OBTAINING PAPER FROM THE COMPOSITION OF WASTE PAPER AND BASALT FIBER

Jumayev A
Oxunova R
Alamov U
Xolxujayeva N
Tashkent state technical university

Abstract: *This study investigates the use of aluminum hydroxide and sodium aluminate as binders in the production of composite heat- and sound-insulating materials based on basalt fibers and waste paper. The research focuses on optimizing binder consumption, determining key technological parameters, and analyzing the formation of aluminum coordination bonds that enhance material strength and water resistance. Experimental samples were prepared with varying amounts of waste paper (0–100%) and tested for their thermal and acoustic properties. Results showed that while higher waste paper content reduces insulation performance, compositions containing 15–25% waste paper maintain satisfactory insulation efficiency and significantly lower production costs. The findings confirm that aluminum-based binders combined with recycled fibers provide an effective and economical solution for manufacturing durable, eco-friendly insulation materials.*

Key words: *topinambour cellulose, cotton linters cellulose, basalt fiber, strength, composite filter paper, fiber hydration, aluminum hydroxide, filler.*

This study explores the effectiveness of aluminum hydroxide as a binder, its optimal consumption rate, and the main technological parameters in producing composite insulating materials. The formation of hemiacetal bonds between moisture-resistant fibers and the structural transformation of aluminum's semi-core complexes were analyzed.

Waste paper, widely used in the production of technical cardboard such as roofing, binding, and upholstery materials, remains a cost-effective raw material due to its low price and compatibility with standard papermaking methods. However, advanced types of technical cardboard—such as filters for fine air purification and modern heat and sound insulation materials—are typically made from 50–100% organic and inorganic fibers (e.g., basalt and cellulose from various sources) using specialized equipment and resin treatments for added strength. Recently, paper-based manufacturing methods for these materials have expanded globally, particularly with "Packing Industries" machines that operate with pulp concentrations of 0.01–0.05%.

Selecting an appropriate binder capable of functioning across a wide temperature range (20–1200°C) is critical. Aluminum compounds, which are affordable and capable of forming complex polynuclear structures, are particularly effective in neutral or slightly alkaline conditions. Reducing the production cost of mineral-fiber-based insulating materials remains an urgent task, and waste paper serves as a promising additive due to its low cost and sufficient performance when used with suitable binders.

In this research, composite sheets based on basalt fibers were produced using a Shumadzu sheet former at a 0.05% pulp concentration, layered to achieve a total mass of 600 g/m². The samples, dried at reduced tension to maintain low density (≈150 kg/m³), incorporated 10% sodium aluminate as a binder. During hydrolysis, aluminum formed complex polynuclear structures that bonded with surface hydroxyl groups on both basalt and cellulose fibers, creating strong coordination bonds of the type "cellulose–aluminum–basalt." Upon heating to 150–200°C, these bonds transformed into stable, water-resistant dioxo bonds. The optimal pH was maintained between 8.5 and 9.0 using 0.1N HCl.

The proportion of waste paper (grades MS-6 and MS-7) was varied from 0% to 100%, and its influence on heat and sound insulation was tested at the Tashkent Architectural Institute. Results (Table 1) showed that increasing waste paper content reduced insulation performance: heat loss rose from 0.17% to 22%, while sound absorption dropped from 62% to 12%. However, adding 15–25% waste paper maintained acceptable insulation levels while significantly reducing production costs and improving elasticity.

The findings confirm the economic and technical feasibility of using waste paper and aluminum-based binders in composite materials. These materials, combining mineral fibers with inorganic binders, provide adequate thermal and acoustic insulation while lowering overall manufacturing expenses.

Conclusion The study demonstrated that aluminum hydroxide and sodium aluminate are effective and economical binders for producing composite insulating materials from basalt fibers and waste paper. The formation of strong aluminum coordination bonds significantly improved the mechanical strength and water resistance of the materials. Experimental results showed that while increasing waste paper content reduces heat and sound insulation efficiency, adding 15–25% waste paper provides an optimal balance between performance and cost reduction. Therefore, the use of aluminum-based binders and recycled paper fibers offers a practical and sustainable approach for manufacturing low-cost, high-quality thermal and acoustic insulation materials.

REFERENCES:

1. http://chemanalytica.com.

2. Galbrajh Ps cellulose and its derivatives // Soros educational magazine- 1996.- №.11- P. 47-53.

3. M.M.Murodov, E.A.Egamberdiev M.Ķ.Urozov, J.P.Tojiev "Polymerization of cellulose ethers from local raw materials on the basis of innovative technology and applications in the workplace" –Tashkent, 2011. -№1.-P. 39-41.