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Pearl Powder And Nacre Powder Both Were Used In Cosmetics And In Health Sectors

Dr. Sabina Yeasmin
Research Scholar, Phd, University Of Calcutta

Abstract
In Chinese medicine pearl powder was used as beauty product and in healthcare sector. In recent times pearl powder were used in medicine and also in facial kit. This products were used by female most than male. It had wound healing and tissue engineering properties. Pearl powder we get from pearls (grinding in a mixer). Nacre powder is the inner layer of outer corner layer and middle prism layer. In this review scientist used pearl powder and nacre powder both. It have various biological activities (wound healing, anti fibrotic and anti inflammatory, antioxidant and antiaging property) on human body.

Keywords: *pearl powder, nacre powder, antiaging, anti-inflammatory, skintone*

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I. Introduction:

More than thousand year, Chinese people were doing research on pearl powder. It was used in medicine, cosmetics and in food industry [1,2]. It is rich in protein and mineral and used as a medicine in different skin and bone disorders, insomnia, epilepsy and in palpitation [3,4]. Additionally, pearls have been used as cosmetic agents and the utilization of pearl powder for maquillages can be traced back to as early as the Northern Song Dynasty. Lu Dalin in China is a famous place for pearl powder cosmetics. Pearls are harvested for use in jewellery and in health benefits [5]. In a tomb in China archaeological people discover white powder freshwater pearls [6]. Though pearls were cultured in many countries in large scale it was observe that the price of pearl jewellery is comparatively high than normal pearl powder used in healthcare and cosmetics.

The molluscs shells were full of calcium carbonate ($CaCO_3$) and magnesium carbonate ($MgCO_3$). The organic matrix contain proteins, glycoproteins and polysaccharides [7]. Silica, calcium phosphate, aluminium oxide and iron oxide present on the rest of the shell. Pearl also contains trace elements like sodium, manganese, selenium, aluminium and copper. Pearl powder have a lots of pharmacological effects like antioxidant, anti-inflammatory, antiaging, immunomodulating and wound healing [3, 8-11]. Pearl powder used in food and health industry in the treatment of gastric, duodenal and aphthous ulcers [4,9]. Esssential amino acids aspartate and glutamate possess antioxidant properties that boost up the immune system [12-15]. Cysteine, leucine, isoleucine, valine, tryptophan and phenyl alanine were some essential amino acids present in pearl powder, help in free radical quenching [16]. Calcium, magnesium, selenium were some cofactors enhance the antioxidant property of enzymes [17]. The iridescent inner shell of certain molluscs (mother of pearl) and pearls are composed of nacre- an inorganic/ organic composite composed of mainly calcium carbonate in the aragonite isomorph. Bones were made up of calcium phosphate and hydroxyapatite (HA).

Both exist naturally as composites via biomineralization and have a structural supporting function [18,19]. Shell nacre contains less protein than pearl. It contributes potential biomedical applications such as bone growth stimulation.

This review focuses that in recent year how many use of pearl powder were there. It had various application like wound healing, tissue engineering and bone regeneration. While the number of publications on peal powder is still small, we expect the number of publications to grow further in the coming years.

II. Minerals Present In Pearls:

Our earth is abundant with different type of composite and metals. $CaCO_3$ (Calcium carbonate) was the main component present in pearls. It present in the nacre and mollusc shells and otoliths. Calcite, aragonite and vaterite were three most polymorphs exist in mature as a single crystalline cubes (Calcite), needle like crystals (aragonite) and polycrystalline spherulites (vaterite) [22]. Aragonite and calcite can be easily found in nature whereas vaterite required to find out in some extreme conditions like; pH, temperature and pressure [23,24]. Vaterite could also be prepared in the laboratory by adding organic additives or templates. IN aqueous solution

vaterite was unstable. Whereas vaterite transform to Calcite in some specific condition (20-25 hr at room temperature). At temperature above 60^{o} C vaterite can transform to aragonite [25,26].

Fresh water pearls were lustrous. "Aragonite pearls" were named of the pearls due to presence of aragonite in it. As aragonite responsible for the lustrous property "aragonite pearls" were famous [27,28].

The main component of half-lacklustre or lacklustre pearls were Vaterite. Irregular $CaCO_3$ biomineralization give rise to the " vaterite pearls" [28]. Nacre is generally formed by the biomineralization of $CaCO_3$. It also consist of aragonite (Ca 95 wt%), matrix proteins and other soft organic biopolymers (Ca 5 wt%). Organic matrix of the nacreous layer stimulated the crystallization of $CaCO_3$. Various organic matrices had been extracted and purified from the nacreous layer of mollusc shells using ethylenediamine-tetraacetic acid (EDTA) or acetic acid, and were subsequently tested for in vitro $CaCO_3$.crystallization to clarify the mechanism of biomineralization in nacre [29-33]. The matrix determines the morphology of the $CaCO_3$ crystals, crystal size and nucleation site. Gong et al. extracted matrix protein from the mantle epithelia of Pinctada fucata pearl. It initiates crystal nucleation and calcium deposition with comparing its morphology [34]. Zhang et al. extracted matrix protein from P. fucata used in controlling the crystallization of $CaCO_3$ and needle-like aragonite crystal formed [35].

Nacre organic matrix can be extracted by decalcification method. Decalcification by ethylenediamine tetraacetate dehydrate [Na_2EDTA] was done in proper time. Weak acid can be used to extract organic matrices from pearls [36]. Aizenberg et al. introduced gas diffusion method to determine soluble organic matrix [37]. In vivo crystallization is done in which supersaturated $CaCO_3$ enters inside the cell in a continuous and gradual manner. To characterize the crystal scanning electron microscopy (SEM) and Raman spectroscopy were used. Raman spectroscopy were used to distinguish the polymorphs of $CaCO_3$. It also could be measured by using infrared reflectance spectroscopy. Pearl powder and shell powder were calcined at various temperature by infrared reflectance spectroscopy [38]. To differentiate between two sources pearl powder and shell powder were calcined at 400^{o}C for 30 minute. Infrared reflectance spectroscopy used to differentiate between pearl powders and shell powders. Tri-step infrared spectroscopy coupled with chemometrics has also been developed for qualitative classification of pearl powders according to pearl contents and quantitative analysis of shell powders in adulterates pearl powders [39].

III. Applications

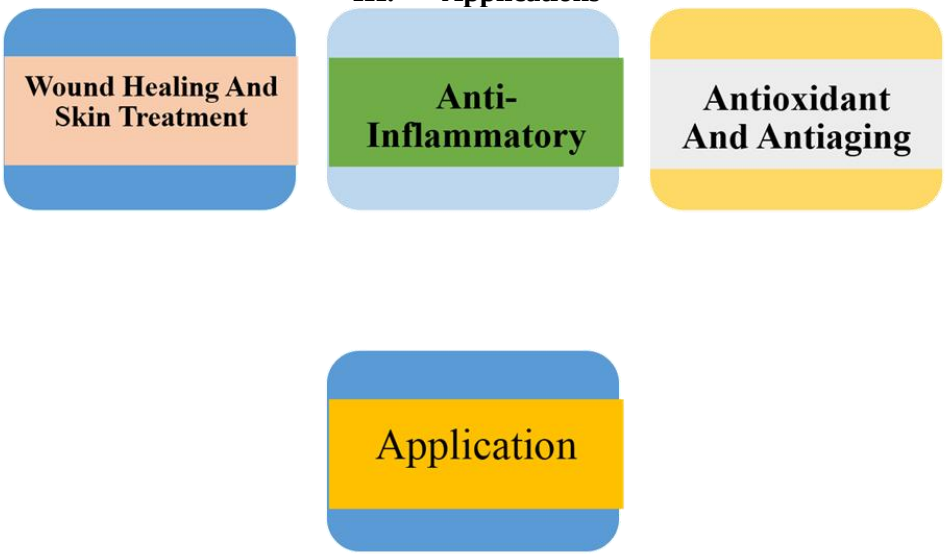

Figure 1: Application of pearl powder in different biological sectors

Wound healing and skin treatment by pearl powder:

Burn and ulcers are complex lesions (acute injury) was very difficult to treat. Inflammation, proliferation and maturation were the three step of wound healing [40]. Inflammation occur when neutrophils release elastases and proteases with vascular dilation that result in blood vessel permeability. Wound angiogenesis takes place in the second proliferation phase. Keratinocytes migrate to the injured dermis. In the third maturation stage, some fibroblasts differentiate into ofibroblasts. Both of them together produce the extracellular collagen matrix [ECM] [10,41].

Hypoxia, poor local blood supply, bacterial infection, age and diabetes affect the wound healing property [42-44]. Food and Drug Administration (FDA) is platelet derived growth factor (PDGF)-BB was caused promotion of tumours [45]. Some active particle present in the pearl powder help in skin cell regeneration and wound healing. Nacre (mother of pearl) (Pinctada maxima) when imparted on rat dermis result in better skin tone than untreated [46]. Instead of nacre, pearl extract was also be able to promote fibroblast migration in an in vitro human fibroblast cells model also treated by pearl extract [9]. Fibroblast cells migrate more in case of medium containing PL than to a control without PL.

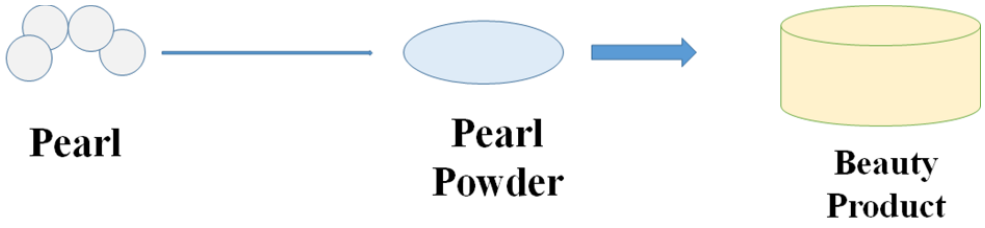

Figure 2: Pearl powder using in beauty products

Moreover PL containing medium stimulated mRNA expression of collagen type III in fibroblasts, boosting wound healing.

Rousseau et al. extracted lipids from the nacre of Pinctada margaritifera and applied it on the artificial dehydrated skin of atopic dermatitis [47]. The intercellular part of the stratum corneum reconstituted for the signalling action of atopic dermatitis. The pearl powder become beneficial due to the presence of a protein (made up of 17 amino acids) [48]. In study, it was observed that conchiolin hydrate our skin and collagen layer also rebuilds. A report on wound healing properties of pearl powder was reported. Essential minerals conjugate with Conchiolin and help in wound healing. Lee et al. take water soluble components of nacre and applied on the burn of porcine skin [8]. The water soluble components of nacre result in the treatment of burn induced granulation on the skin. It help in the formation of dermis and epidermis layer. Regeneration and angiogenesis of apoptotic and necrotic cells present in the wound promoted by the water- soluble components of the nacre. The previous result also get supported by the murine fibroblast NIH3T3 cells model. This cell model also treated with the water soluble components of nacre. It also result in the proliferation and collagen formation. To treat the wound healing are water soluble part of the nacre most effective than pearl powder. Ping et al. employed a mouse model to demonstrate that the water soluble matrix (WSM) of pearl powder (Hyriopsis cumingii) could induce oral fibroblast proliferation and collagen aggregated. The matrix metalloproteinase-2 promote TIMP-1 synthesis which benefit wound healing [49,50].

Anti- Fibrotic and Anti- Inflammatory action :

Yang et al. in an experiment mixed pearl extracts with poly (gamma-glutamic acid) hydrogels. It was separated by super-extraction method (at room temperature). In low dose ultraviolet B (UVB), hydrogels and pearl extract composite were effective against anti-inflammatory and anti-apoptotic function. It can also be able to prevent the radiation of dermatitis in keratinocytes [51]. The shells of edible molluscs like blue Nussle Mytilus edulis and the Pacific oyster Crossostrea gigas were used in an experiment. The matrix macromolecular components derived from the shells help in the culture of human dermal fibroblasts [7]. Both extracts from the molluscs have beneficial effect on cell metabolic function. Both treatments decreased amount of COL-1 together improve the activity of matrix metalloproteinase-1. It can also improve the treatment of fibrosis for scleroderma.

Application as an antioxidant and anti-aging agent:

Lipid peroxidation can be induced by free radical oxidation and cause irreversible impairment of cellular macromolecules such as membrane lipids, proteins and nucleic acids via reactive oxygen species (ROS) [14]. Excessive ROS generation made cell to die and result in aging. Oxidative stress caused by the interaction between ROS and antioxidant. Continuous ROS production and prolonged exposure to oxidative stress would lead to the pathophysiology of diseases such as diabetes, inflammation and neurological disorders [52]. Natural oxidant present in fresh fruits and beverages (tea, fruits and vegetables) react with free radicals and protect us from degenerative diseases [53,54].

Chin et al. in his experiment found that protein rich pearl powder controlled antioxidant properties [3]. Due to the antioxidant property of protein rich pearl powder could increase the lifespan of Caenorhabditis elegans. Maximum age related degenerative diseases were treated by pearl powder (as it have antioxidant property) in both in vitro and in vivo study. Shao et al. used pearl powder in beauty product for its antiaging property. Particle size can also effect the antioxidant activity. Ultra-micro pearl powder were most effective than water-soluble

pearl powder. It show free radical scavenging activity [55]. A recent randomized, placebo controlled experiment on the use of blue pearl pigment reported that it could generate the perception of blue light effect, contributing to the transparency and glass on Korean Women's faces [56].

IV. Conclusion:

In this paper we used pearl powder and nacre powder as biological agents for the treatment of different diseases. Pearl powder have various biomedical issues. The synthetic preparation of pearl powder become essential for its use as biomedical remedy. It is difficult to find out commercial pearl powder for its use as low cost shell powder. Analytical methods are necessary to purify pearl powder from adulterated material. Nevertheless, a great effort is required to find out original pearl for making pearl powder.

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