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Fish Skin as a sustainable alternative to Animal Skin

Salem Isegbe

Natural Sciences (Life and Physical Sciences), School of Biological Sciences, University of Leicester
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Abstract

Fishes generate an enormous amount of waste; despite being used to produce by-products. Humans consume majority of fishes caught or farmed and, fish skin is one of the parts which usually end up as waste. This paper seeks to explore the sensible sourcing of fish skin as a raw material, to produce fish leather, giving a walk-through of the process involved, comparing the skin to those of terrestrials and emphasizing the utilization in various industries.

Keywords: *Sustainability; Biology; Sensible sourcing; Waste generation; Fish Leather*

Introduction

Globally, 50 million metric tonnes of fish are produced globally each year [1], this includes fishes grown in farms. About half of the fish the world consumes comes from farms [2], and of the total produced globally, about 40% of this are used for by-products [3], this leaves approximately 60% that are partially used or not at all used i.e., flesh consumed, and the rest wasted, or fish caught is never consumed. This makes fishing and fish farming a significant waste generator [4], fish skin being a big part of that waste. In comparison to terrestrial animal skins, fish skin has a regular pattern, because in water there is equal pull and pressure on all sides of their body. This pulls their skin in all directions always [5]. In abundance, fish skin is more readily available in comparison with terrestrial animal hides. Presently humans eat three times more seafood than they used to 50 years ago and the question is, why this surplus resource is destined majorly to be waste.

Fish Skin

Human demand makes up most of the fish waste, this was proven by the World Economic Forum in 2018, where they discovered that 27% of fish caught are never consumed [6]. Out of 60%, this means 33% are partially consumed, and human consumption still makes up the majority in this category. Fish skin is one of the major wastes produced from fish, but recent technologies have found ways to utilise the skin as raw materials to produce desirable fish

leather. The production of fish leather from fish skin goes as far back as the traditional attire of the Hezhen tribe of China [7], but in modern day, the major issue that has undermined fish leather is the odour that persists post-production, and the size of the skin, because the fishes whose skins are usually used include, salmon, trout, carp etc., and they cannot compare in size to terrestrial animals like cattle [1].

The processing of fish skin could either be domestic [5] or industrial [1]. The processing to leather usually begins with the proper removal of the flesh from the skin, the removal of all flesh and fat from the skin are important because these are the reason for the odour post-production [1]. Being careful not to injure the skin, the scales on the skin are then removed by scraping along the grains but, industrially the scales removal is done by washing in solutions that dissolve the scales without running the quality of the skin. The skin is then washed in detergent and to kill the microbes and further breakdown any fats left behind. After washing, the tanning liquid is prepared, and the stiffness, rigidity or malleability of the fish skin is put into consideration [8], when choosing the tanning method and concentration of the liquid [1]. Domestically, for oil tanning a mixture of eggs and oil can be used, for bark tanning, the tree bark is boiled, and the solution is used [5], for vegetable tanning, polyphenol containing vegetable are used to create the tanning solution [1]. The tanning process is where the skin is turned to leather, and the leather gains

strength and the ability to retain dyes [1]. After tanning, the skin is dried with the scales side facing the down (ensures a smoother surface). The dried and shrunk skin is then massaged to soften it and colouring can be done after the soften. The dyes used are usually synthetic, or a mixture of natural with synthetic dyes, because fully natural dyes fade after about 6 months [1]. If coloured, the skin is dried again and then stretched out to gain the most surface area [8]. The final dye coating and application of resin, for protection is done after the stretching. The detergent composition and the type of chemicals used in the tanning process, are usually at the manufacturer's discretion, domestically normal detergent is usually used. Although, sustainability favours the techniques involved in the processing of fish skin.

Comparison to Animal Skin

The major difference between fish skin and animal skin is in the pattern, this is due to the balance of forces acting on the skin [5]. With animal skin like cattle, deer etc., their neck and back are thicker because the skin hangs and receives the most pressure due to gravity pulling their hide towards the earth in those parts, but under their belly is not as tightly woven [5]. In comparison, if you had fish skin the same thickness as animal skin, it will be stronger all-around, because of the uniform crosswise fibre structure in fish skin [5]. With similar thicknesses, fish leather is strongest type of leather, with tensile strengths of up to 90 newtons [9].

The processing techniques of animal skin to leather usually involves the use of Chromium VI containing chemicals, and continuous exposure causes skin ulcers and cancerous tumours [10]. In comparison, fish leather is considered a sustainable approach because firstly, fish leather's carbon footprint is relatively low in comparison to processing terrestrial animal hides i.e., cattle, fish leather does not require endangered species that threaten biodiversity [11], and manufacturers found in the fish leather business are usually sustainably minded e.g., Ictyos [1].

The Utilization of Fish Skin in Industries

Fishes are useful across different industries, from the nutrition industry (for humans, plants, and animals)

[4, 5, 12], to the medical industry (for skin therapy) [4]. Fish skins have high collagen content, which makes them useful for cosmetics, pharmaceuticals, and food. The collagen is what makes fish skin useful in skin therapy, for the dressing of wounds on burn injuries [13]. In wounds collagen mediates the healing process like platelet aggregation, inflammation modulation, angiogenesis, granulation tissue formation and re-epithelialization in an integrin signalling-dependent manner [14]. This process still generates waste, except when they are used permanently as autografts, usually in smaller wounds [15].

Today, marine leathers are more expensive than the traditional leather e.g., cattle, but cheaper than the exotic leathers e.g., snakes, crocodile etc. [1]. In the fashion industry, clothing and accessories have been made from fish leather. Big fashion brands like Dior, Prada, Nike, Louis Vuitton, Puma took inspiration from the Hezhen tribe, making sustainable fashion collections [16]. The company Ictyos is looking into developing catfish leather, because as they have no scales, present processing method would not work [1]. In fashion, sustainably sourced fish skin reduces waste, by giving the skins a second lease on life, as clothing or accessories, as can be seen in [1].

Conclusion

Fish leather is considered an eco-friendly alternative to traditional leathers by sourcing its raw material i.e., fish skin, from what would have otherwise been waste. Moving forward, more companies need to refine their processing techniques because exposure to chromium VI is dangerous, and even the dyes used, research has found that 2% of industrial dyes end up in water ways, sickening both animals and humans [1]. More industries should be encouraged to look into sensible sourcing from fish waste, rather than relying on fish farms for the raw materials. This helps to lower the cost price of raw materials, although possibly increasing the processing cost and effort, but the planet is worth the investment. Waste is full of potential, so sensible sourcing should be encouraged in other waste types.

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