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IMPROVEMENT OF WOOD-RESIDUES CONVERSION TECHNOLOGY

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Nowdays the problem of rational and complete utilization of wood-residues as secondary technological raw material acquires great impotance in timber industry. At the moment only 65 % of wood is processed into lumber, while 35 % are turned into such residues as croakers (14 %), sawdust (12 %) and trifles (9 %) (Fig. 1). The further processing of lumber into building components like window and door blocks, furniture etc. gives 40 % of residues in the form of sawdust, shaving and trifles.

a)

b)

c)

Fig. 1. Types of wood residues:
a) – croakers; b) – sawdust; c) – trifles

The insignificant quantity of sawdust is utilized in manufacturing of bricks and gypsum-sawdust plates, while the remaining volume of wood-residues is burnt as a fuel or is transported into a earthboard. The scientists formulate the following causes of inefficient usage of wood-residues: 1) lack of debarking on the pre- sawing stage; 2) retarded location of sources of residues from main consumers of technological wood chips the pulp-and-paper as well as hydrolytic enterprises; 3) outdated machinery applied in chemical conversion of wood-residues. Thus, the adequate utilization of wood-residues would both significantly improve the country supply with lumber products and reduce the annual volumes of wood cuttings.

The existing wood-residues conversion technology presupposes the application of sawdust in production of wall and heat-insulating building materials implementing

cement, lime, plaster (gypsum) and other binding components. Significant volumes of sawdust can be used in manufacturing of partition and finishing plaster plates; it can also be a good filler providing better burning in brick production [1].

Every year big volumes of wood are lumbered and directed mainly into construction of our country. However the more pulpwood is being produced, the more residues are received from timber cuttings as well as of processing stem wood. By now the technological progress has mostly touched mechanized production of joiner's and wood-fiber plates, wood-concrete, wood particle plates, shields, etc., which are received from practically any sized residues. These residues alongside with other materials of the same type, vary in their properties, do not jar on or dry out; besides like other semi-finished products they are used for manufacturing of textured doors, built-in-furniture, facing panels, partitions, heat-insulating products, wall blocks and panels, as well as parquet and roof, etc. Nevertheless large heaps of residues keep accumulating on cutting areas and factory back yards (Fig. 2).

Meanwhile such countries as Finland, Sweden, Norway and Canada demonstrate wonderful examples of further utilization of wood-residues.

Such products as glued panels, parquet shields, plates, door boxes, roofing and plaster lath, roofing tiles and shingles, prefabricated joiner successfully substitute the pulp-wood-based products; besides modern construction industry widely applies wall blocks, wall panels, wood-fiber and wood-shaving plates [2].

Fig. 2. Large heaps of residues on factory back yards

Sawdust- and shavings-based materials are manufactured either with the help of bonding component (sawdust-based concrete, gypsum-sawdust blocks, etc.), or without application special binding component (Fig. 3).

a)

b)

Fig. 3. Sawdust- and shavings-based materials: a – sawdust-based concrete; b – gypsum-sawdust blocks

It is good to note that bark- and twig-based materials are received both on the basis of binding component or without it; in particular, such unique material as carolit, is produced without any special additional binding component.

Wood sawdust can be a good filler for light concrete in regions with a wood-working enterprises. Our industry offers a sawdust-based-cement – warm and fire-resistant wall material which is a mixture of sawdust and binding component. It is more efficient than a solid brick in its heat-shielding qualities; its sanitary-and-hygienic indexes making it one of the most comfortable of all cement materials applied in construction of apartment houses [3].

The opportunity of producing sawdust-cemented blocks with given characteristics makes it possible to use this material for construction of practically any type of general purpose buildings (Fig. 4, 5).

Fig. 4. Sawdust-cemented blocks

Fig. 5. General purpose building made of sawdust-cemented blocks

Besides, sawdust-based-cement is an excellent material for building bordering constructions, it can be used both as additional walls insulation of already erected buildings, and for making of poles and fences (Fig. 6-9).

Fig. 6. Sawdust-cemented bordering constructions

Fig. 7. Additional walls insulation of already erected building

Fig. 8. – Sawdust-cemented pole

Fig. 9. Sawdust-cemented fence

Coniferous sawdust is the best filler for blocks, being less subjected to biological disintegrations. Cement is known to be the best binding component of sawdust-cement mixture, however, it is sometimes replaced by lime or clay to reduce the cost of finished product.

Thus, the best qualities of sawdust-cement components: ecological safety of wood as well as durability and longevity of concrete are incorporated by the manufacturers in its production.

Sawdust-based-cement application in construction processes has great potential, as sawdust-based-cemented products have some advantages in comparison with their wooden analogues. On the one hand, they are fire-resistant, and not exposed to rotting as well as fungi attacks mold, on the other hand, they are microorganisms protective. Fire resistance of this material is higher, than that of other popular modern building materials (like sawdust concrete and woodcrete). It also has high sound insulation and heat insulation indexes. Besides, wooden origin of sawdust-based-cement makes it very ecology friendly both for the human health and for the environment. Sawdust-based-cement, like a tree, regulates interior humidity level. Sanitary-and-hygienic characteristics provide a good microclimate inside premises made of sawdust-cemented blocks [4].

All above mentioned qualities make sawdust-based-cement successfully applied in low-rise housing construction in present day Russia.

This material:

– reduces the cost of construction;

– cuts down the construction terms;

– improves the quality of life due to ecologically safe sawdust-cement production technologies.

However the sawdust-cement is not deprived of certain limitations, in particular, binder component consumption exceeds the mass of wood in 1.5 - 1.6 times. The strength of this material is more than 15 times lower than the corresponding indicators of the initial components. Sugar and water-soluble substances contained in the wood hinder the processes of cement hydration, especially when the fresh wood of deciduous species is used. And finally, the non-uniform anisotropic shrinkage of wood in the process of removing bound moisture leads to irreversible damage in the bordering cement stone layer. Taking into consideration all above mentioned remarks, the outer layer of the enclosing structures needs additional finishing to protect sawdust-cement from dampening.

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