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1 *Cattail (lat. typha)*
2 *Harvesting typha in wintertime*
3 *Bundle of typha stems*
4 *Building material made of typha*

A NEW BUILDING MATERIAL, STRONG AND INSULATING, MADE FROM CATTAIL (TYPHA)

The agricultural production of cattail (lat. typha) as a raw material for industrial exploitation combines numerous ecological and economic advantages.

Cultivation and environmental protection

Due to its enormous productivity, cattail is predestined as a raw material for industrial exploitation. Typha crops are robust natural monocultures with an annual production of 15 to 20 tons of dry matter per hectare (approx. 150 to 250 m³ of building material). This is about four to five times the yield of local coniferous forests. Cultivation on fen ground and valley bottoms in Germany is likely to provide an appropriate basis to cover the total demand of insulation and wall building materials. At the same time plantation would serve as nutrient traps, CO_2 sinks and erosion barriers, for water retention and biotope formation.

The practicability of cultivating typha has been proven in »Cattail Cultivation in Fens«, a project funded by the German Federal Environmental Foundation (Deutsche Bundesstiftung Umwelt DBU) and conducted by the Department of Agricultural Ecology at (Technical University of Munich (1998 to 2001).

Product development

Due to its exceptional structural properties, building materials may be produced offering a combination of insulation and strength, which is unique on the market. Furthermore, the plant's structure makes typha's leaf mass highly suitable to produce innovative building materials. The leaves have a fiber-reinforced supporting tissue filled with a soft open-cell spongy tissue, featuring amazing static qualities and an excellent insulating effect.

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During the past few years, numerous laboratory and outdoor investigations have been conducted at the Fraunhofer Institute for Building Physics IBP, in cooperation with the inventor Dipl.-Ing. Werner Theuerkorn, focusing on product developments based on typha. As a result of the research, numerous interesting products have been found, among of which a mineral-bound isotropic material for board production is particularly promising – the so-called typha-board.

Product features

The newly-developed magnesite-bound typha-board, despite its low thermal conductivity of 0.052 W/mK, has an extremely high strength and dynamic stability, which makes it suitable to solve even static issues. Moreover, this innovative building material comes with some additional positive properties:

- renewable building material with a very high resistance to mould growth
- good protection against fire, noise and summery overheating
- simple processability with common tools
- reasonable permeation and capillary action
- low expenditure of energy during production
- recyclability

The magnesite-bound typha-board is an innovative building material of high competitivity. Especially, if cost-efficiently produced, a remarkable price reduction of essential building components may be achieved.

Example of application: wood construction

On the occasion of building an annex to a spa resort in Radolfzell (Germany), typha-boards were used as load-bearing braces in timber frame constructions, which is where the advantages mentioned above take effect. Owing to its excellent static properties, wall construction was possible with very few studs which have been used primarily for legal reasons. In this case, stud grid was 4.3 meters as opposed to standard 0.6 meters. Furthermore, this kind of wall structure met all demands of noise protection and fire safety. Outer wall thickness is only 24 centimeters with a U-value of 0.23 W/m²K, thus meeting high insulation standards, with wall structure still being very simple and lean.

The board has also been used to build the slim inner walls of only 12 centimeters and served for the roof area as well.

Example of application: timber-framed buildings

In case of the timber-framed building of Altstadtfreunde Nürnberg e.V. (Society for historic city) at Pfeifergasse 9 in Nuremberg, the constructional problem was about restoring the visibility of the timber frame construction, moreover, observing German Energy Conservation Regulations (EnEV 2009), considering legislations concerning preservation of historic buildings and, at the same time, stabilizing the building. Typha-board material has been applied, and it has met all of those requirements.

This exemplary utilization of material has been sponsored by the German Federal Foundation for the Environment (DBU) and by the Bavarian State Bureau for the Conservation of Historic Buildings and Monuments (Bayerisches Landesamt für Denkmalpflege).

Using typha-board, an extremly lean exterior wall construction has been realized, thickness measuring only 16 centimeters, plus 4 centimeters of plaster, wall heating included. Fraunhofer IBP has been analyzing the suitability of the wall structure over a measuring period of 1.5 years and determined that thermal transmittance (U-value) of the bracing elements was 0.26 W/m²K. U-value of the entire construction (timber structure and bracing) was 0.31 W/m²K.

5 *Wall structure at an annex construction to a spa and wellness resort in German Radolfzell.*
6 *Refurbished traditional timber-frame house at Nuremberg's Pfeiffergasse.*