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Pearl luster and shelf-life enhancement through pearl treatment

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ABSTRACT

To investigate the pearl luster and shelf life enhancement a study was conducted at the Pearl laboratory, Bangladesh Fisheries Research Institute, Mymensingh with rice pearls and image pearls from July 2017-June 2018. Rice pearls and image pearls were kept in bottles, each filled with different concentrations (10%, 15%, 20%, 25%, 30%, 35%, 40%) of H_2O_2,CH_3OH and C_2H_5OH solutions and kept in treatment units under (1,700-15,300 lumens) and at a temperature of 33-40^{0}C for 4 months. Shelf life of the treated pearls were measured by examining the longevity of the luster for a period of eight months. Treatments were used for enhancement of pearl quality. During the experiment highest luster increase (49%) was observed in treatment with 10% C_2H_5OH followed by treatment with 10% CH_3OH (47%), 15% C_2H_5OH (43%), 15% CH_3OH (39%). Decaying and decrease in pearl luster was found in treatments with 30, 35 and 40% H_2O_2 (-23%, -29% and -38%); 35 and 40% CH_3OH treatment (-8% and -13%); 40% C_2H_5OH treatment (-7% and -15%, respectively. Current study revealed that pearl treatment with 10% C_2H_5OH for four months showed better peal luster and shelf life.

INTRODUCTION

Pearls are one of the most precious gems in the world. They are formed from living creatures, thus, giving them the appellation of biological gemstones (Zhao et al., 2013).Pearls are exceptional organic jewels, the only one organic gem which do not require cutting or polishing before use. Pearl excellence and hence, their price and beauty, is measured using various tools and methods that are mostly visual and often particular (Norton *et al.*, 2000). Optical microscopes can be used to differentiate frank, natural, and cultured pearls from forged pearls. In contrast fake pearls, look smooth, genuine pearls show relief lines on their external surface (Rahman and Krishnamurti 1954). However, it is hard to distinguish between natural and cultured pearls. Natural pearls have a concentrically layered edifice, whereas the inner structure of the cultured pearls varies rendering to the type of bead (Snezana and David 2012). Research showed that pearl luster can wither. But the finest quality pearls have been extremely valued as gemstones and objects of beauty for many centuries. As for its commercial value, pearl culture technology is a developed sector in countries like China and Japan. Tremendous progress was made by China in culturing freshwater pearls in triangular mussel *Hyriopsis cumingii* (Yan *et al.*, 2009), through which pink-to-purplish coloured quality pearls are formed. Akoya and freshwater cultured pearls are usually treated to expand their appearance (Zhao et al., 2013). Now a days, almost all pearls used for jewelry are cultured by planting nuclei into mother oysters (Wada, 1973). Among the cultured pearls, Akoya, South Sea, Tahitian, and freshwater pearls are most frequently encountered in market (Miyoshi, 1987). In general, most pearls are cleaned and washed to remove residues and odors; they are typically stumbled in rotating barrels with salt (Song, 1999). Bleaching, buffing, and filling are not considered a routine but occasionally conducted (Ju, 2011). Realizing the potentiality Bangladesh Fisheries Research Institute (BFRI) has been started pearl culture from 1999 and successfully produced pearl in pearl producing native mussel such as *Lamellidens marginalis*, *L. corrianus*, *L. phenchooganjensis* and *L. jenkinsianus* (Tanu *et al.*, 2019). But unfortunately many of the produced pearls are less lustrous and gloomy which needs to be treated for enhancement of luster and shelf life. On the basis of these aspects the aim of this study was to investigate how pearl luster and shelf life can be enhanced.

MATERIALS AND METHOD

Three different treatments were applied to enhance pearl luster and shelf-life.

Treatment 1

The procedure is called bleaching. In this procedure different image pearls and rice pearls produced by BFRI was cleaned with concentrated brine solution and then dried. The dried pearls were bleached after drilling. Drilled pearls were placed in vessels of hydrogen peroxide of different concentrations (10%, 15%, 20%, 25%, 30%, 35%, 40%). These vessels was placed under strong fluorescent lights (1,700-11,900 lumens) where they were kept for as long as four months at 33-40^{0}C under intense fluorescent light and controlled temperature. Temperature was checked. Collection of treated pearl and data recording were performed every 3 days interval.

Treatment 2

The procedure is called maeshori. In this procedure different image pearls and rice pearls of BFRI were dipped in methyl alcohol to clean them and remove impurities. Afterwards these cleaned pearls were drilled

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using hand drill. Then the drilled pearls were dipped in methyl alcohol of different concentrations (10%, 15%, 20%, 25%, 30%, 35%, 40%). These pearls were kept in bottles under intense florescent light (1,700-15,300 lumens) for 120 days. Temperature was kept 33-40^{0}C. Collection of treated pearl and data recording were performed every 3 days interval.

Treatment 3

The procedure is called heating. In this treatment different image pearls and rice pearls of BFRI was cleaned with concentrated brine solution and then dried. The dried pearls were drilled. These pearls were soaked in distilled water. Then the pearls were kept in heating cabinets. Then these pearls were kept in bottles of ethyl alcohol of different concentrations (10%, 15%, 20%, 25%, 30%, 35%, 40%) solution under intense florescent light (1,700-15,300 lumens) light of about 33°C-40°C temperature for 4 months. Temperature was checked, treated pearl were collected and data were recorded every 3 days interval.

Evaluation of Treatment

The luster of the treated image and rice pearls compared with the collected Vietnamese pearls in order to know the suitability of the treatment. Brightness and light refraction was assessed by using light refractometer. Brittleness or plasticity was assessed by microscopic examination for the presence or absence of cracks around the edge of the treated image. Shelf life of the treated pearls was measured by examining the longevity of the luster of the treated pearls through keeping in open petri dishes as long as for eight months.

Table 1: Different treatments used to enhancement pearl luster and shelf-life

Treatment	Type	Type of Pearl
Treatment1	Bleaching	Rice pearl, Image pearl
Treatment2	Maeshori	
Treatment3	Heating	
Evaluation of Treatment	Justification of suitability (Brightness, Light refraction, Temperature tolerance, Brittleness)	Rice pearl Image pearl Standard pearl

Table 2: Pearl luster increase (%) in different pearl treatments

Treatment	Used Chemical	Average Initial light reflection of pearl (Mean±SD)	Average Final light reflection of pearl (Mean±SD)	Luster increase (%)
Treatment 1	10% H_2O_2	143.23±1.61	187.72±0.59	31
	15% H_2O_2	147.47±1.02	174.06±1.41	21
	20% H_2O_2	154.19±2.03	171.11±1.29	11
	25% H_2O_2	137.11±0.91	149.35±2.19	9
	30% H_2O_2	141.43±0.43	108.05±1.25	(-) 23
	35% H_2O_2	136.69±1.21	97.14±0.63	(-) 29
	40% H_2O_2	149.02±2.13	92.06±1.55	(-) 38
Treatment 2	10% CH_3OH	128.23±0.57	188.26±1.47	47
	15% CH_3OH	142.07±1.26	197.03±0.31	39
	20% CH_3OH	138.14±1.08	176.13±1.35	28
	25% CH_3OH	125.67±1.61	158.02±2.16	26
	30% CH_3OH	157.83±0.74	168.27±1.33	7
	35% CH_3OH	142.06±1.73	131.04±0.57	(-)8
	40% CH_3OH	136.03±1.13	119.15±1.26	(-)13
Treatment 3	10% C_2H_5OH	145.14±1.41	216.07±1.61	49
	15% C_2H_5OH	142.17±1.02	204.18±1.06	43
	20% C_2H_5OH	129.43±0.37	157.04±1.17	22
	25% C_2H_5OH	134.04±1.27	151.03±1.09	13
	30% C_2H_5OH	153.07±1.17	161.14±0.37	5
	35% C_2H_5OH	139.12±0.83	128.05±1.17	(-)7
	40% C_2H_5OH	126.52±1.76	107.16±1.38	(-)15

RESULTS AND DISCUSSION

Treatment jars each with 50ml solution of H_2O_2, CH_3OH and C_2H_5OH of different concentrations (10%, 15%, 20%, 25%, 30%, 35%, 40%) was used for the treatment of rice pearl and image pearls. Luster was increased highest at 10% H_2O_2 but decreased with increasing concentration of H_2O_2 (Table 2). While in solutions of CH_3OH *ie.* 10%, 15%, 20%, 25%, 30%, 35%, 40% the result of luster increase was 47%, 39%, 28%, 26%, 7%, (-)8% and (-)13%, respectively. Use of 10%, 15%, 20%, 25%, 30%, 35%, 40% solution of C_2H_5OH resulted in luster increase of 49%, 34%, 22%, 13%, 5%, (-)7% and (-)15%, respectively. Among different treatments the highest increase (49%) of luster was observed in treatment with 10% C_2H_5OH under intense florescent light (1,700-15,300 lumens) at temperature of 33°C-40°C. It was observed that with increasing concentrations the luster was decreased (Table 2). A representative treatment effect is shown in Figure 2. However treatment with 10% C_2H_5OH provided best result with highest (49%) increase of luster (Figure 3).

Shelf life of the treated pearls were measured by examining the longevity of the luster of the treated pearls through keeping in open petri dishes for eight months. No luster change was observed throughout the study period in the treated pearls.

Initial stage of image pearl

After 3 days of treatment (25% H_2O_2)

After 15 days of treatment (25% H_2O_2)

Figure 2: Chronological changes in luster of image pearl

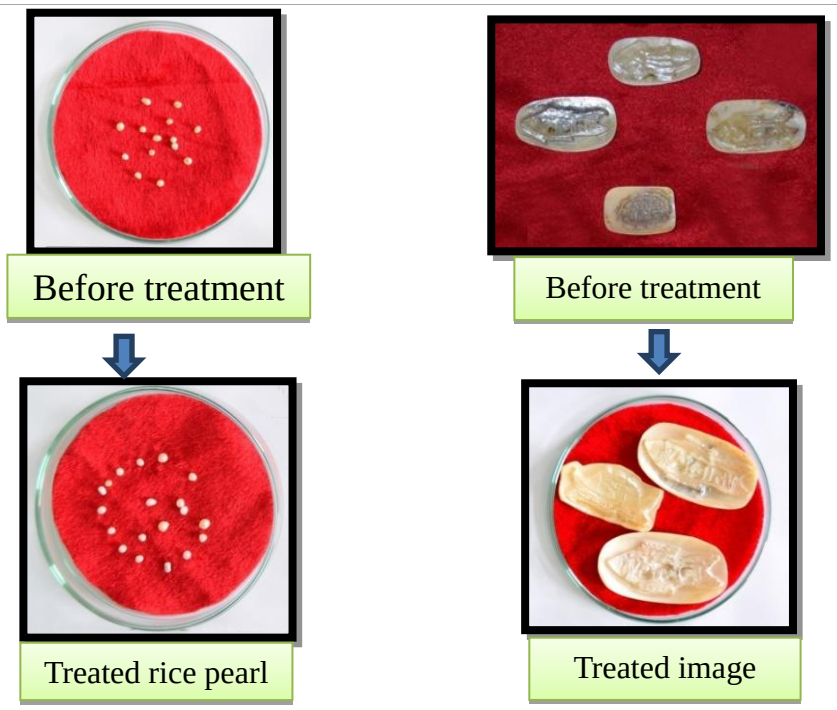

Figure 3: Results after post-harvest treatment

CONCLUSION

Assessing the quality of pearls involves the use of various tools and methods, which are mainly visual and often quite subjective. Pearls are normally classified by origin and are then graded by luster, nacre thickness, surface quality, size, color and shape. The aim of this study was to investigate how pearl luster and shelf life can be enhanced. Different chemical treatment was used for enhancement of luster. Post-harvest treatment of pearl with low concentrated ethanol and methanol under intense florescent light and ambient temperature increases its luster and shelf life but higher concentration results in decaying of pearl and luster decrease. During the observation pearls treated with 10% ethanol (C_2H_5OH) showed better luster and shelf life. More research work should be done to establish suitable post- harvest treatment of pearl for its importance in sustainable pearl culture in Bangladesh.

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