



Current Situation, Problems and Countermeasures of Comprehensive Utilization of by-Products in Agricultural and Industrial Processing of Jingzhou city

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Abstract

As agricultural product yields continue to rise annually, the by-products generated during production and processing are also increasing. However, these by-products often remain underdeveloped at a basic level, failing to be fully utilized. This not only leads to resource waste but also negatively impacts the environment, while simultaneously affecting farmers' income and product quality safety. Therefore, it is crucial to prioritize the comprehensive utilization of agricultural processing by-products. Through policy support and technological breakthroughs, we can maximize resource efficiency and achieve sustainable development.

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1. Characteristics and Utilization Status of By-products in Agricultural Product

Processing As a major agricultural production base in Hubei Province, Jingzhou City has developed a thriving agricultural product processing industry, forming a diversified industrial system encompassing grain, aquatic products, livestock, and fruits/vegetables. The by-products generated during these processing stages exhibit distinct characteristics, with their utilization demonstrating diversified trends. This analysis will examine key industries, product features, and current utilization status of by-products.

1.1. Grain Processing Industry

Jingzhou's grain processing primarily focuses on rapeseed and rice. In 2024, rapeseed production reached 382,000 tons, with rapeseed meal production capacity at 210,000 tons. Key by-products include rapeseed meal, which contains 34%-38% crude protein, high levels of methionine and lysine, and is rich in minerals such as calcium, phosphorus, selenium, and manganese, making it an excellent feed ingredient. The 2024 rapeseed meal production capacity of 210,000 tons is expected to increase the city's total feed processing capacity by over 15%. Some enterprises reduce the impact of anti-nutritional factors through processing techniques, thereby improving feed utilization efficiency. Rice bran: A by-product of rice processing, it can be used for extracting edible oil, achieving "making full use of every grain." Specialized production lines have been established to refine rice bran oil, enhancing the added value of grain processing. Yihai Kerry (Jingzhou) Grain and Oil Industry Co., Ltd. employs an automated PLC control system, processing thousands of tons of rice daily. Rice bran is utilized for extracting rice bran oil or producing raw materials for griseofulvin through fermentation. Hubei Modern Agriculture Group extracts griseofulvin from soapstock refined from rice bran oil. The pilot-stage raw material has passed GMP compliance checks, increasing the rice bran utilization rate from 15% to 45%.

1.2. Aquatic Processing Industry

Jingzhou City's aquatic processing industry primarily focuses on crayfish and freshwater fish. Jianli City has maintained the national top position in crayfish production for 12 consecutive years. Key by-products include: processed crayfish by-products

such as shrimp heads, which are used to cultivate turtle and shrimp farming, forming a distinctive industrial chain. Zhongsen Aquatic invested 28 million yuan to build a sewage treatment station with daily processing capacity of 600 tons, while shrimp shells are processed into bio-feed. The Tuochuanbu Village base in Qinshi Township handles 15,000 tons of live shrimp annually, where shrimp heads are used for turtle and tortoise farming, improving quality while reducing pollution. Fish bones and scales: rich in collagen, they can be used to produce fish meal or health supplement raw materials, or extracted through enzymatic hydrolysis for collagen conversion or transformed into aquaculture feed. Jichuang Company developed China's first intelligent eel slaughtering production line, processing 7,000-10,000 eels per hour, with fish scales collected centrally for phosphorus fertilizer production. Companies like Biwang Technology process freshwater fish into fish paste products to enhance resource utilization efficiency.

1.3. Livestock Processing Industry

In 2024, Jingzhou City's pig slaughter volume increased by 3.9%. By-products from slaughtering and processing such as blood meal and bone meal are primarily used in feed production, though high-value applications like bioactive peptide extraction remain in the technical exploration phase. Key by-products include blood and bone meal for feed production, which can serve as additives or raw materials for biological products. Pig slaughter enterprises in Jingzhou District utilized blood and bone meal as protein feed ingredients, generating a livestock industry output value of 1.526 billion yuan in 2024. Tianhu Poultry Co., Ltd. developed patented egg yolk de-shelling equipment (with 99% cleanliness rate) and nano-desalination technology for egg white, achieving waste utilization in egg product processing. Manure resource utilization involves composting to produce bio-organic fertilizers for soil improvement. As a national pilot zone for green circular agriculture, Jingzhou District has implemented manure return to fields at 26 large-scale farms, enhancing soil quality. For instance, Pingfeng Environmental Protection Company in Langping Town produces bio-organic fertilizer using straw and livestock manure. The Wen's Pig Farming Community in Jianli City adopts a "centralized nursery + centralized fattening" model, converting manure into liquid organic fertilizer through 90-day fermentation, achieving zero emissions.

1.4. Fruit and Vegetable Processing Industry

The fruit processing sector, exemplified by Jiangling Sanhu Yellow Peach Industry, generates by-products such as peach branches and pits, achieving the transformation of "peach waste into treasure". In vegetable processing, Xudong Vegetable Production and Marketing Cooperative processes 70,000 to 100,000 jin (approximately 28,000 to 33,333 metric tons) of vegetables daily, producing substantial by-products including vegetable leaves and stems. Regarding straw utilization, Mashan Town in Jingzhou District employs a dual-track model combining "field removal" and "field return" methods, processing 10,000 tons of straw annually.

2. Problems in the Comprehensive Utilization of Agricultural By-products

2.1. Low Comprehensive Utilization Rate

Currently, although China has vigorously promoted the comprehensive utilization of agricultural by-products, the

overall utilization rate remains relatively low. The technological content of comprehensively utilized products is not high, and there is still a lack of high-value-added products with high purity, functionality, and specialization. Developed countries achieve a comprehensive utilization rate of up to 90% for agricultural products, while China's rate stands at only around 40%. In Jingzhou City, the comprehensive utilization rate is less than 10%. To date, the effective utilization rate of oilseed processing by-products remains below 50%, with most being subjected to simple crude processing or directly used as feed and fertilizer, resulting in severe resource waste. With the rapid development of livestock and poultry farming, by-products have increased significantly. Apart from a small portion being processed, most are discarded, leading to substantial waste of livestock by-product resources and serious environmental pollution. Due to insufficient deep processing of by-products, they are often sold at low prices through crude processing, resulting in low product added value and hindering the development of comprehensive utilization of by-products.

2.2. Backward level of technology and equipment

Currently, the technological equipment and technical standards in agricultural product utilization are generally lower than those in processing. First, products suffer from poor stability, reliability issues, high energy consumption, rough manufacturing quality, and short lifespans of basic components and accessories. Second, the adoption of new technologies, materials, and processes remains slow. Third, existing equipment demonstrates low performance, minimal technical sophistication, inadequate automation, and subpar design and manufacturing capabilities. For instance, the lack of advanced rice bran oil extraction technology leads to significant loss of bioactive substances; deficiencies in dietary fiber and functional sugar extraction technologies result in low enzymatic hydrolysis efficiency and reduced product yields; while the absence of integrated separation and extraction techniques for livestock processing by-products causes suboptimal comprehensive utilization rates.

2.3. Low degree of standardization

Currently, most products derived from the comprehensive utilization of agricultural processing by-products are new products developed based on their active components. However, due to delayed standardization efforts, the majority of these integrated products lack national and industry standards. Furthermore, there is no foundational framework, management guidelines, or methodological standards to effectively support product quality control. Only enterprise-specific standards currently regulate production and sales. To advance the development of comprehensive utilization, national or industry standards for such products must be established in tandem with standardization efforts, ensuring synchronized progress between product integration and regulatory alignment.

2.4. Lack of policy measures

The development of agricultural circular economy primarily relies on government policy guidance. While the agricultural product processing industry plan outlines comprehensive utilization strategies, supported sectors, and relevant policies for by-products, substantive and actionable measures remain underdeveloped. The absence of effective incentive mechanisms and enforcement capabilities has left most by-

product resource utilization enterprises unmotivated, significantly hindering the advancement of comprehensive processing of agricultural by-products.

3. Strategies for high value utilization of by-products in agricultural and sideline products

3.1. Policy recommendations

To enhance guidance on the comprehensive utilization of agricultural by-products and create a favorable development environment, we propose two key measures. First, strengthening strategic planning. It is recommended to formulate a dedicated development plan for the comprehensive utilization of agricultural processing by-products, establishing their crucial role in the industry. Second, improving public awareness. Current publicity efforts predominantly focus on agriculture and food processing sectors, with minimal emphasis on by-product utilization. Therefore, relevant media outlets including newspapers, online platforms, television, and radio should launch special sections and columns dedicated to promoting the comprehensive use of agricultural processing by-products, thereby guiding public opinion to foster a supportive atmosphere.

3.2. Suggestions on financial input policies

The current fiscal input policies for by-product utilization are all supplementary to agricultural processing industry policies, and no standalone fiscal policy specifically targeting by-product utilization has been established. Therefore, it is recommended to reference policies related to agricultural machinery, comprehensive agricultural development, and primary agricultural processing by relaxing preferential conditions in areas such as land use, electricity, water supply, taxes, loans, and services. Efforts should be made to integrate funds from agricultural projects like processing and industrialization, with a focus on by-product utilization. Local governments at all levels should allocate annual funds for technical renovation loan interest subsidies in by-product utilization, while fiscal research funds should prioritize supporting industrial technological breakthroughs and new product development. For instance, Jingzhou City has allocated 200 million yuan in municipal fiscal funds for intelligent transformation of agricultural processing industries, focusing on key technologies like fish-scale collagen extraction.

3.3. Suggestions on tax preferential policies

We encourage enterprises engaged in comprehensive utilization of agricultural by-products to fully implement existing preferential policies. Most tax incentives for by-product utilization are modeled after those for the primary processing sector, but they often offer limited benefits with narrow coverage. To address this, we propose establishing targeted tax incentives specifically for by-product utilization. These measures should enable enterprises to access various preferential policies and systematically categorize by-product utilization activities within the scope of corporate income tax and value-added tax (VAT) reductions.

3.4. Suggestions for broadening financing policies

Enhance collaboration with financial institutions to facilitate government-bank and bank-enterprise partnerships. We should prioritize the comprehensive utilization of agricultural by-products in financial support programs, establishing

diversified financing channels at multiple levels while continuously refining financing models. Key measures include lowering financing thresholds, relaxing eligibility requirements, and supporting enterprises in listing on stock exchanges, issuing bonds, and engaging in financial leasing to meet their varied financial needs. A corporate financing database should be created to achieve mutual benefits between lenders and borrowers. A corporate development fund should be established to provide interest subsidies for loans, direct grants for technological upgrades, and funding for public welfare projects like R&D initiatives.

Through these strategies, we can progressively develop effective pathways for utilizing agricultural by-products across different regions, sectors, and product categories in Jingzhou City.

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