

8. Фролов Є.А., Кравченко С.І., Попов С.В., Гнітько С.М.. Технологічне забезпечення якості продукції машинобудування. Монографія. Полтава: ПНТУ ім. Ю.Кондратюка, 2019, С. 111-113.

9. Horejš O., Mareš M., Havlík L., Compensation of thermally induced errors in five-axis computer numerical control machining centers equipped with different spindles, J. Manuf. Sci. Eng. 144(10) (2022) 101009. <https://doi.org/10.1115/1.4055047>

10. Jacso A, Szalay T., Sikarwar B.S., Phanden R.K., Singh R.K., Ramkumar J. Investigation of conventional and ANN-based feed rate scheduling methods in trochoidal milling with cutting force and acceleration constraints, Int. J. Adv. Manuf. Tech-nol. 127 (2023) P. 487–506. <https://doi.org/10.1007/s00170-023-11506-x>

11. Jiang Y, Chen J., Zhou H, Yang J., Hu P., Wang J., Contour error modeling and compensation of CNC machining based on deep learning and reinforcement learning, Int. J. Adv. Manuf. Technol. 118 (2022) P. 551–570. <https://doi.org/10.1007/s00170-021-07895-6>

12. Lyu D., Zhao Y., Song Y., Liu H., Wang D., Mechanism analysis of time-dependent characteristic of dynamic errors of machine tools, Machines 10 2022. P.160. <https://doi.org/10.3390/machines10020160>

13. Mareš M., Horejš O., Havlík L., Thermal error compensation of a 5-axis machine tool using indigenous temperature sensors and CNC integrated Python code validated with a machined test piece, Precis. Eng. 66 (2020) P. 21–30. <https://doi.org/10.1016/j.precisioneng.2020.06.010>

NEW FLOCCULANT FOR RESOURCE-EFFICIENT HANDLING OF RECYCLED FIBER IN CARDBOARD PRODUCTION

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Production of paper and cardboard from waste paper is one of the important directions of development of the domestic pulp and paper industry, which ensures independence from imported expensive pulp. The use of secondary raw materials has significant advantages, as it allows to significantly reduce the amount of solid household waste that ends up in landfills. However, waste paper pulp, compared to primary cellulose, is characterized by lower strength indicators due to repeated mechanical and temperature loads on the fibers during their cyclic use. Each subsequent cycle of using cellulose fiber is accompanied by its shortening and loss of paper-forming properties [1, 2].

Therefore, an important stage in the production of paper and cardboard from waste paper is to ensure the proper strength of the finished product. This can be

achieved by using additional chemicals that compensate for the low quality of secondary fiber [3].

Various reinforcing additives, such as polyacrylamide resins, polyvinylamines, carboxymethylcellulose and other polymeric agents, can be added to the composition of the paper pulp. These substances ensure better interaction of the fibers with each other due to the formation of additional hydrogen bonds and contribute to the improvement of various physicochemical indicators, operational properties.

Waste paper recycling processes are characterized by contamination of the under-screen water as a result of short fiber leaching [4]. Therefore, not only the problem of ensuring mechanical properties is important, but also the retention of fine fibers on the paper machine screen. Flocculants are used for this purpose. However, most of the known flocculants are characterized by high costs, which affects the cost of the finished product.

Therefore, the aim of the work is to obtain and study the properties of a new flocculant based on modified polyacrylamide. Cation of polyacrylamide was performed in laboratory conditions using glyoxal, sodium hydroxide, sulfuric acid, and deionized water. As a result, an aqueous raisin of medium cationic polyacrylamide with a high molecular weight was obtained.

In order to assess the tensile strength of paper materials in a dry and wet state, laboratory samples of paper weighing 75 g/m² were produced. The studies were conducted using different dosages of flocculant, which was introduced into the paper stock to increase fiber adhesion and improve the mechanical properties of the final product. The dosage of flocculant was 1.05; 2.10; 2.52; 3.15 and 4.20 kg per ton of absolutely dry matter. This made it possible to analyze the effect of different concentrations of the additive on the physical and mechanical characteristics of the finished paper, in particular on the strength at break in a dry state and the retention of strength after wetting. The results obtained served as the basis for determining the optimal amount of flocculant in order to achieve the best operational properties of paper products.

Based on the analysis of the obtained experimental data, it was established that the highest indicators of paper strength both in the dry and wet state are achieved when using flocculant in the amount of 2.10 and 2.52 kg/t of absolutely dry fiber (which corresponds to 15 and 18 kg/t of the commercial product). This confirms the effectiveness of the use of additional chemical additives, in particular polyacrylamide resins, which significantly increase the mechanical properties of paper and cardboard products. Such results demonstrate the feasibility of introducing such modifiers into the production process to improve the quality of the finished product. In addition, the obtained data emphasize the need for further scientific research aimed at optimizing the composition of chemical additives and technological parameters in order to ensure stable paper strength under various operating conditions.

References:

1. Pivnenko K., Eriksson E., Astrup T. F. Waste paper for recycling: Overview and identification of potentially critical substances. *Waste management*, 2015, 45, 134-142.
2. Lubis M. A. R., Hong M. K., Park B. D., Lee S. M. Effects of recycled fiber content on the properties of medium density fiberboard. *European Journal of Wood and Wood Products*, 2018, 76, 1515-1526.
3. Halysh V., Trus I., Tverdokhlib M., Nosachova Y., Krysenko T., Hlushko O., Ploskonos V., Radovenchyk V., Gomelya M. Starch Modification to Ensure Resource Savings and Environmental Safety in the Production Cardboard from Waste Paper. *Journal of Ecological Engineering*, 2022, 23(11), 68-75.
4. Kamali M., Khodaparast Z. Review on recent developments on pulp and paper mill wastewater treatment. *Ecotoxicology and Environmental Safety*, 2015, 114, 326-342.

REGENERATIVE ARCHITECTURE: INNOVATIONS, TECHNOLOGIES, AND ITS IMPACT

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Modern ecological challenges, such as climate change, degradation of natural resources and increased energy consumption, are driving the search for new approaches in construction and urban planning. Regenerative architecture is an innovative paradigm focused not only on reducing the negative impact of construction on the environment but also on its active restoration.

Digital modelling and 3D printing technology also play a role in implementing regenerative principles. The use of digital prototypes can optimise material consumption, reduce production waste and increase the energy efficiency of buildings, as evidenced by the research of Lucanto and co-authors. The use of 3D printing with eco-friendly materials, such as clay, biopolymers and recycled waste, makes it possible to create structures that harmoniously integrate into the natural environment and contribute to long-term sustainability.

The integration of natural elements into building systems is another important aspect of regenerative architecture. Marina One in Singapore is a landmark of sustainable and innovative architecture and urban design. Developed by Ingenhoven Architects, it seamlessly integrates architecture with nature, redefining how urban spaces function in tropical, high-density settings. The centerpiece of Marina One is the "Green Heart," a lush garden featuring over 350 species of plants. This design enhances biodiversity, reduces urban heat, and naturally improves the microclimate. It showcases how large-scale developments can coexist with nature..

Bird-friendly architecture is not only about conservation, but also about maintaining ecological balance. Birds play an important role in pollination, seed dispersal and pest control. Protecting birds contributes to the health of ecosystems and enhances the sustainability of the urban environment. One key feature of the