



AGGREGATION OF GREEN METHODS IN RECYCLING TEXTILE PRODUCTS FROM COFFEE GROUNDS AND RECYCLED PLASTIC BOTTLES

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Abstract: Ensuring raw material autonomy and advancing the greening of the supply chain from production to usage are crucial for Vietnam's textile industry. The process of improving and optimizing operations within the textile industry to achieve sustainability goals demands attention to aspects such as employing sustainable materials, recycled fabrics, organic cotton, and optimizing production processes to conserve energy, water, and chemicals. In response to the 'green' and environmentally friendly movement, numerous recycled products have been developed to minimize environmental pollution and preserve resources. This article provides an overview of methods for creating eco-friendly products using two primary materials: recycled coffee grounds and plastic bottles within the textile industry. Integrating technology and utilizing recycled materials significantly contribute to producing valuable products that aid in environmental conservation and promote sustainable manufacturing.

Keywords: Sustainable materials, production processes, technology integration

TỔNG HỢP CÁC PHƯƠNG PHÁP XANH TRONG TÁI CHẾ SẢN PHẨM DỆT TỪ CÀ PHÊ VÀ CHAI NHỰA TÁI CHẾ

Tóm tắt: Đảm bảo tự chủ về nguyên liệu và thúc đẩy việc xanh hóa chuỗi cung ứng từ sản xuất đến sử dụng là rất quan trọng đối với ngành dệt may của Việt Nam. Quá trình cải thiện và tối ưu hóa hoạt động trong ngành dệt may để đạt được các mục tiêu về bền vững đòi hỏi sự chú ý đến các khía cạnh như sử dụng vật liệu bền vững, vải tái chế, bông organic và tối ưu hóa quy trình sản xuất để tiết kiệm năng lượng, nước và hóa chất. Đáp ứng với phong trào 'xanh' và thân thiện với môi trường, đã có nhiều sản phẩm tái chế được phát triển nhằm giảm thiểu ô nhiễm môi trường và bảo tồn tài nguyên. Bài viết này cung cấp một cái nhìn tổng quan về các phương pháp tạo ra các sản phẩm thân thiện với môi trường bằng hai nguyên liệu chính: cà phê tái chế và chai nhựa trong ngành dệt may. Tích hợp công nghệ và sử dụng vật liệu tái chế đóng vai trò quan trọng trong việc sản xuất các sản phẩm có giá trị giúp bảo vệ môi trường và thúc đẩy sản xuất bền vững.

Từ khóa: Vật liệu bền vững, quy trình sản xuất, tích hợp công nghệ

1. Research problem

In today's modern society, environmental protection and sustainable development are becoming one of the top priorities of global society. The textile industry is also facing increasing pressure to create environmentally friendly products. Although it is an important supplier to meet the demand for apparel and fabric products from importers, it is also causing problems, have a major negative impact on the environment.

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Large use of industrial chemicals, waste of resources, and inefficient production processes have contributed to environmental pollution [1].

However, in this context, opportunities also exist in the green textile industry. New technology and innovative manufacturing processes can be applied to minimize negative environmental impacts.

The promotion of the use of recycled materials, the use of greener chemicals, and the optimization of production processes can bring both environmental and economic benefits. Textile products from coffee grounds and recycled plastic bottles is the process of using waste and recycled materials to create valuable products, while contributing to efforts to protect the environment and promote sustainability.

Green textile products made from coffee grounds and recycled plastic bottles is the process of creating environmentally friendly products and promoting sustainability by using recycled materials and an impactful production approach. Little impact on the environment. Currently, the textile and garment industry and its opportunities are facing many challenges and at the same time opening up many development potentials and opportunities to improve the production environment, promote sustainable development, and contribute to raising social awareness about handling the environment and using resources in a protective way [9]. Measures to greener fashion products and reducing waste are there fore extremely important.

2. Research content

2.1. Factors affecting the greening process of textile products.

Green products are becoming a key element in the transition to a sustainable consumption and production model. That a positive attitude towards green products and the level of information held by the consumers about them are significant predictors of green product satisfaction [10]. Greening the textile and garment manufacturing industry in Vietnam is influenced by many different factors including: production, environment, economics, society and technology.

** Using raw materials and chemicals:*

Using appropriate raw materials and chemicals is an important part of the process of greening textile products.

- Using sustainable materials:

+ Organic materials: Using organic materials such as organic cotton or recycled natural fibers helps reduce chemical and water consumption in the production process.

+ Recycle and reuse materials: Using recycled materials from used textile products can reduce waste and resource consumption.

+ Raw material origin survey: Track the origin of raw materials to ensure they comply with environmental and social standards.

- Using environmentally friendly chemicals:

+ Friendly dyeing and printing chemicals: Using environmentally friendly dyeing and printing chemicals, minimizing water pollution and toxic emissions. You should choose to use chemicals that can decompose naturally and are not harmful to human health. At the same time, optimize the use of chemicals in the production process to reduce environmental impact and save costs.

+ Optimize wastewater treatment processes: Ensure that wastewater treatment processes operate effectively to remove chemicals and pollution from wastewater before releasing it into the environment.

When applying environmentally friendly materials and chemicals, it should be noted that their selection and use must go hand in hand with ensuring product quality and economic feasibility.

** Energy and water consumption:*

Energy and water consumption in the textile industry are important aspects that need to be considered and optimized in the greening process.



- *Save energy*: Apply more energy-efficient machinery and equipment in the production process. Use LED lights and smart devices to control energy consumption. Incorporate production process adjustments to reduce unnecessary operating time and energy consumption. If available, use solar or wind power to power production processes.

- *Save water*: Use water recycling systems and wastewater treatment technologies to reuse water in the production process. Set up water saving programs such as using automatic flushing that adjusts according to needs.

Reducing energy and water consumption not only saves resources but also reduces environmental impact and helps create more sustainable textile businesses. In fact, in textile enterprises, the use of rooftop solar power is extremely effective, the payback period is 5.5 -6 years, the rest, 14-15 years is beneficial and effective, we just need Spend a small portion on maintenance costs. Textile and garment enterprises' access to renewable energy and green energy is helping to reduce production costs, create green certificates for goods, and increase competitiveness in the international market [2].

* *Production process*:

The production process in the textile industry is a series of work steps in which raw materials are converted into finished textile products, applying cleaner production technology such as applying digital technology in design. Supply chain design and management. To green the production process, it is necessary to focus on optimizing each step to reduce environmental impact and increase efficiency [10].

- *Product design*: Use 3D design software to create test samples before actual production. Apply sustainable design to optimize product structure and materials, reduce waste and increase recyclability.

- *Use organic or recycled materials*: Use organic or recycled materials to reduce impact on the environment. Ensure the origin and quality of raw materials to ensure environmental friendliness and worker health.

- *Cutting and sewing*: Apply cutting and sewing technology that uses less energy and resources. Optimize the sewing process to reduce material waste and increase labor efficiency.

- *Dyeing and Printing*: Use environmentally friendly dyeing and printing chemicals to reduce water pollution. Optimize dyeing and printing processes to save water and chemicals.

- *Finishing and packaging*: Use recycled or reused packaging to reduce packaging waste. Adopt environmentally friendly finishing methods to avoid the use of polluting chemicals.

- *Post-use treatment and recycling*: Consider how to collect used products and recycle them to reduce waste [3].

Greening the production process in the textile industry requires focusing on each step, optimizing the process and applying environmentally friendly technologies and methods. This helps create products that have a positive impact on the environment and create customer satisfaction.

2.2. Some greening solutions in textile production

Research, testing and applying greener measures to the production of textile and garment products is essential. This may include substituting raw materials, using environmentally friendly production methods, and examining the effectiveness of minimizing negative environmental impacts [2].

Applying greening measures in textile products requires focus on many different aspects of the production process.

- *Using sustainable raw materials*:

Choose to use organic or recycled ingredients to reduce your impact on the environment. Limit the use of synthetic materials that can be harmful to the environment and human health.



Figure 1: Textile products made from coffee grounds and recycled plastic bottles

- *Cleaner production process*: Using cleaner production technology such as water-free weaving, using solar energy or adjusting processes to save energy. Minimize waste in the production process and optimize resource use digital technology to manage production processes and supply chains. Research and apply new technologies to improve production processes and reduce environmental impact [11].

- *Increase green awareness*: Provide detailed information about the production process and applied greening measures. Create a green label or label to increase customer awareness of environmentally friendly products.

- *Green fashion*: is a trend in the textile industry, especially growing strongly in the fashion industry. Green fashion encourages the use of safe and sustainable materials such as: Natural fabrics (made from degradable natural fibers), organic fabrics (made from natural fibers without the use of pesticides) pests, herbicides, handmade materials (hand-made such as knitting, yarn...). In addition, the packaging used to package "Green fashion" products must also be friendly and non-toxic to the environment [8].



Figure 2: Green fashion [8]

- Green textile products requires a focus on implementing specific measures from working environment to improving production processes, reducing environmental impact and creating value for customers [8].



Figure 3: Green working environment [8]

2.3. Process for producing fibers from coffee grounds and recycled plastic bottles.

Fabrics made from coffee grounds and PET plastic bottles are recyclable and environmentally friendly materials. Choosing products made from recycled coffee grounds and plastic bottles is also a more environmentally friendly choice because difficult-to-decompose waste such as plastic bottles and coffee grounds have now been regenerated with a new life cycle. The fiber making process also contributes to reducing the amount of CO₂ emitted during the production process, saving more energy than the conventional fiber production process.

Step 1: Clean

Coffee grounds will be cleaned and oil removed. More specifically, the separated oil can be used to make soap or cosmetics...

Recycled bottles are also cleaned and crushed.

Step 2: Refine

These coffee grounds will continue to be ground smaller to micro and nano sizes. It is then mixed with polymer created from recycled PET plastic bottles to create the basic raw materials to initially form colored plastic granules.

Step 3: Spinning

After evenly distributing the powder on the surface of the yarn, place it in the machine and proceed to tear the yarn.

Coffee fabric fibers will be pulled under high pressure and low temperature with S.Café exclusive technology. Finally, there are similar steps in the textile process such as creating rolls, weaving, dyeing or cutting to size, etc. Proceed to produce coffee fiber fabric for many uses. [5]



Figure 4: Fabric production process from coffee grounds and plastic bottles [5]

- Outstanding properties of products from coffee grounds and recycled plastic bottles:

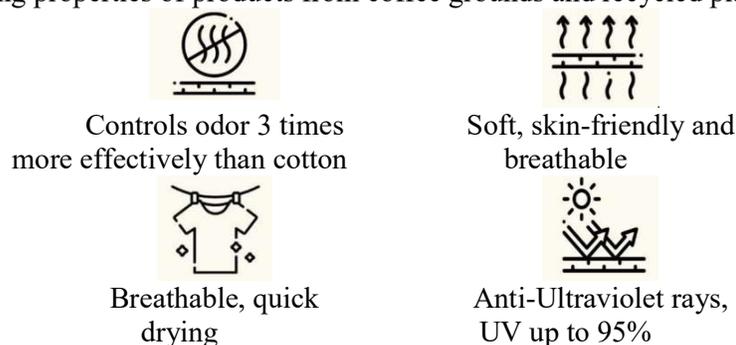


Figure 5: Advantages of the product [6]

2.4. Application of greening products from coffee grounds and recycled plastic bottles.

- Products made from coffee grounds and recycled plastic bottles are commonly used because of their airy and sweat-absorbent properties. Athletes will feel comfortable during practice and competition.



Figure 6: Shoe model made from coffee grounds and recycled plastic bottles [6]



Figure 7: T-shirt made from coffee grounds and plastic bottles [5]

- Storage bags: Non-woven bags made from coffee grounds and recycled plastic bottles have high applications in life and are widely used. Its advantage is that it is durable and safe for users, especially environmentally friendly.



Figure 8: Bag containing ingredients from coffee grounds and plastic bottles [8]

- Mask: Non-woven fabric made from coffee grounds and plastic bottles can be used to make disposable masks. The advantage of this product is that it has good deodorizing ability, convenient, and has a low price.



Figure 9: Masks made from coffee grounds and plastic bottles [8]

From a diverse range of types, plastic pellets made from coffee grounds can be applied in many fields, from everyday life to manufacturing. Their advantages include:

- Good thermal retention, withstanding temperatures up to 120°C
- Health safety (BPA-free)
- Durable and lightweight, reusable many times
- Easy to clean after use
- Suitable for use in dishwashers and microwaves
- Biodegradable
- Possess a distinctive coffee color and aroma

Recycling coffee grounds and recycled plastic bottles not only optimizes the exploitation of environmentally safe raw materials, but the energy savings when using S.Cafe fabric production technology is also highly appreciated. This combination makes an important contribution to environmental protection in the fashion industry, complying with the mission of "Green Fashion" - creating environmentally friendly products from material use to product technology export.

3. Conclusion

In the context of increasing awareness of the impact of production activities on the environment and society, greening textile products has become a mandatory requirement and a promising opportunity for this industry. From efforts to improve raw materials used, optimize production processes to design environmentally friendly products, greening measures have contributed positively to reducing pollution and saving resources and create value for customers.

Textile products made from coffee grounds and recycled plastic bottles will promote the transformation of the fashion industry towards sustainability, it is a symbol of creativity - commitment to environmental protection, reducing environmental impact in the fashion and manufacturing industries. This product not only benefits the environment by reducing waste, saving resources, encouraging consumers and industry to participate in the eco-friendly fashion revolution.

With the potential to expand the market and the ability to promote economic and social development, textile products from coffee grounds and recycled plastic bottles promise to contribute to building a better future for the environment and community. From reducing waste to promoting environmental awareness, this product represents the harmony between innovation and sustainability and gives wings to the future. Maintaining greening measures will not only create economic value but also contribute to protecting the environment and improving the quality of life of the community and workers.

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