Technology of Advanced Lime Paint

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Lime wall (Traditional Coated Wall)

Lime wall has been around for centuries in the traditional way as Lime walls are environmentally friendly and have unique functions that usual paints don’t have.
What’s Lime?

Lime is one of the environmentally friendliest materials. Lime is made from Limestone which is dug out from mines throughout the world and purified by treating with only water. 100% of the components are made from natural materials.
Why Lime?

Lime can provide comfortable atmosphere due to alkaline surface and inactivate microorganisms like bacteria, mold, virus.
So Lime has been protecting us from hazardous microorganisms by surrounding us.
# 2 ways to apply lime on walls

<table>
<thead>
<tr>
<th>Type</th>
<th>Lime Paste</th>
<th>Lime paint</th>
</tr>
</thead>
<tbody>
<tr>
<td>History</td>
<td>Traditional</td>
<td>Recent</td>
</tr>
<tr>
<td>Application</td>
<td>Trowel</td>
<td>Roller, Brush</td>
</tr>
<tr>
<td>Finish</td>
<td>Trowel texture, Flat</td>
<td>Flat (paint finish)</td>
</tr>
<tr>
<td>Applicator</td>
<td>Skilled painter</td>
<td>General painter</td>
</tr>
<tr>
<td>Cross section</td>
<td>wall</td>
<td>wall</td>
</tr>
<tr>
<td>Functions</td>
<td>Lime feature</td>
<td>Lime feature</td>
</tr>
</tbody>
</table>

Lime paint doesn’t need sophisticated skills and can be applied with rollers. It also has lime feature!
Functions of lime paint

- Deodorization
- Humidity control
- Anti-Microorganisms
  - (Bacteria, Mold, Virus)
Unpleasant smells around us

Sweat
Excretion
Garbage

Distinctive body odor
Cigarette

Various types of odor
Deodorization

Lime paint makes the atmosphere comfortable
Deodorization test

<table>
<thead>
<tr>
<th>Fumes</th>
<th>Chemicals</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painted panel</td>
<td>Acetic acid</td>
<td>99%</td>
</tr>
<tr>
<td>Painted panel</td>
<td>Isovaleric acid</td>
<td>98%</td>
</tr>
<tr>
<td>Plastic bag</td>
<td>Indole</td>
<td>97%</td>
</tr>
<tr>
<td>Fumes</td>
<td>Formaldehyde</td>
<td>&gt;99%</td>
</tr>
<tr>
<td></td>
<td>Nonenal</td>
<td>90%</td>
</tr>
<tr>
<td></td>
<td>Hydrogen sulfide</td>
<td>31% (58%:24hrs)</td>
</tr>
</tbody>
</table>

Lime paint can reduce unpleasant smells

*tested by BOKEN Quality Evaluation Institute*
Principles (Deodorization)

Smelly molecules

Scentless molecules

Lime paint can change the chemical structure of specific odor thanks to alkaline surface

ex. [Formaldehyde reduction]

\[
\begin{align*}
\text{HOOH} & \xrightarrow{\text{catalyzed by Lime}} \\
\text{H}_{2}\text{CO} & \quad (\text{Formaldehyde})
\end{align*}
\]

Deodorization test
(with Japanese traditional snack)

[Method] Place the kelp and lime paint or nothing in a bottle. In 30 sec the concentration is measured.

Terrific taste

Lime paint can reduce the kelp odor
Humidity Control

Lime paint (film) breathes itself with moisture.

- absorb water vapor at high humid environment
- release the vapor when it is dry

Lime paint conditions air
Moisture absorption and Desorption

Humidity control (at 23°C)

- Absorption (90RH% x 3days)
- Absorption (90RH% x 2days)
- Initial
- Desorption (10RH% x 1days)
- Desorption (10RH% x 2days)

Lime paint is easier to change air
Principles (humidity control)

Because of porous surface Lime paint (film) can tailor humidity in a room.

(magnified x3000)

As you may know, surface with multiple holes is known as air-conditioning surface.
Humidity Control test
Water drops and a test panel in each bottles.
(The bottles were cooled till they get steamed.)

Lime paint
Wall paper
Usual paint

Painted Panel
Painted Panel
Painted Panel

Clear
Condensation
Condensation

Lime paint can absorb moisture in a humid room
Anti-microorganisms (Bacteria)

Lime paint can inactivate microorganisms so that they can’t incubate themselves.
Anti-microorganisms (Bacteria)

Anti-bacteria test (Following JIS* Z2801-2000)

*Japanese Industrial Standard

Bacterial Solution → Anti-Bacteria film → Lime paint plate

Count living bacteria

Collect bacterial solution

If lime paint doesn’t work, a number of bacteria will be found

*tested by Japan Food Research Laboratories
Anti-microorganisms (Bacteria)

Target Bacterium

Lime Paint Plate

**Escherichia coli**

**Methicillin-Resistant Staphylococcus Aureus, MRSA**

With out Lime paint

Bacterial Colonies

NBRC12732, NBRC13275 were also tested

Lime paint can prevent bacteria from incubating

*tested by Japan Food Research Laboratories*
Anti-microorganisms (Mold)

If you have lime paint wall

Lime paint can keep mold inert.
Anti-microorganisms test (Mold)

Following JIS Z2911

*tested by Japan Food Research Laboratories

Mold spores

Lime paint plate

After 7 days, we’ll see if Lime paint works.
**Anti-microorganisms test results (Mold)**

<table>
<thead>
<tr>
<th>Popular mold</th>
<th>Inert Mold</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Aspergillus niger</em></td>
<td></td>
</tr>
<tr>
<td><em>Penicillium funiculosum</em></td>
<td></td>
</tr>
<tr>
<td><em>Rhizopus oryzae</em></td>
<td>67%&lt;</td>
</tr>
<tr>
<td><em>Cladosporium cladosporioides</em></td>
<td></td>
</tr>
<tr>
<td><em>Chaetomium globosum</em></td>
<td></td>
</tr>
</tbody>
</table>

More than 67% of mold are affected.

*tested by Japan Food Research Laboratories*
Anti-microorganisms (Virus)
Nowadays, there are many types of Virus around us like SARS, Influenza, Ebola, Noro and so on.

Lime paint protects you from being infected with Virus
Anti-microorganisms test (Virus)

The viral test was conducted by Institute of Tropical Medicine Nagasaki-Univ.

Dr. Yasuda, who is Japanese Viral authority, led the team.

Virus Solution → Lime paint plate

Check viral infection power

If lime paint works on virus, they will have weaker infection power than they have.
Anti-microorganisms test results (Virus)

99% of infection power will be lost by Lime paint plate
We conclude Lime paint can disintegrate any virus

Anti-microorganisms test results (Virus)

Virus are categorized into 4 groups

<table>
<thead>
<tr>
<th>Typical Virus</th>
<th>Inert Virus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parvo virus</td>
<td></td>
</tr>
<tr>
<td>Influenza virus</td>
<td>99%</td>
</tr>
<tr>
<td>Vesicular stomatitis virus</td>
<td></td>
</tr>
<tr>
<td>Bovine popular stomatitis virus</td>
<td></td>
</tr>
</tbody>
</table>
Sustainability of Anti-Microorganisms (Bacteria, Mold, Virus)

Alkaline surface leads Anti-Microorganisms

We investigated the change of alkaline substance in lime paint film.

Alkaline substance deteriorate slowly

Anti-Microorganisms seems to last for 8 years approximately
Actual Functions of lime paint

- Deodorization
- Humidity control
- Anti-Microorganisms
  - (Bacteria, Mold, Virus)
Case Reference

~ Iga Ueno castle ~
(Mie Pref.)
Case Reference 2

~ Saiseikai Hospital ~
(Tochigi Pref.)

~ Ishikawa Clinic ~
(Saitama Pref.)
Case Reference 3

~ Sapporo Hospital ~
(Hokkaido Pref.)

~ Imadate Hospital ~
(Fukuoka Pref.)
Case Reference 4

~ Sakai Wanpaku Nursery ~ (Osaka Pref.)
Case Reference 5

~ Le Sucre ~ (Malaysia)
Case Reference 6

~ St. Francis Care Center ~
(Boksburg, South Africa)
Case Reference 7

Before

After

in 3 years

~ Ryukyu Univ.~ (Okinawa Pref.)
Thank you for listening !!