Amazing power of Tatami rush, Igusa
makes your room air condition like
a grassy plain.

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No.130002
熊本産イグサを使った
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かみいぐさアイビーウォール

The creation of highly functional, zero emission rush grass wall paper

Rush Paper AI B WALL（かみいぐさAI b WALL）

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Tatami as the pioneer biomass material

Since 500 years ago, rush grass, which has come to be a representative agricultural product of Kumamoto Prefecture, has been used as the material for tatami mats, one of the indispensable elements of a Japanese house. It is said that rush grass was imported to Japan long ago from the marshy wetlands of the Indonesian peninsula. With the ability to automatically regulate the indoor humidity and a resistance to bacteria and mold, tatami protects people’s living environment from dramatic seasonal changes, providing a pleasant place to lie down whether it be in the middle of the hot and humid summer or the dry and cold winter. As a material utilizing straw and marshy grasses in the human environment, tatami is truly was and is a pioneer biomass material.

The tatami in my house.

In the wake of WWII, the shape of the Japanese household has changed to match the transformation in people's values and lifestyles. The number of rooms using tatami has only decreased, and new materials to substitute rush grass in tatami are continually being developed. Demand for tatami has decreased dramatically.

My dealings with tatami began 50 years ago when I was asked to develop a different use for rush grass. I was surprised to find out that, at that time, short rush grass stalks, which are produced in the same amount as the longer stalks used for tatami, were treated as waste and incinerated. I decided to use this waste grass to make paper.

Rush grass waiting to be harvested in May.

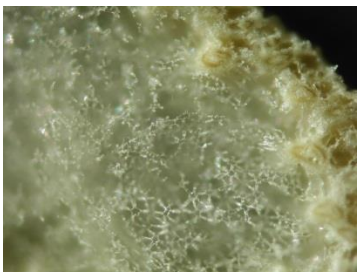
Making Rush Grass Paper

If you process rush grass like the other materials used for making Japanese paper, such as *mitsumata*, *gampi*, and *kōzo*, it becomes a muddled, sludge-like mess that is very difficult to make into paper. Therefore, I developed my own original process for treating rush grass, and was able to make paper similar to traditional Japanese paper. Also, because the green of rush grass is the green of chlorophyll, and is therefore lost during the treatment process, I decided to apply a small amount of indigo dye to restore the look of the original rush grass. Sadly, the anti-bacterial and anti-fungal properties of the rush grass were also lost in the treatment process due to the heat and chemicals used. With only the fibrous part of the grass being used, the other elements became a new source of waste.

Rush grass fiber for use in hand-made Japanese paper

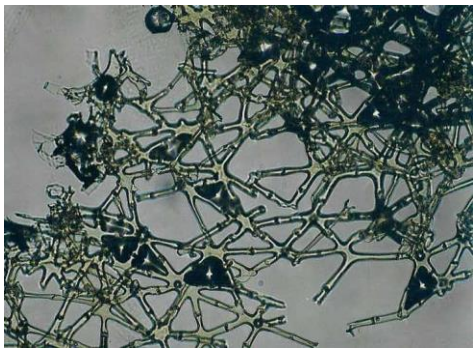
Discovering the Latent Faculties of Rush Grass

It is often said that tatami has the ability to purify the air. However, it is hard to believe that rush grass, a non-porous material, could have such an effect when used as flooring material. On the other hand, when experimenting on samples of paper made from rush grass, there is no doubt that the material has the ability to absorb formaldehyde. I decided at this point to perform experiments on the moisture absorption power of unprocessed rush grass, powered rush grass, and rush grass crushed to an arbitrary extent. The results of the experiment showed no significant absorption power in unprocessed rush grass and powdered rush grass.



Star-shaped cells in rush grass

Looking carefully at the crushed rush grass, one can see that the "wick" portion of the soft, spongy central cylinder of the plant tissue (a.k.a. pith) is exposed. The photo above shows a cross section of this portion of the pith. The white, star-shaped material that forms the pith is called stellate cells. One star is approximately 10 microns ($1/100^{th}$ of a millimeter). The space between stars is empty space, and it is here that moisture and other chemical compounds are absorbed.



Moisture captured in the stellate cells

As moisture is also absorbed into the stellate cells themselves, the cells swell and shrink as moisture is absorbed and released. Thanks to this phenomenon, when the cells dry and release their moisture, the cells shrink and prevent the re-release of chemical compounds. This is the latent faculty of rush grass.

Behold! The creation of highly functional, zero emission rush grass wall paper!

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Even if the finished product was high in quality, making something that resulted in excessive amounts of waste was not possible in a place like Minamata. When I had half given up on the idea of making non-standard rush grass into a source of paper material, a supportive voice came from a local: “We want you to make wallpaper for the local school.” Without thinking twice, I decided to develop a wallpaper using the stellate cells of rush grass material, and to do so without creating waste.

After repeated experimentation and failure, I one day conceived an idea for a treatment method for rush grass pulp while I was hurriedly cleaning my machinery. This method (patent 4208047) did not involve heating, chemical treatment, or digestion, and because it did not produce waste material, it was also good for the environment. Of course, by preventing the stellate cells from being pulverized, the cells are able to spread over the surface to an appropriate size, and the anti-bacteria and anti-fungal functionalities are preserved. Furthermore, we were able to prove through experimentation that, even without excessive amounts of flame retardant material, the paper is quite difficult to burn.

AI B Wallpaper used on the ceiling and walls of the Minamata City school Fukuro Elementary.

Teachers at Minamata City Fukuro Elementary School offered these comments about AI B Wallpaper.

- In the hot summer season、 the classrooms our energetic students use come to reek of sweet. However, I was surprised how the smell strangely disappeared when entering the class in the morning.
- In the winter, I almost never see the windows fog up.
- People who visit the classroom of say things like, “The moment I stepped in, I felt the air change.”
- This winter there was a serious outbreak of influenza in the other Minamata City schools. Although a few students become infected at Fukuro, strangely, the illness did not spread.

With everyone’s support, we received in 2007 the Prime Minister’s Accolade, the “Second Annual Japan Craftsmanship Award, Award of Excellence.” Thank you everyone for your support.

Reference data

1) Kumamoto Prefectural Forestry Research and Instruction Facility
Experiment Result Report 173 (2008)

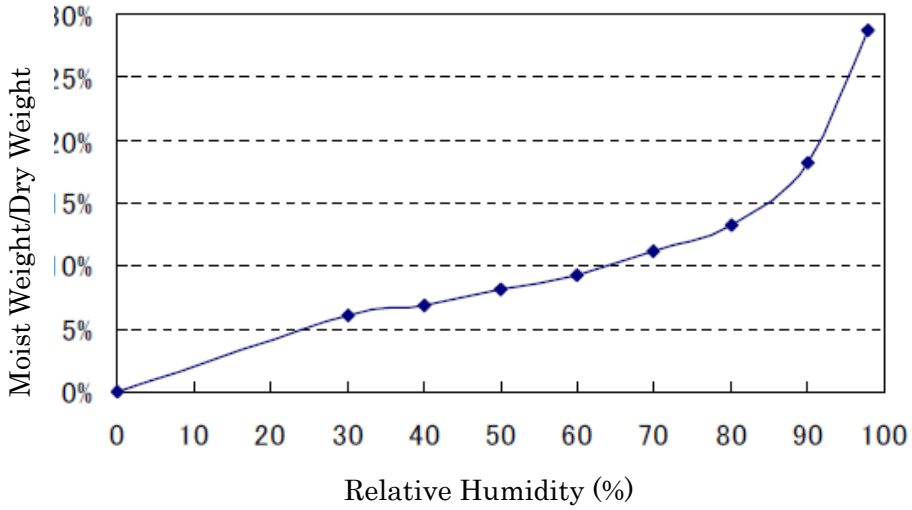


Fig. 1 Isothermal Moisture Absorption Curve of Rush Grass Wall Paper (23℃)

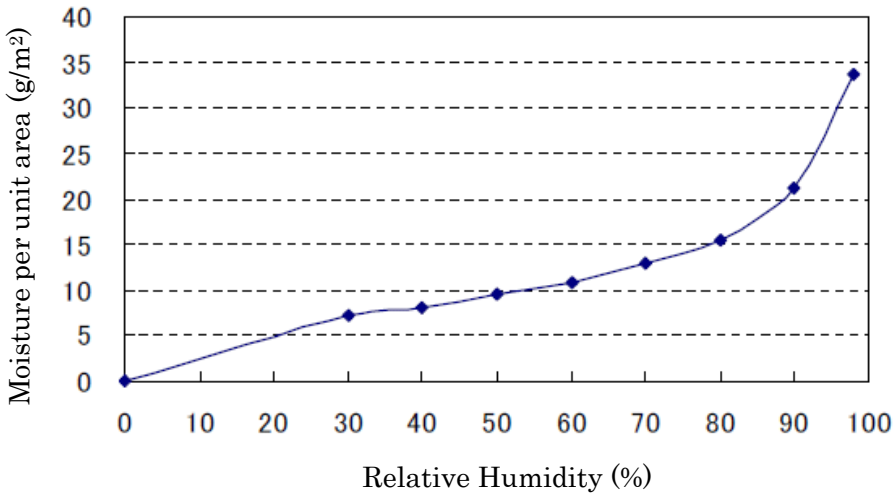
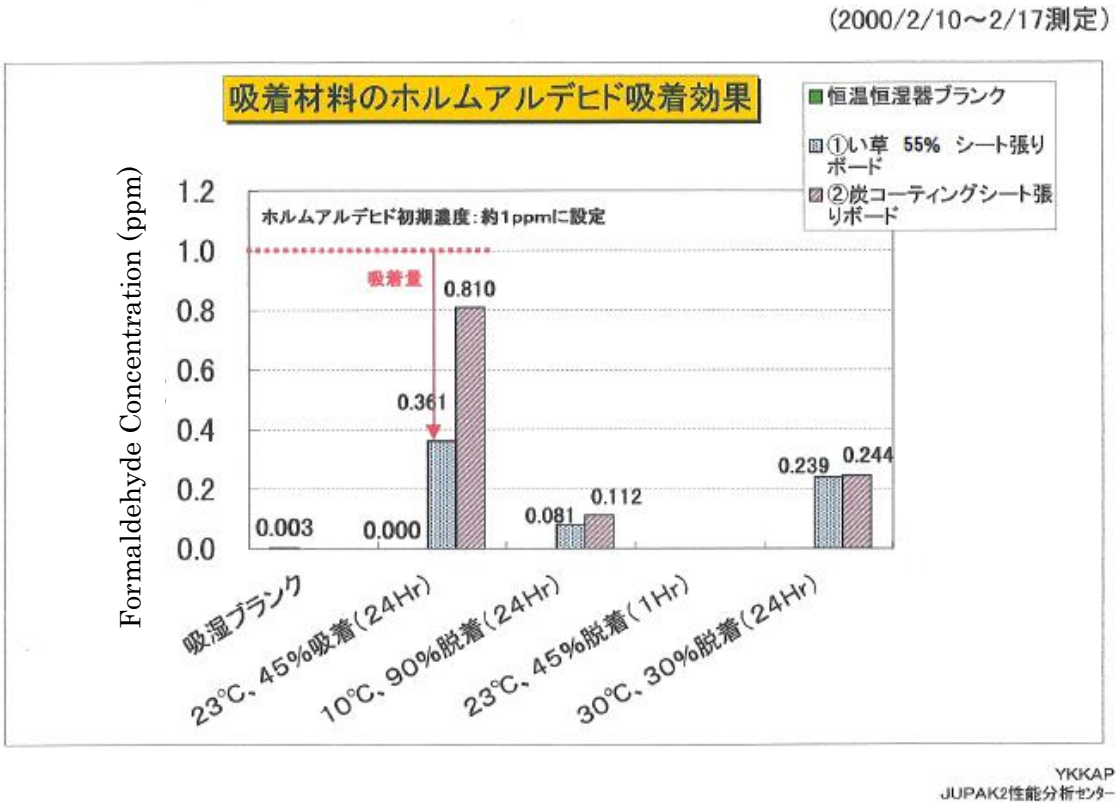


Fig. 2 Isothermal Moisture per Unit Area Absorption Curve (23℃)

Humidity Conditions	Measured Weight (g)	Weight of Absorbed Moisture (g)	Weight of Absorbed Moisture per m² (g/m²)
Completely Dry	87.56	0.00	0.00
Temp. 23 ℃, Relative humidity 30%			
Temp. 23 ℃, Relative humidity 40%		※Experimental surface area: 0.7497m²	

2) Absorptive Effect of Various Absorptive Materials on Formaldehyde



In this graph, the red dotted line represents the original concentration of formaldehyde. The red arrow shows how much formaldehyde has been absorbed after 24 hours at 23℃ (the difference between the original concentration and the current concentration). The amount absorbed is more than that of the board with a carbon coating.

3) Ammonium in dessicator graph

Kumamoto univ.

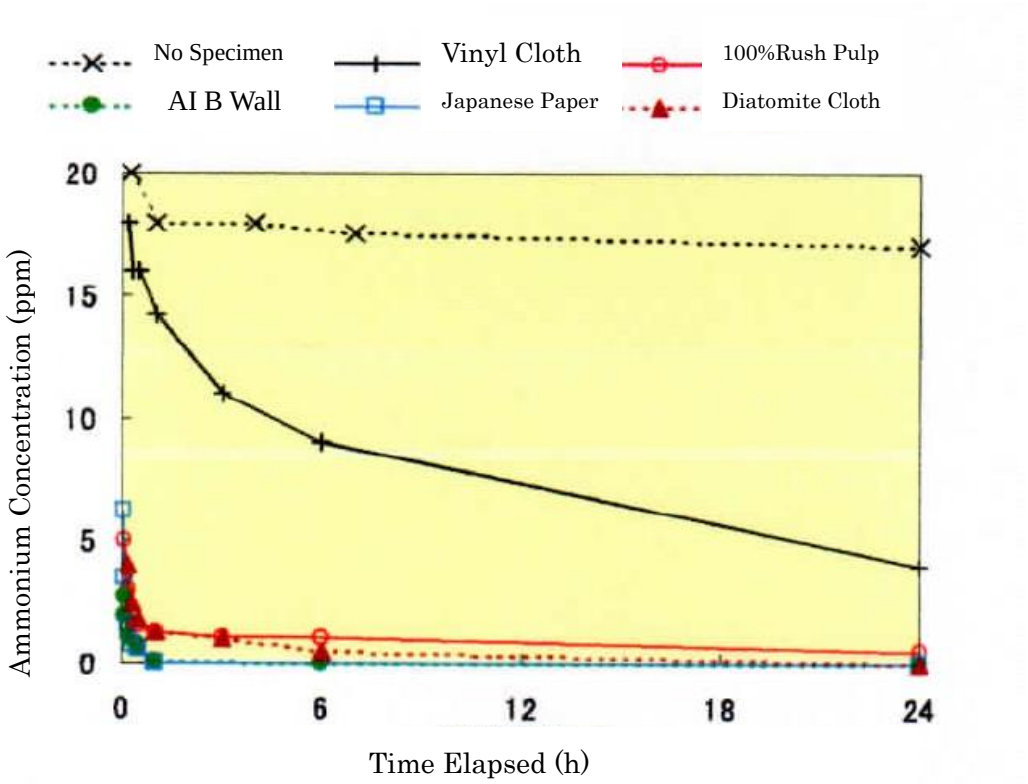


Fig. 1　Change in ammonium concentration within a dessicator

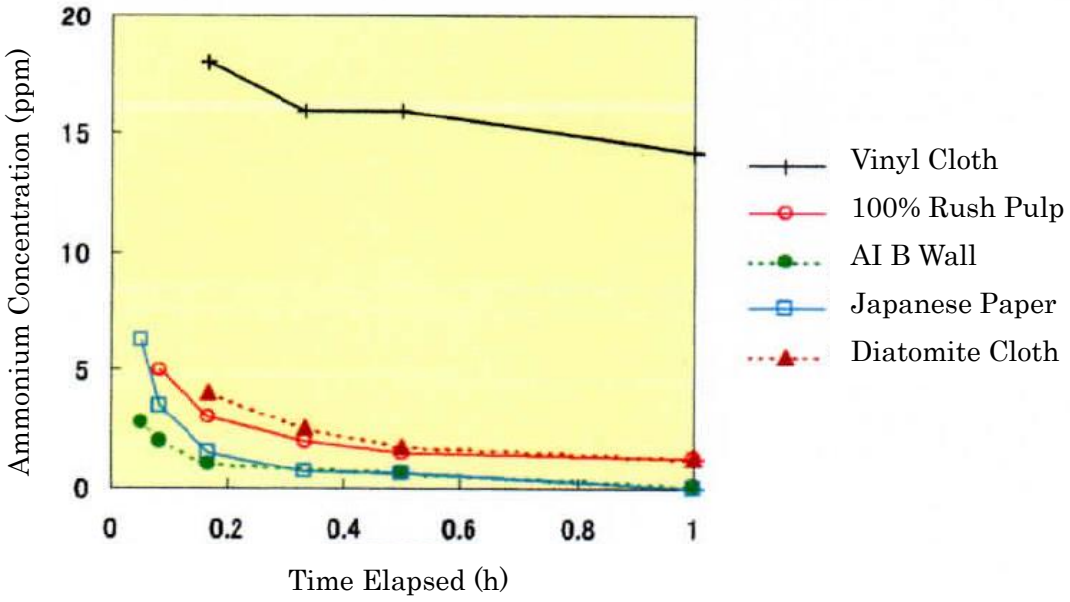


Fig. 2　Change in ammonium concentration within a dessicator within one hour's time