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OPPORTUNITIES FOR USING THE SKIN OF AFRICAN CATFISH (CLARIAS GARIEPINUS) FED IN ARTIFICIAL RESERVOIRS OF NAMANGAN REGION AS RAW MATERIAL FOR THE LEATHER INDUSTRY

PhD, Prof. Makhbuba Shamsieva[1],
[1] Tashkent Institute of Textile and Light Industry

Nizom Ismatullaev[2]
PhD Researcher [2] Namangan State Technical University

Abstract
The leather industry traditionally relies on hides and skins from large and small ruminants as well as pigskins as its primary raw materials. However, the growing demand for sustainable and traceable resources has led to increased interest in alternative sources, particularly exotic leathers such as fish skins. In this study, the potential of African catfish (Clarias gariepinus) cultivated in artificial reservoirs of Namangan region was investigated as a raw material for leather production. Skins were obtained as by-products from local aquaculture enterprises and subjected to processing under controlled technological conditions. The results demonstrate that African catfish leather is characterized by a scaleless and strong structure, distinguishing it from trout and salmon leathers, which are fine-scaled and delicate, and carp leather, which is coarse-scaled and difficult to process. Processing African catfish skins not only provides high-quality, durable leather suitable for various applications but also contributes to waste reduction, environmental sustainability, and the efficient use of local resources. Furthermore, this practice can stimulate the expansion of the leather assortment, create new employment opportunities, and support the development of export-oriented products.

Keywords: Fish leather; african catfish; clarias gariepinus; aquaculture; exotic leather; sustainable raw materials; namangan region; environmental protection.

Introduction

The leather industry has historically relied on hides of large and small ruminants as well as pigskins as the primary raw materials due to their wide availability, quality stability, and established supply chains [1–3]. Leathers produced from these materials are extensively used in the manufacture of footwear, clothing, furniture, and a variety of consumer goods. However, the scope of leather production is not restricted to these types alone. In recent decades, increasing attention has been given to exotic leathers, such as those derived from ostriches, crocodiles, snakes, and, in particular, fish skins. These materials are especially valued for their rarity and

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unique aesthetic qualities, which make them highly sought after in the fashion industry for the production of luxury items such as handbags, wallets, accessories, and footwear.

Among exotic leathers, fish skins occupy a distinctive position. In certain regions with long-standing fishing traditions, the processing of fish skins has historically developed as a form of traditional craftsmanship. For instance, in Scandinavian countries, Japan, and parts of Africa, the history of fish leather utilization spans centuries, where it has been used to produce clothing, household goods, and decorative items [4]. Despite this historical significance, the industrial application of fish skins has remained limited due to technological challenges, including the delicate fibrous structure of the material and its high water and fat content.

In recent years, however, aquaculture has rapidly expanded, increasing fish production volumes worldwide [5]. Farmed fish have gained attention as a potentially more reliable raw material compared to certain traditional resources, particularly because aquaculture supports product traceability, which has become one of the central issues in the leather supply chain. In the Namangan region of Uzbekistan, African catfish (Clarias gariepinus) is cultivated in artificial reservoirs, and its skins are often discarded as waste by local enterprises. The utilization of these skins for leather production represents an opportunity not only to diversify raw material resources for the industry but also to reduce environmental pollution associated with protein- and fat-rich by-products.

This study therefore aims to evaluate the potential of African catfish skins obtained from aquaculture enterprises in Namangan region as a raw material for leather production. By examining their structural characteristics and comparing them with the skins of other fish species, the research provides insights into both the technological feasibility and the economic and ecological significance of processing fish leather on an industrial scale.

Materials and Methods

Source of Raw Materials African catfish (Clarias gariepinus) skins were obtained as by-products from two private aquaculture enterprises located in Namangan region: Okean Baliq Markazi and Fishvel Norin. These enterprises cultivate African catfish in artificial reservoirs, and the skins are typically discarded as waste during fish processing. For this study, freshly obtained skins were collected, preserved under controlled conditions, and subsequently processed into experimental leather samples.

Preliminary Treatment of Fish Skins Prior to tanning, the raw skins underwent standard preliminary operations, including washing, fleshing, and trimming. Special attention was paid to the removal of residual fats, as African catfish skins are characterized by relatively high lipid content. Multiple washing cycles combined with degreasing agents were applied to ensure the effective elimination of fat and protein residues that might otherwise hinder the tanning process.

Tanning Process

The tanning experiments were conducted under controlled laboratory conditions. Processing was carried out using both conventional and specially adapted chemical formulations designed for delicate raw materials. Specific treatments included:

- Soaking and liming: to rehydrate the skins and loosen structural proteins.

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- Deliming and bating: employing enzymatic and mild chemical agents to remove non-collagenous proteins.
- Pickling and tanning: using optimized solutions to stabilize the collagen structure.

The tanning methods were selected to account for the scaleless structure and high water content of African catfish skins, with the aim of obtaining leather with improved strength and elasticity.

Comparative Analysis

For comparative purposes, leather samples obtained from trout, salmon, and carp skins were also analyzed. These samples allowed for the identification of key morphological and structural differences between catfish leather and other types of fish leather. Microscopic examination was performed to evaluate fiber structure, scale patterns, and overall texture.

Evaluation Criteria

The quality of the processed leathers was assessed based on the following parameters:

- Morphological features: scaleless or scaled structure, fiber density, and texture uniformity.
- Physical properties: strength, elasticity, and resistance to deformation.
- Aesthetic qualities: surface smoothness, decorative appeal, and potential for fashion applications.

Results and Discussion

The experimental processing of African catfish (Clarias gariepinus) skins yielded leather characterized by a scaleless, dense, and durable structure. This morphological feature distinguishes catfish leather from other fish leathers, making it more comparable in performance to conventional mammalian hides. The absence of scales reduces surface irregularities and allows for a smoother, more uniform finish after tanning, which is advantageous for the production of high-quality leather goods.

By contrast, leather obtained from trout and salmon was observed to have a fine-scaled morphology. While aesthetically attractive and suitable for decorative purposes, such leathers were found to be relatively delicate, with limited strength and elasticity. Carp leather, on the other hand, exhibited a coarse-scaled structure with large, prominent scale imprints. Although carp leather demonstrated a certain degree of durability, the rough texture and the difficulty of processing due to its scale structure [6] limited its industrial potential.

Figure 1. Comparative morphology of leather derived from African catfish, trout, salmon, and carp skins.

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The comparative analysis clearly indicated that African catfish leather offers several advantages. Its scaleless morphology simplifies processing, reduces the need for extensive surface finishing, and contributes to higher structural integrity. Moreover, the resulting leather exhibited strong physical properties, including resistance to deformation and good elasticity, making it suitable for both functional and luxury applications in the leather industry.

Beyond technological feasibility, the utilization of African catfish skins also carries significant economic and environmental benefits. Processing these skins into leather helps reduce the negative impact of protein- and fat-rich waste, which otherwise decomposes rapidly and creates sanitary and ecological concerns. By transforming this by-product into a value-added material, the efficiency of aquaculture enterprises is increased, and the leather industry gains access to a sustainable and locally available raw material resource.

Furthermore, the integration of fish leather into industrial practice supports the diversification of the leather assortment, contributes to sustainable resource management, and enhances environmental protection. At the regional level, such initiatives have the potential to create new employment opportunities and foster the production of export-oriented goods, thereby strengthening the local economy.

Conclusion

The findings of this study demonstrate that African catfish (Clarias gariepinus) skins obtained from aquaculture enterprises in Namangan region represent a promising and sustainable raw material for the leather industry. The processed catfish leather is characterized by a scaleless and strong structure, which not only simplifies technological processing but also results in high durability and elasticity. Compared with other fish leathers, such as trout, salmon, and carp, African catfish leather offers superior structural and physical properties, making it more suitable for a wider range of industrial and luxury applications.

In addition to its technological advantages, the utilization of African catfish skins contributes to economic efficiency and environmental protection. By converting a protein- and fat-rich by-product into a value-added material, waste is reduced, local resources are effectively utilized, and sustainable practices are supported. This approach not only expands the assortment of leathers available to the industry but also provides opportunities for job creation and the development of export-oriented products.

Therefore, the integration of African catfish leather into industrial production can play an important role in advancing sustainable raw material management, diversifying the leather industry, and supporting the regional economy through innovative and environmentally responsible practices.

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