



18th International Conference on Rehabilitation and Reconstruction of Buildings 2016, CRRB  
2016

## Development of organic and biodegradable insulating material for ETICS

Eva Tůmová<sup>a\*</sup>, Rostislav Drochytka<sup>a</sup>, Vít Černý<sup>a</sup>, Pavel Čada<sup>a</sup>

<sup>a</sup>*Brno University of Technology, Faculty of Civil Engineering, Veveří 331/95, 602 00 Brno, Czech Republic*

---

### Abstract

When developing new insulating materials, there is, in recent years, a pressure to replace the widely used polystyrene insulation for material, which is more sustainable and more eco-friendly. The shelf life of ETICS insulation on a building is around 25 – 30 years and that with proper care and repairs. When the polystyrene insulation is taken down from the building, there is a little to none chance of its recycling due to the residues of mortar and other building chemicals. When the insulation system on a building is repaired or replaced, a big advantage for the environment would be, if the main part of the system, as well as the whole system, would be biodegradable.

For the sustainable building industry, the advantage is also in the source of the main raw material, as it is grown naturally instead of being chemically produced, as the polystyrene. That is the place, where the straw based insulating panel comes in. Even the use of the casein glue, which base is also natural, contributes to the environmental importance of this research.

This paper is fully dedicated to the complexity of making an insulating panel of rye straw bonded with casein glue.

© 2017 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of the 18th International Conference on Rehabilitation and Reconstruction of Buildings 2016

**Keywords:** insulation, ETICS, straw, casein glue, biodegradable

---

---

\* Corresponding author. Tel.: +420-541-147-522.

E-mail address: [tumova.e@fce.vutbr.cz](mailto:tumova.e@fce.vutbr.cz)

## 1. Introduction

The use of straw from various sources is common all over the world. Historically, the straw was used for roofing and other purposes in buildings everywhere, where straw was available. Depending on the geographical location, the used straw was cereal or rice, etc. Nowadays, the use of straw as a building material is common especially in the developing countries and around the tropical and subtropical climate. [9, 10]

The ETICS insulating system was firstly used, in the Czech Republic, in 1993. The system has then well spread throughout the building industry in the Czech Republic and has been implemented on a large number of existing and newly constructed buildings since then. The current production is about 16 millions of square meters, which puts the Czech Republic at the forefront of production per inhabitant in Europe. [1, 3, 4]

Currently, the cereal straw, mostly wheat and rye is sometimes used for building houses using straw bales as a heat- insulating padding for wooden walls. Also, but less frequently, parcel straw used as an additional thermal insulation of residential houses. [1]

This article deals with the possibilities of using straw as a thermal insulator. The straw is bonded with casein glue, for the purposes of this article.

## 2. Binders

Selection of a suitable binder depends primarily on theoretical compatibility of the binder with straw. Other criteria were behavior of binder in external environment, thermal insulation properties, biodegradability, bonding potential and the cost of the binder. For theoretical selection of a suitable binder, a listing of materials recorded as other waste from the EWC Ministry of Environment and a list of currently known bonding agents were compiled. From both of those lists the theoretically suitable materials for bonding straw were selected. [1, 5]

From the list of currently known binders, the following materials were chosen:

- cement,
- lime,
- casein adhesive,
- rubber cement,
- polyvinyl acetate adhesive,
- polyvinyl adhesive,
- polyester adhesive,
- chlorinated pvc adhesive,
- bicomponent fibers,
- cornstarch adhesive,
- soy protein isolate.

[1]

## 3. Experimental section

### 3.1. The selection of specific raw materials

A rye straw (the straw) was used as filler. It has a golden – yellow color and it was grown on the surroundings of Slavkov. The straw was delivered in bales, the straw bulk density was around  $130 \text{ kg.m}^{-3}$ . The bales contained straw straws with length 30 – 350 mm with short-term water absorption by total immersion of about 490 % by weight (according to ČSN EN ISO 15148) and humidity of 12% (according to ČSN EN ISO 12570). [1, 6]

The main reason for the selection of a casein adhesive is its biological safety and like the cement, its alkaline nature. The casein adhesive, which was used for insulating boards, was manufactured by Kreidezeit in Germany and according to the data sheet, it is a traditional natural formula used more than 3 decades. [1,2]

Download English Version:

<https://daneshyari.com/en/article/5026845>

Download Persian Version:

<https://daneshyari.com/article/5026845>

[Daneshyari.com](https://daneshyari.com)