demanded in the marketplace. Prof H.A. Hanni expounds the rules of nomenclature and puts the identification of cultured pearls and their treatments under the microscope.

Before plunging into the topic of cultured pearls, I want to first remind you the nomenclature rules set by the World Jewellery Confederation (CIBJO), which apply terms that clearly defines the nature of pearls. There are three terms – natural, cultured and imitation.

The latter is made of a spherical (or other shape) bead material that is covered with a shimmering surface layer. The lacquer gives a pearly lustre imitating that of the natural pearl, which can be found accidentally in wild oysters. Regardless whether the bead used inside is made of glass, plastic or shell, such products must be called imitation. Great effort is put in by producers to make their imitations appear more natural – or at least cultured – by selling them under fancy names like Majorica and shell pearl.

Contrary to rumours that natural pearls no longer exist, they are still produced in small scale as much sought-after merchandise. In fact, over 90 per cent of pearl necklaces tested in our gemological institute are natural. From time to time, we also come across a lot of fresh, undrilled natural pearls.

Majority of pearls available in the market today are cultured pearls. Tonnes of them are produced in saltwater and freshwater pearl farms worldwide. As cultured pearls are the result of the reaction of the shell on a transplanted piece of mantle tissue that is artificially introduced, they are not considered natural pearls according to the rules of nomenclature. There are two major techniques that can be applied to all kinds of shells – the tissue transplant can be made alone or by adding a bead.

Such products have to be termed cultured pearls, and this

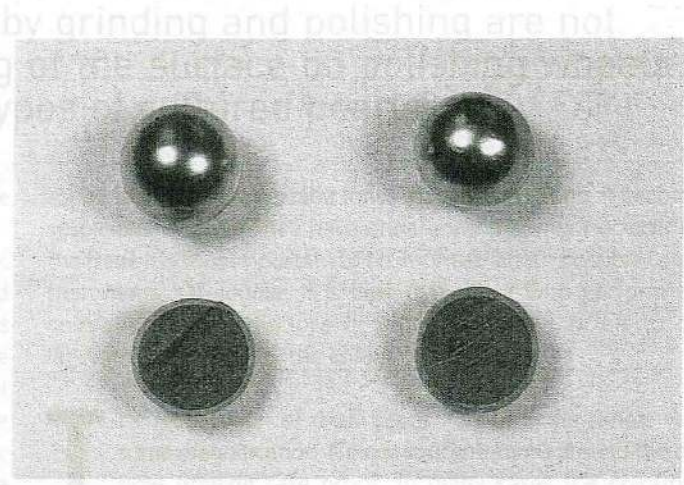
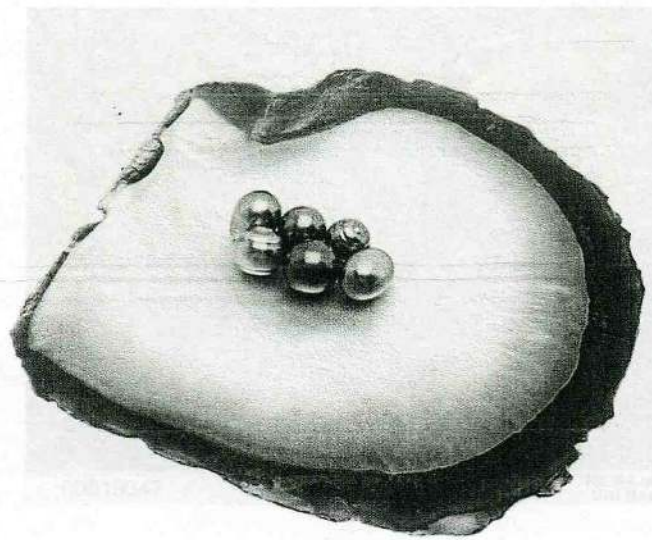
includes those shells that might have rejected the implanted bead after the operation. Cultured pearls are usually presented to the public with descriptive labels – such as freshwater, South Sea, Tahiti and Kasumigaura – which differentiates them from other types of cultured pearls. These additional terms often exclude the term ‘cultured pearl’ from the products when they are sold. In my laboratory, we observe a lot of resistance from some cultured pearl producers to call their product ‘cultured pearls’. Characteristics such as colour, surface, shape, lustre and nacre thickness are sometimes covered by the general term ‘quality’.

METHODS TO IMPROVE QUALITY OF CULTURED PEARLS

Although human intervention is involved in the production of cultured pearls, the gemstone may not be formed as perfectly as desired. In reality, a large quantity of pearls, when harvested, are far from perfect to be able to please the producer and the consumer.

Because both natural and cultured pearls are expensive, different means are taken to make them appear as flawless as possible. Competition among producers is stiff and any cosmetic enhancements made can greatly increase the sales prospects and fetch a higher selling price. Enhancements made to improve the quality of pearls are difficult to define. Most processes include gentle actions like washing, removing attachments from the shell body, or slightly polishing the surface.

As pure white pearls are in high demand and most pearls come in a creamy tone, bleaching has become an option to meet consumers’ requests. Bleaching may be done with chemical substances (for instance, immersing the pearls in a 1:20 hydrogen peroxide-solvent solution at 30°C for a few days) and also exposure to bright tube light. The surface of pearls can be conditioned in tumblers with bamboo pieces before they are waxed for a final polish.



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All such soft treatments are considered ‘processing’ rather than ‘treatment’. More severe interventions leading to changes of the appearance of pearls, on the other hand, must be called treatments. All colouring actions such as dyeing and irradiation are considered treatments and have to be disclosed at the time of sale and on bills, in accordance to nomenclature rules.

Besides bleaching, changing the original colouration of pearls is another method producers take. Colouring can be done by immersion into dyes or by irradiation. One of the oldest pearl dyeing procedures that have been practised is the use of silver nitrate $AgNO_3$ solution. This chemical is usually applied on drilled pearls so that it is soaked up by the nucleus as well as the cultured pearl coating. A major portion of the dye is usually deposited in the gap between the core bead and its overgrowth. The resultant colour is grey to silvery black, depending on the concentration of the solution.

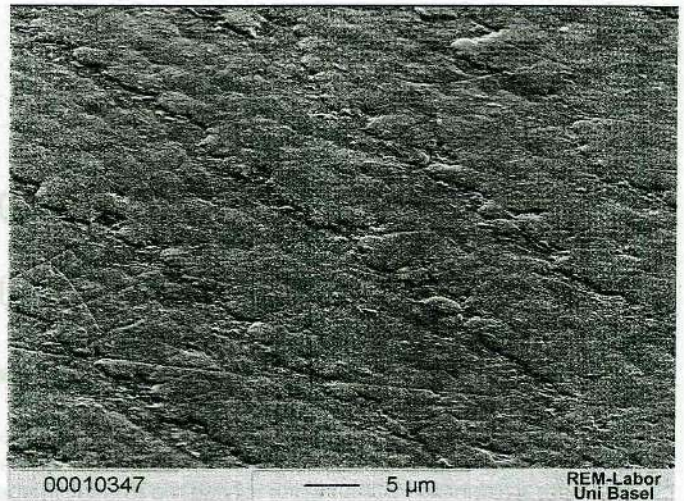
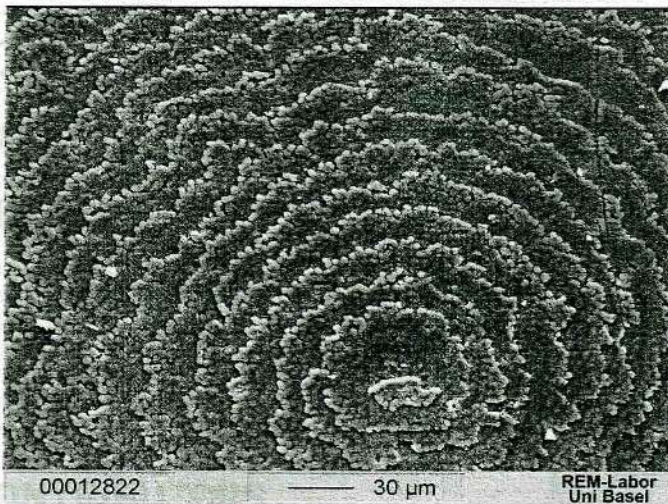
Freshwater pearls, on the other hand, can be irradiated grey as they contain manganese, a trace element necessary for the successful treatment. Those cultured pearls whose beads are



Facing page: A 14mm cultured pearl strand with beaded freshwater pearls of fine quality. It is not evident how much of the beauty is original and how much is made up.

From top: Natural colour Tahiti cultured pearls with strong iridescence colours; dyed beads and their effect on the colour of beaded cultured pearls; stain marks around a drill hole of an Akoya cultured pearl.

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While removal of shape deviations by grinding and polishing are not frequently performed, the polishing of the surface on polishing wheels seems to be a standard for some types of cultured pearls.

of freshwater nacre (Akoya for example) are also susceptible to irradiation.

Cultured pearls can also be stained pink or golden. It is surprising to see that even undrilled golden South Sea cultured pearls may be artificially coloured throughout by effective dyes with very strong penetrative power. Many of the small Chinese freshwater cultured pearls are dyed by immersion to shades of green, violet, pink and golden brown. In the laboratory, we have also seen cultured pearls with stained beads in blue and green; their colour shining gently through the overgrowth (see last picture on previous page). Some of the stained pearls even come in unusual shades of chocolate brown. We think that some colouring agents and methods of changing the colour of cultured pearls are still unrevealed and kept secret.

Shape and lustre are important factors that affect a pearl's quality. While removal of shape deviations by grinding and polishing are not frequently performed, the polishing of the surface on polishing wheels seems to be a standard for some types of cultured pearls (see images above). Surface polishes can be easily recognised with magnification, either with a 50-times optical microscope or with a scanning electron microscope, where the characteristic step-like arrangement of aragonite tablets on the pearl's surface appears eroded and scratched.

Sometimes, the lustre can be so strong that the pearls look unnatural. The use of polymer coatings may be the responsible for the pearls' appearance and such coatings have been reported in literature. The soft consistency of polymer coatings can be determined with a needle.

IDENTIFICATION TECHNIQUES

Many of the pleasant pastel colours encountered in Chinese freshwater pearls are natural. Deriving their hues from the black pinctada margaritifera shell, Tahiti cultured pearls usually have natural grey to near black body colour on which strong iridescence is visible. Terms like 'peacock' are used to describe the effect. Pearls from the gold-lipped pinctada maxima may show golden

tones, but when they exhibit tones that are too strong, it becomes suspicious whether they have undergone treatment or not. For the trade it is thus important to be informed about possible colour treatments. Of course, it is best that those who perform the coloration would disclose it, but too often it is left to the laboratories to identify the colour origin.

The recognition of dyed pearls may be quite simple with some magnification. Colour concentrations around the drill hole provide safe proof. In many cases the colouring agent can be dissolved with acetone and a small drop of the solvent used may leave a trace on a white paper towel.

Grey pearls stained by silver nitrate can be identified either on x-rays where silver concentrations appear as bright lines. The silver is also visible by an Ag signal in the EDXRF (energy dispersive x-ray fluorescence) spectrum. Some dyes such as carotene can be picked up by Raman spectroscopy. Carotene is found in red corals, but not as a natural pigment in pearls.

Some tests may also be ambiguous, as with the reddish ultraviolet fluorescence seen in many natural brown to black pearls and also in some treated ones of similar colours. Spectroscopic investigation with a spectrophotometer (peak at 700 nm) is considered as a proof of natural colour in such cases. Dyed golden cultured pearls present a tough challenge as no straightforward method of detection has been established. Microscopic evidence, in some cases, may help with the identification.

However, most of the colour authenticity tests are a matter of instrumental analysis that requires a well-trained laboratory gemologist and sophisticated equipment. A crucial point is the availability of research material on known treated and untreated pearls that provides safe data for research projects. **P**

From left: A scanning electron microscopy image of a natural pearl surface; a scanning electron microscopy image of a polished pearl surface, magnified six times more than the previous picture.

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