Матеріали XXIII Міжнародної науково-практичної конференції «Екологія. Людина. Суспільство» (м. Київ, Україна, 7 грудня2023 р.)

Handbook of the XXIII International Science Conference «Ecology. Human. Society» (December 7, 2023 Kyiv, Ukraine)

ISSN (Online) 2710-3315
DOI: https://doi.org/10.20535/EHS2710-3315.2023.290920

UDC 676

IMPLEMENTATION OF RESOURCE-EFFICIENT CLEAN PRODUCTION AT THE MILLS OF THE PAPER INDUSTRY

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Resource-efficient clean production is an approach in production that focuses on optimal use of resources, reduction of waste and negative impact on the environment. The main goal of this approach is to achieve efficiency and sustainability of production with minimal consumption of resources and emissions [1]. The approach of resource-efficient and clean production is designed to facilitate the transition to a circular economy, in which the prevention of waste generation is a top priority, as well as the preparation of enterprises to reuse or increase the value of residues by introducing residues into value-added production chains [2]. Resource-efficient clean production includes the implementation of technologies for the ecologization of industry. The reduce in the consumption of materials and raw materials will help to avoid losses and minimize the impact on natural resources. Implementation of recycling systems and use of waste will help to create new products or energy. Development of products that have a lower impact on the environment during production, use and disposal priority direction of development of chemical technologies. Search and implementation of the latest technologies and production methods aimed at increasing efficiency and reducing waste. Implementation of environmentally friendly technologies to reduce emissions and pollution in air, water and soil the priority direction of the development of ecology.

The overall goal of resource-efficient clean production is to create a sustainable, cost-effective and environmentally responsible production process. Paper production faces a number of serious challenges, including high volumes of water consumption, high electricity costs and the need for heat recovery. Paper mills are sources of air pollution [3]. The high volume of water use poses a serious threat to natural water resources and can lead to water shortages in regions where paper mills are located. Electricity consumption in paper production is significant due to the processes of bleaching, drying and other stages of production.

This leads to large emissions of greenhouse gases and a negative impact on the climate [4]. In addition, the need for heat recovery is an important task, since the efficient use of thermal energy can contribute to the reduction of energy consumption and emissions, improving the overall sustainability and environmental efficiency of paper production. In addition, an important factor in the production of paper and cardboard is the large consumption of pulp, which is obtained from wood, which is accompanied by deforestation [5]. The development and implementation of the latest technologies aimed at optimizing production and reducing its impact on the environment are becoming important tasks for overcoming these problems.

To overcome these problems, paper factories must actively implement technologies for efficient use of resources, improve recycling systems, and improve production processes with regard to sustainability and environmental safety. The implementation of resource-efficient clean production at enterprises of the paper industry can include:

1. Modernization of equipment [6]: modernization of production equipment at paper industry factories is carried out in order to increase the productivity and quality of production of different types of paper and cardboard, both from primary fiber and using waste paper. This includes the purchase of modern machines and technological systems to improve production processes. Modernization of production facilities can apply to the entire technological process of paper and cardboard production, starting from the preparation of cellulose materials and ending with the storage of finished products.
2. Use of the latest technologies [7]: the introduction of modern technologies in production, such as automation, monitoring and quality control, which will help reduce costs and ensure high quality of final products, reduce the number of defects and by-products. It is also interesting to introduce new production technologies using chemical reagents in the composition of paper and cardboard to capture fiber and reduce pollution of sub-grid waters.
3. Use of domestic raw material sources for obtaining pulp [8]: the transition to the production of paper and cardboard from 100% pulp from non-wood plant raw materials will allow to reduce the cost of finished products and increase their competitiveness on the domestic market. Any country can choose its own source of plant raw materials, depending on the specifics of the agro-industrial complex, because waste from the processing of agricultural crops can be a source of cellulose products to meet the needs of the pulp and paper industry.
4. Reducing energy consumption [9]: improving the energy supply system and increasing the energy efficiency of production to reduce electricity consumption, which will be important for reducing the cost of finished products. It is important to develop and implement alternative energy sources that will reduce the use of fossil raw materials. This includes the burning of plant waste, the production of gaseous or liquid biofuels from plant materials, waste from the processing of plant materials or by-products of wastewater treatment.
5. Implementation of green practices [10]: take into account environmental aspects in the production process, including reducing the impact on the environment and using secondary resources. Secondary processing of paper and cardboard is important from the point of view of saving primary cellulose fibers and allows reducing the amount of solid waste accumulation in the environment.
6. Improvement of quality control [11]: improvement of the product quality control system at all stages of production to ensure high quality of final products, which meets the requirements of consumers of certain types of paper and cardboard.
7. Improving logistics efficiency [12]: optimizing transport costs by improving logistics processes and ensuring efficient delivery of raw materials and finished products to consumers. It is important to create optimal schemes for the transportation of materials to meet both the needs of the enterprise in raw materials and consumers in cardboard and paper products. It is also important to provide employees with access to information sources in which the latest achievements in the field of paper production are published.
8. Training of workers [13]: provide training and preparation of stuff to work with new equipment and technologies. It is also important to provide employees with access to information sources in which the latest achievements in the field of paper production are published. An important factor in the development of workers is their constant improvement of qualifications through relevant courses, as well as attendance at conferences, symposiums and exhibitions.

9. Implementation of the development strategy [14]: to develop a long-term strategy for the development of the enterprise, taking into account the growing needs of the market and competitive opportunities. In general, the development strategy involves the development of a set of strategic decisions that determine the priority directions of the company's development as a whole in the long term.

These approaches can be implemented individually or jointly at domestic paper mills to improve production conditions, reduce resource consumption, and increase product quality and competitiveness. This is necessary not only to improve production indicators, but also to ensure the principles of sustainable development. Greening of paper production will also have a significant impact on the environment not only on a local scale, but also on a global scale, as emissions into the air and water bodies of the environment will decrease.

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