

EG60411 Biomaterial Science

Toshiharu Enomae

Professor, PhD, Paper Device and Eco-friendly materials

2G103, 10:10-11:25, Tuesday

Biomaterial Science (2015 Schedule)

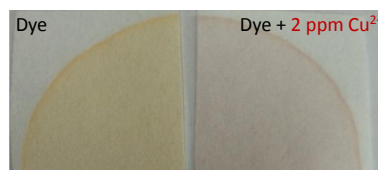
#	Date	Content
1	10/6	History of papermaking
2	10/13	Pulps – Beating and fiber properties
3	10/20	Pulps – Additives and functions
4	10/27	Papermaking processes & interfiber bonding
5	11/10	Paper– Structural properties
6	11/17	Paper– Surface properties
7	11/24	Paper–Wetting and absorption properties
8	12/1	Paper– Mechanical and optical properties
9	12/8	Polysaccharide chemistry by Assoc Prof Akiko Nakagawa
10	12/15	Recent research of paper science and technology
11	12/22	Examination

Lecture information and contact

- ▶ Homepage of “Biomaterial Science (T. Enomae)”
- ▶ <http://www.enomae.com/>
→ Handouts in lecture(講義資料)
- ▶ E-mail address
→ t@enomae.com
for any questions and visit to laboratory
(Bio-Agr. Bldg. 生農C209 or 総合A618)

Water quality sensor

Paper-based sensors to detect Cu^{2+} in drinking water

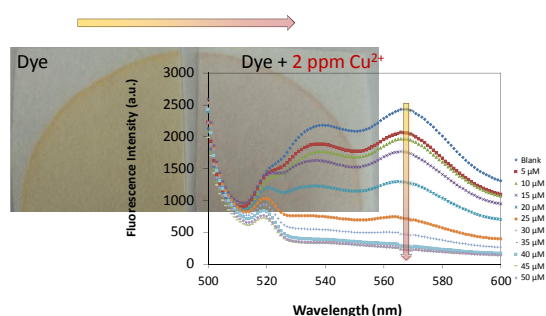


Filter paper with quinone derivative dye

Cu^{2+} 2 ppm (maximum amount allowed by WHO)

Light scattering by paper enhances color difference.

Water quality sensor



Paper-based power generator

Paper-based water quality sensor

Paper-based bioassay

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Bacterial culture system using paper substrate and ink jet printing



Tithimanan Srimongkon
Toshiharu Enomae



Concept

Human-operated system

Automatic system



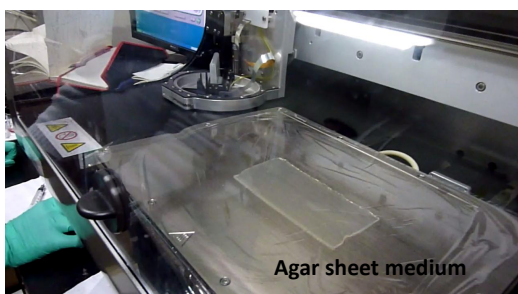
Bacterial cells are dispensed on media in paper container using inkjet printer

Conditions of bacterial growth on paper can be observed by microscope

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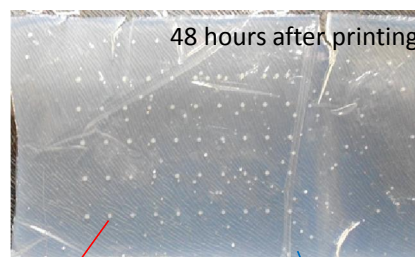
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E. coli printing



Agar sheet medium

E. coli printing



48 hours after printing

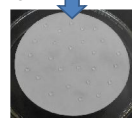
Dot of *E. coli* colony

Agar sheet medium

Preparation of paper substrates



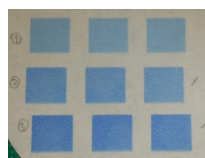
Soaking paper in polystyrene (PS) solution for 1 hour and drying



Test of hydrophobicity



Toluene (with blue dye dissolved) printed by using inkjet printer



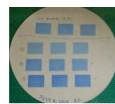
Hydrophilic/hydrophobic paper

K. Abe, and et., Anal. Chem. 80 (2008): 6928-6934

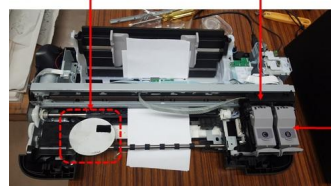
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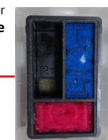
Multi cartridge system printer



Place paper sample



Multi Cartridge System (MCS) Printer

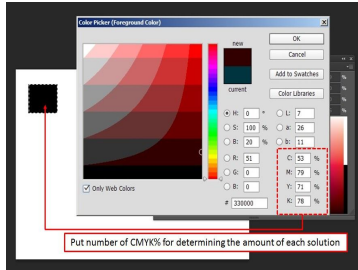


Black cartridge for Sodium alginate (sol)

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Amount of solution = %CMYK

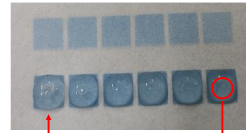


Cyan = CaCl_2 aq
Magenta = Yeast extract
Yellow = Bacto trypton
Black = sodium alginate

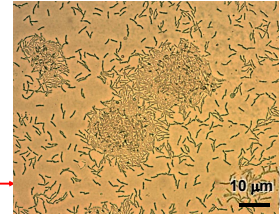
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Bacterial culture



Gel that formed on hydrophilic areas



Colonies of bacteria growing on medium after 24 h

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Conclusion

Hydrogel medium was successfully formed by reaction on semi-hydrophilic areas of filter paper with multi-cartridge ink-jet printer. The growth of bacteria was successfully observed with optical microscope.

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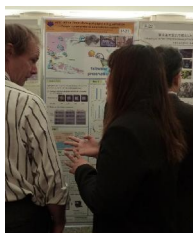
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Thank you for your attention.

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Influence of saltwater immersion on properties of flood-damaged paper



Tunchira Bunyaphiphat
 Akiko Nakagawa-Izumi
 Toshiharu Enomae



Save flood-damaged paper



Mold grows and

- Characters cannot be read due to color
- Bad smell
- Health hazard
- Artistic value lost

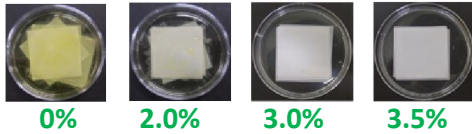
Flood-damaged paper and books

To inhibit mold growth

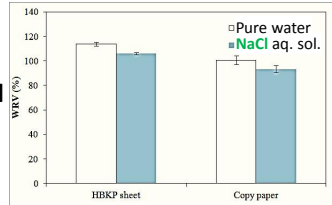


was proposed.

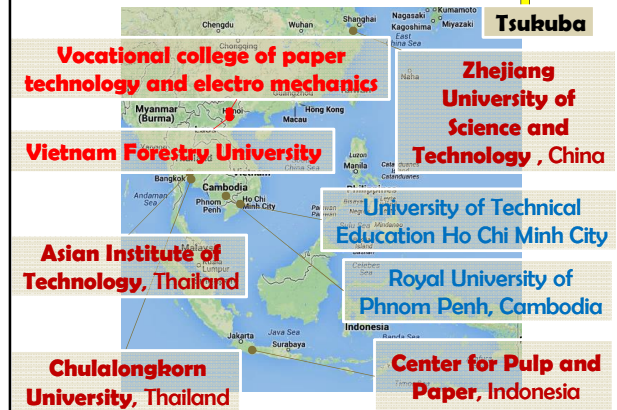
Saltwater inhibits mold growth



- As **NaCl concentration** increases, bacteria grew less (top), and
- fibers swelled less (right).



International alliances



Thank you for attention.

Your questions are welcome.
t@enomae.com