

# Gemological Characteristics and Chemical Composition of Imitation Pearls with the Trade Name Shell Pearl

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## Introduction

An imitation pearl is something that man-made materials to imitate a pearl. Most of them are made of plastic or glass. The imitation pearl known as the trade name Shell Pearl is an imitation pearl made from natural shells. It has a chemical composition similar to pearls. The chemical formula is calcium carbonate ( $\text{CaCO}_3$ ). It comes in a variety of sizes, shapes, and colors. They have a uniformity of shape achieved by molding the seashell material and enhanced color through dyeing or coating to improve beauty and durability. In this study, a sample of 14 Shell Pearls was used to study gemological characteristics and chemical composition. All the samples are spherical in shape, ranging in diameter from 0.8 to 1.0 mm, and they were coated in a variety of colors, including white, yellow, red, pink, gray, and black.

## Materials and Methods



Figure 1. Shell Pearl sample.



Figure 2. Shell Pearl diameter sample.

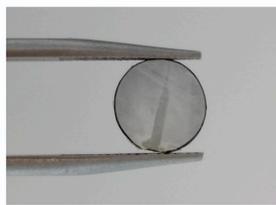


Figure 3. Sample of a cross-sectional photograph of shell pearl.

In this study, 14 samples of Shell Pearl with a weight range between 3.20 to 5.80 carats used to examine the gemological characteristics and chemical composition using basic instruments including Hydrostatic Weight and Ultraviolet Lamp, and Advanced instruments analysis including Fourier Transform Infrared Spectrophotometer (FTIR) to identify the type of dye used in the coating and the presence of  $\text{H}_2\text{O}$  or OH in the structure, a Scanning Electron Microscope and Energy-Dispersive X-ray Spectroscopy (SEM-EDS) to analyze the chemical composition and structure of the Shell Pearl, and X-ray Diffractometer (XRD) to examine the mineral composition.

## Result and Discussion

Sample	Weight in air (carat)	Weight in water (carat)	Specific gravity (S.G.)
SP01	3.66	2.25	2.60
SP02	4.20	2.64	2.67
SP03	4.35	2.76	2.72
SP04	3.59	2.27	2.70
SP05	4.28	2.69	2.69
SP06	3.78	2.38	2.69
SP07	3.94	2.48	2.68
SP08	4.50	2.86	2.73
SP09	3.85	2.42	2.69
SP10	5.86	3.72	2.72
SP11	3.76	2.34	2.63
SP12	3.26	2.02	2.62
SP13	4.08	2.60	2.74
SP14	4.03	2.56	2.72
Average	4.08	2.57	2.70

Figure 4. Table showing specific gravity values.

The results of the study, Shell Pearl sample were Opaque. The specific gravity is in the range between 2.60 to 2.74. They were inert under short-wave ultraviolet and long-wave ultraviolet



Figure 5. Short-wave ultraviolet.

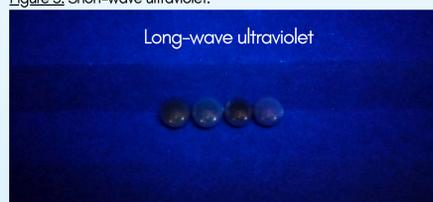


Figure 6. Long-wave ultraviolet.

## SEM-EDS

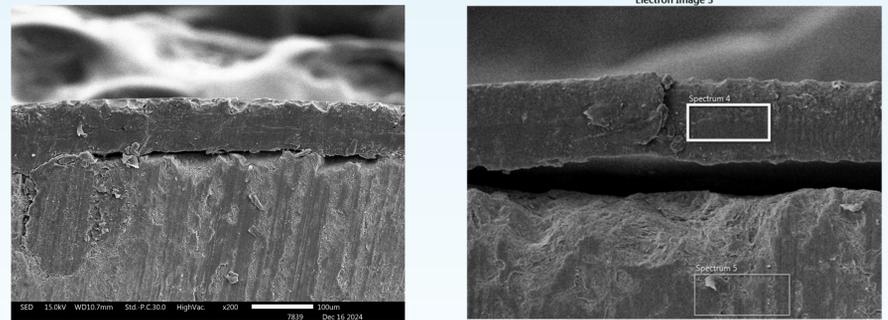


Figure 7. SEM image structure of shell pearl sample SP03.

SEM studies from the image show the separation of layers between the coating substance and the shell pearl. The surface of the shell pearl showed crystalline characteristics in stacked plates.

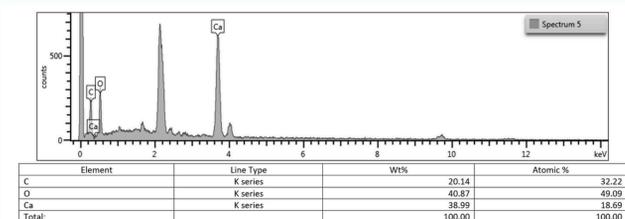


Figure 8. EDS chemical composition of shell pearl sample SP03.

The chemical composition with EDS has shown that the coating substance and shell pearl areas are composed of calcium, carbon and oxygen.

## FTIR

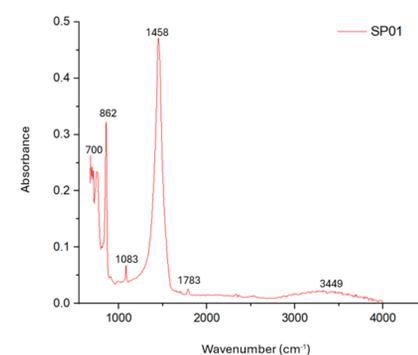


Figure 9. FTIR absorption of shell pearl sample SP01.

Infrared Absorption with FTIR Shell pearl powder displayed absorption at the following positions:  $700\text{ cm}^{-1}$  is the position of  $\text{CO}_3^{2-}$  in-plane bending,  $862\text{ cm}^{-1}$  is the position of C-H bending,  $1083\text{ cm}^{-1}$  is the position of  $\text{CO}_3^{2-}$  symmetric stretching,  $1458\text{ cm}^{-1}$  is the position of  $\text{CO}_3^{2-}$  asymmetric stretching,  $1783\text{ cm}^{-1}$  is the position of C=O stretching and  $3449\text{ cm}^{-1}$  is the position of O-H stretching.

## XRD

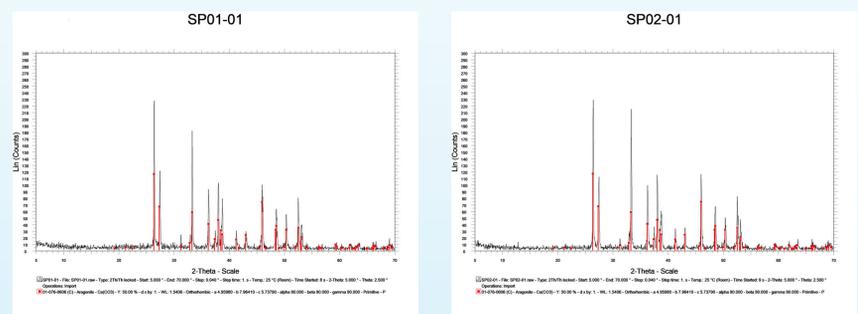


Figure 10. XRD composition of shell pearl sample SP01 and SP02

XRD revealed that the mineral compositions of samples contained only one type of aragonite mineral.

## References

- Hanni H., 2004, "Shell Pearls" with Tridacna clam shell beads, *Gems & Gemology*, Summer 2004, Vol.40, No.2, pp. 178.  
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