Marine Image Pearls : Designed By Man, Created By Nature

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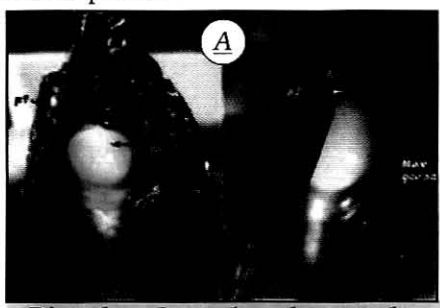
Over times immemorial, pearls have emerged as a symbol of perfection and of the highest spiritual ideals within most of the religions of the world. Pearls are also believed to possess certain physical properties that would prevent aging, ensure long life and also serve as an aphrodisiac.

The Chinese are credited with the world's first experiments in pearl farming many centuries ago. They inserted tiny Buddha figurines into oysters to be covered with nacre, creating "Buddha pearls". The world's fascination and passion for pearls served as an inspiration for the invention of modern pearl farming techniques by Kichimatsu Mikimoto. In 1893, he began to produce mabes (half pearls) and subsequently full, round pearls.

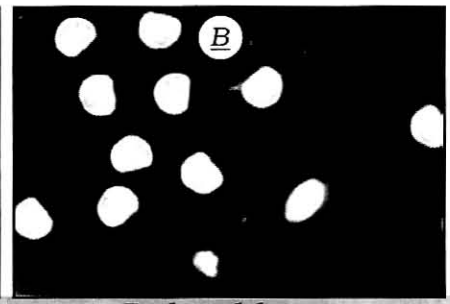
Inspired by the techniques used by the Chinese in creating "Buddha pearls" and the success achieved by Central Institute of Freshwater Aquaculture, Bhubaneswar, in producing image pearls from freshwater mussels, Vizhinjam Research Centre of CMFRI has standardised several novel techniques for the production of quality image pearls upto 20 mm size.

Difference between Natural and Cultured Pearls

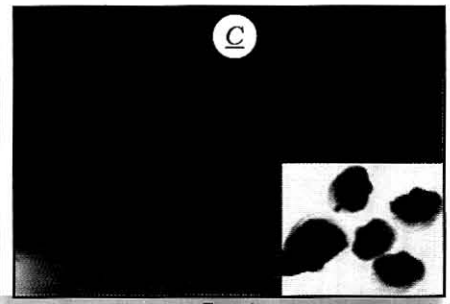
There is only one difference between a natural pearl and a cultured pearl. This difference has its origin from the very beginning of the process that creates a pearl. In the making of natural pearl, the process is left to nature; some foreign body, mostly a parasite, must find its way into the oyster in such a way that it cannot be dislodged, and the oyster then isolates the intruder/irritant over time in smooth layers of aragonite, or "mother of pearl", resulting in a natural pearl which in most cases will be irregular in shape. The cultured pearl begins in an almost identical way as the pearl in nature, with the only difference that a highly skilled grafter carefully implants the irritant/nucleus and a piece of pearl forming tissue in the oyster at a pearl farm rather than leaving it to chance. After this, nature takes over and the pearl forms in exactly the same manner as the natural one. The colour, the surface quality and the luster depends on the interaction of the oyster and the environment.



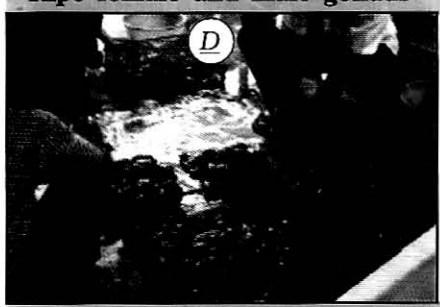
Ripe female and male gonads



D shaped larvae

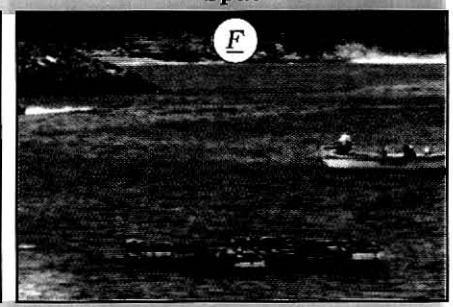


Spat



Sorting and stocking of Oysters in cages

Implantation of image nucleus



Pearl culture raft

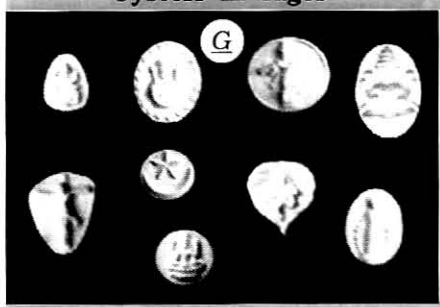


Image nuclei

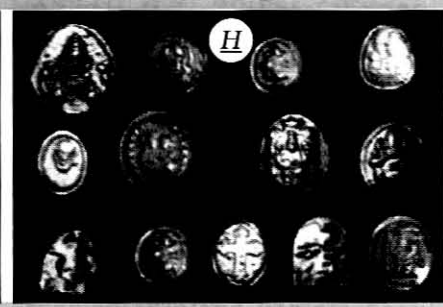


Image pearls

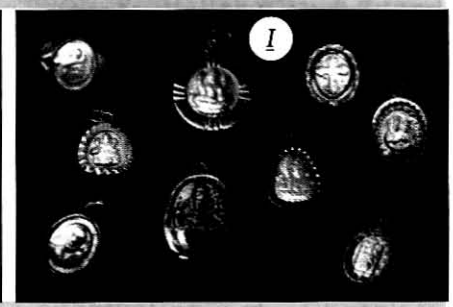


Image pearls ornaments

Difference between Normal Cultured Pearl and Image Pearl

In normal pearl production a spherical or oval shell bead or nucleus and a graft tissue are inserted into the gonad/soft tissue of the recipient oyster. Graft tissue is a small piece of mantle tissue excised from the pallial zone (which has cells capable of secreting pearly coating) of the oyster. A donor oyster is sacrificed for obtaining the graft tissue pieces. These are used for implanting in many oysters. During post operative farming phase, the graft tissue disintegrates and the epithelial cells capable of secreting the shiny layer forms a covering over the bead/nucleus (called 'pearl sac'). The 'pearl sac' builds up successive layers of aragonite and conchiolin over the bead to create a pearl.

Image pearls are grown against the inside shell of an oyster rather than in the soft tissues of animals. A mould/nucleus is made from shell-based cement using a metal template of the idol or shape. This nucleus is implanted into the pearl oyster and the oyster does the rest. The animal coats the image nucleus with several layers of lustrous material producing an image pearl. Image pearls are typically used in pendants, studs or rings that fully or partially cover the flat back side of the pearl.

Technology of Image Pearl Production

Production of Oysters: Unlike in spherical pearl production which requires oysters with larger thickness or larger body cavity for implanting spherical shell beads of appropriate size, image pearl production requires large flat bodied oysters. Keeping these aspects in view, pearl oysters (*Pinctada fucata*) of large size, with flat surfaces and of required hue were produced by selective breeding. For this, female with orange yellow gonad and ripe male oyster with creamy off-white gonad (Fig. A) of required shell traits including colour were selected. Biopsy method was used for the production of larvae. Sperm and eggs were extracted with a catheter (from selected points) from these oysters into embryo cups. (These oysters can be reused after the healing of wounds and rematuration). The extracted gametes were then transferred to filtered disinfected seawater and activated to fertilize eggs, using ammonia. Advantage of this method is that it helps in improved selection and lesser contamination compared to the mass spawning method traditionally used for pearl oyster spat production. The degree of selection achieved in mass spawning is low. D-shape larvae (Fig. B) so obtained were reared to spat (Fig. C), using pure microalgal culture of *Isochrysis galbana* for feeding. It takes 24 to 30 days for D shaped larvae to develop and settle as spat. Spat were reared for another 30-45 days in nursery tanks fed on a mixed diet comprising *Isochrysis galbana* and *Chaetoceros calcitrans*. These grown up spat were then transferred to mesh bags which in turn were put in plastic cages. These plastic cages were hung from the raft (Fig. F), moored in Vizhinjam Bay. In the Bay they grew fast feeding on the natural food available. As the animals grew they were transferred from the mesh bag to cages (Fig. D) of different mesh size depending on the growth of oysters. They can be used for pearl production after 12 to 18 months of rearing.

Image Implantation: Oysters of required size and number preferably above 70 mm DVM are taken from the pearl farm and brought to lab for implantation. They were cleaned and stocked in FRP tanks containing seawater. Before implantation, oysters were stocked in a tray containing seawater and narcotised with a pinch of menthol (E). Due to the relaxation of aductor muscles, the animal opened the shell. It was pegged with a small wooden piece to keep the two values in an open condition, to keep the animal ready for implantation. Each oyster was taken and opened using a speculum and inspected carefully for the nacre colour and to identify area suitable for implantation. Accordingly they were clamped to a surgery stand to facilitate implantation. Based on this inspection and experience of the implanter, the size and number of images that could be implanted and the areas of implantation were decided. The image nucleus (Fig. G) was implanted carefully using a quick drying adhesive. Care had been taken in selecting size of the image and the position for implantation so that it would not hinder normal biological activities of the oyster such as complete closing of the shell valves. After the implantation the oysters were kept in tanks with aerated sea water.

Post Operative Farming: This can be done in offshore or onshore facilities. In offshore farming the oysters were stocked in cages and transported back to the Bay to be hung from the raft. These oysters required no special care other than monthly cleaning to remove pest or predators that may have entered in to the cage.

In the onshore method followed, the post operative culture was carried out in indoor tanks. Recirculation system was used in these operations with partial replacement of water for the rearing of oysters (Fig. 1 on next page). The system consisted of a rearing tank, water treatment tank, storage tank and feed reservoir. The implanted oysters were kept in the rearing tank which received continuous inflow of cultured microalgae from the feed reservoir. Daily, part of the seawater from the rearing tank was transferred into the treatment tank and an equal amount of seawater was added to the rearing tank from the reservoir. The treatment tank was provided with biological filtration system and a protein skimmer. The next day treated water was transferred to the reservoir. This cycle continued and 50% of the water was replaced with fresh seawater at fortnightly intervals. In this system good pearl coating was obtained in three months.

Pearl Harvest and Processing: It took about 50 to 60 days to get proper coating in the case of offshore method whereas it took 60 to 90 days in the case of onshore method. The oysters were brought to the lab and examined for the level of coating. Those with required coating were opened and the meat removed. Then the shell with image pearl was thoroughly cleaned with repeated washing in freshwater.

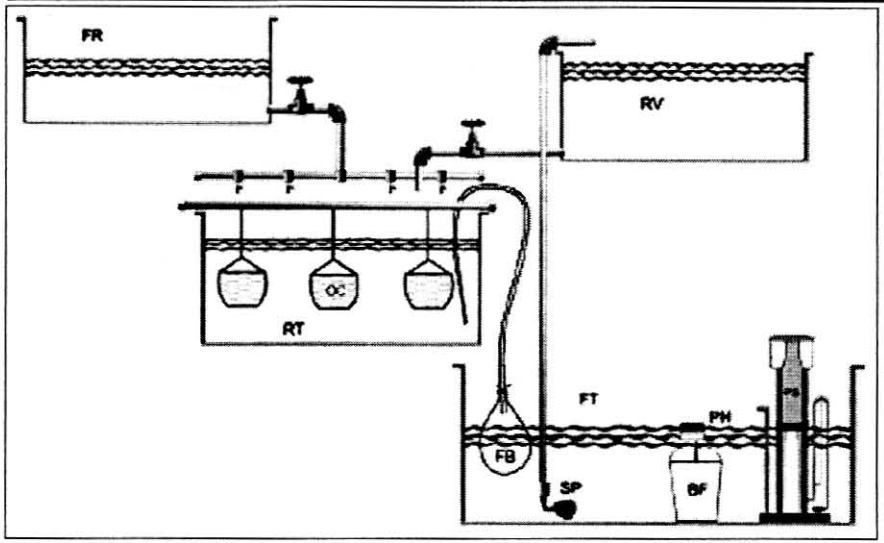


Fig.1: Recirculation system arrangement for onshore image pearl production. RT-rearing tank, OC-oyster cage, FR-feed reservoir, RV-reservoir, FT-filtration tank, FB-filter bag, SP-submersible pump, BF-biological filter, PH-power head, PS-protein skimmer.

Then it was kept immersed in dilute hydrogen peroxide for 2-5 minutes for removing impurities. After this cleaning the images were sawed off carefully and the edges shaped with a fine hand file. The beautiful image pearls with natural lustre of peacock blue, green, steel gray and golden hues so obtained were used for making different ornaments. The pearl produced from open sea farm showed better nacre coating, colour and sheen. Image pearls can make a fashionable presence when used with other pearl jewellery, stones or alone. These pearls fetch high value depending on its quality and size.

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