

# Antibacterial Property of Washed Fabrics using Zeolite Supported by Metal-ion

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With the rising awareness of saving water in recent years, 57% of people use leftover bath water for laundry. However, leftover bath water used for laundry sometimes emits objectionable odor. Bacteria seem to be the cause of the odor. The focus of this study was zeolite, which is a water softener contained in synthetic detergents. Zeolite that supported metal ions possessed antibacterial properties. Zeolite supporting metal ions was mixed with a detergent to study laundry. As a result, washed cloth obtained antibacterial properties. In other words, clothing acquired a semi-permanent antibacterial effect. The detergent that contained zeolite supporting metal ions also showed a high antibacterial effect on washing water.

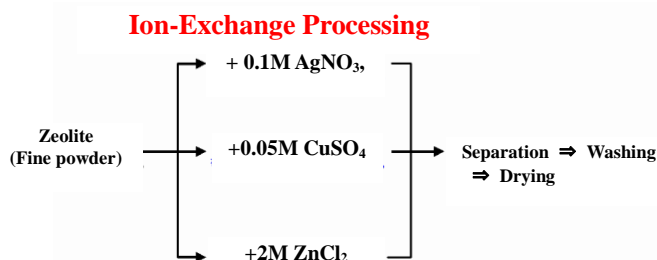


Fig. Supporting method of Metal-ion for Zeolite

Table Zeolite supported metal ion

Sample name	Metal	Ag (wt%)	Zn (wt%)	Cu (wt%)	note
ZL-1	Ag	2.2	—	—	Ag only
ZL-2	Ag, Zn	2.2	9.5	—	
ZL-3	Ag, Zn	3.5	6.5	—	
ZL-4	Ag, Cu	3.2	—	6.0	
ZL-5	Ag, Zn	2.2	9.5	—	Coating
ZL-6	Na	—	—	—	Before being supported by metal-ion

Table Bacteria number in washing solution for different weight fractions of zeolight

Sample name	DBS (mol/l)	Zeolite (wt%)	number of bacteria (CFU/ml)
J1-1	—	—	$2.1 \times 10^6$
Y1-1	—	ZL-6 (0.10)	$1.3 \times 10^6$
M6-1	—	" (0.20)	$4.5 \times 10^6$
N1-1	$5.5 \times 10^{-5}$	—	0
N6-1	"	ZL-6 (0.05)	$5.1 \times 10^4$
N7-1	"	" (0.10)	$1.2 \times 10^5$
A6-1	"	" (0.20)	$9.5 \times 10^4$
N2-1	$5.5 \times 10^{-5}$	ZL-2 (0.05)	0
N3-1	"	" (0.10)	0
N4-1	$5.5 \times 10^{-5}$	ZL-5 (0.05)	0
N5-1	"	" (0.10)	0

Table Bacteria number in bath water

	Before bathing	After bathing Center	After bathing Bottom	After incubation (37°C, 48hrs.)	After washing*)
number of bacteria (CFU/ml)	1	$5.7 \times 10^5$	$4.8 \times 10^5$	$3.7 \times 10^6$	0

\*) ZL-5: 0.05wt%, DBS: none

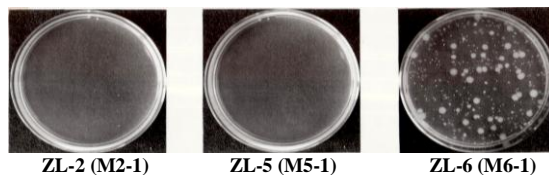


Fig. Bacterial test of fabrics after washing .  
(DBS: none, Dilute ratio:  $2.0 \times 10^4$ )

Table Antibacterial test of fabrics after washing for different weight fractions of zeolight

Sample name	Zeolite	Number of <i>Escherichia coli</i> (cells/ml)
Ref.)	—	none(20>)
N2-1	ZL-2(0.05wt%)	none(20>)
N3-1	" (0.10wt%)	none(20>)
A2-1	" (0.20wt%)	none(20>)
N4-1	ZL-5(0.05wt%)	none(20>)
N5-1	" (0.10wt%)	none(20>)
A5-1	" (0.20wt%)	none(20>)
N6-1	ZL-6(0.05wt%)	none(20>)
N7-1	" (0.10wt%)	none(20>)
A6-1	" (0.20wt%)	$1.4 \times 10^5$

Washing time=30min ( at 40°C)  
Rinsing time=3min × 2

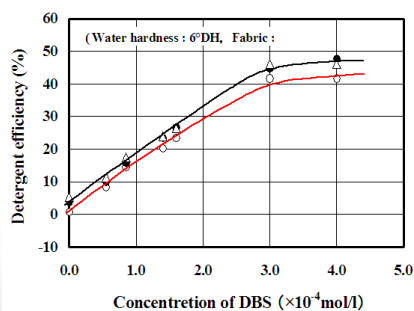


Fig. Relationship between detergent efficiency and concentration of sodium dodecylbenzene-sulfonate for different amounts of zeolite

Table Residual calcium-ion concentration for different weight fractions of zeolight in the case of 6°DH-water

Sample name	Zeolite (wt%)	Concentration of calcium-ion (mg/l)
1A	—	41.0
2B	ZL-6 (0.10)	4.4
2C	" (0.20)	0.7
2D	" (0.40)	0.2
1B	ZL-5 (0.10)	30.0
1C	" (0.20)	30
1D	" (0.40)	30