

The background features a dark blue field with several circles of varying sizes and shades of blue. A small, bright blue circle in the top-left corner contains the text 'MMB'.

MMB

MethoxyMethylButanol

Home & Air care ingredient

kuraray



Agenda

1. MMB – Home Care
 2. MMB – Air Care
 3. MMB – Other applications
 4. MMB-AC
- 

A respectful
ingredient

A circular inset image showing a close-up of a person's hand, palm up, holding a small, torn strip of white paper. The word "SAFE" is printed in bold, dark red capital letters on the paper. The background of the entire image is a solid dark blue.

SAFE

A safe ingredient

For users

- Incidental Food Contact
- Low allergenic risks
- Low toxicity
- Registered REACH
- Listed CTFA

For the environment

- Biodegradable
- Low eco-toxicity
- Approved by US EPA* as DFE* solvent
- Listed “cleangredients” in 2009
- European Ecolabel compliant



* : CTFA : Cosmetic Toiletries and Fragrance Association
EPA : Environmental Protection Agency
DFE : Design for the Environment



Registered worldwide

• CAS Number : 56539-66-3	✓ EINECS (EU)	: Listed (260-252-4)
	✓ Swiss	: Listed (G-117002)
• INCI Name : Methoxymethylbutanol	✓ TSCA (US)	: Listed
	✓ DSL (Canada)	: Listed
	✓ AICS (Australia)	: Listed
	✓ NZIoC (New Zealand)	: Listed
	✓ ENCS (Japan)	: Listed (2-3079)
	✓ ECL (Korea)	: Listed (KE-24367)
	✓ CRC-SEPA (China)	: Listed
	✓ ASIA-PAC	: Listed
	✓ PICCS (Philippine)	: Listed
	✓ REACH	: Registered by Kuraray Europe

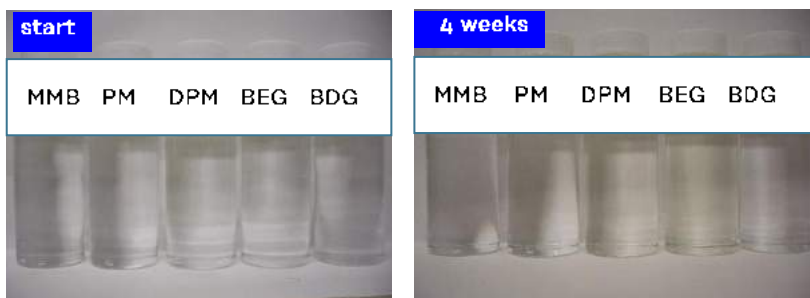


A stable product

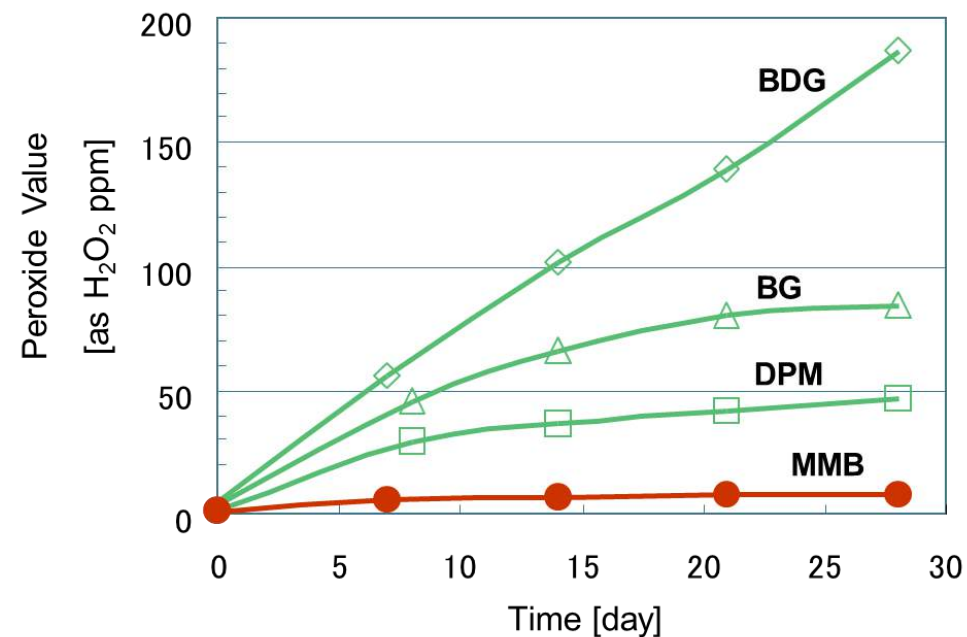
pH 12 (Solutions kept 4 weeks at 50°C)



pH 2 (Solutions kept 4 weeks at 50°C)



MMB and auto-oxidation



→ MMB is stable at low and high pH.

→ MMB stable vs oxydation.

Home Care





Benefits of MMB for detergency

- Clear and colorless liquid
- Good solvency properties
- Stable molecule
- Amphiphile
- Mild odor
- Safe product for users
- Eco-friendly
- Enables to decrease the amount of surfactant

Detergent type ?

Multi purpose
cleaner, grease
remover, window
cleaner....

To clean what ?

Nearly
everything:
Kitchen,
Bathroom,
Car...

Technology ?

Spray, wipes,
liquid based...



MMB for Home Care

1. Laundry detergents
& stain removers
2. Multi-purpose cleaners
3. Degreasers & Oven cleaners
4. Alternative to D-Limonene

Laundry detergents and stain removers



MMB in concentrated laundry detergent

Dilution of surfactants in water

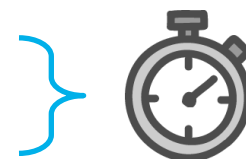
Concentrated formation

POE(6)Lauryl ether	35wt%
LAS	10wt%
Sodium myristate	5wt%
Monoethanol amine	5wt%
Solvent	10wt%
Water	35wt%
Total	100wt%

0.1g →

Cold water 100mL

stirred at 5°C



Dissolution time is measured.

Transparent solution

<u>Solvent</u>	None	PG	BEG	Ethanol	BDG	MMB
Time [sec.]	810	150	120	90	80	60

→ Even at low temperature, quickest dissolution with MMB.



MMB in spot removers

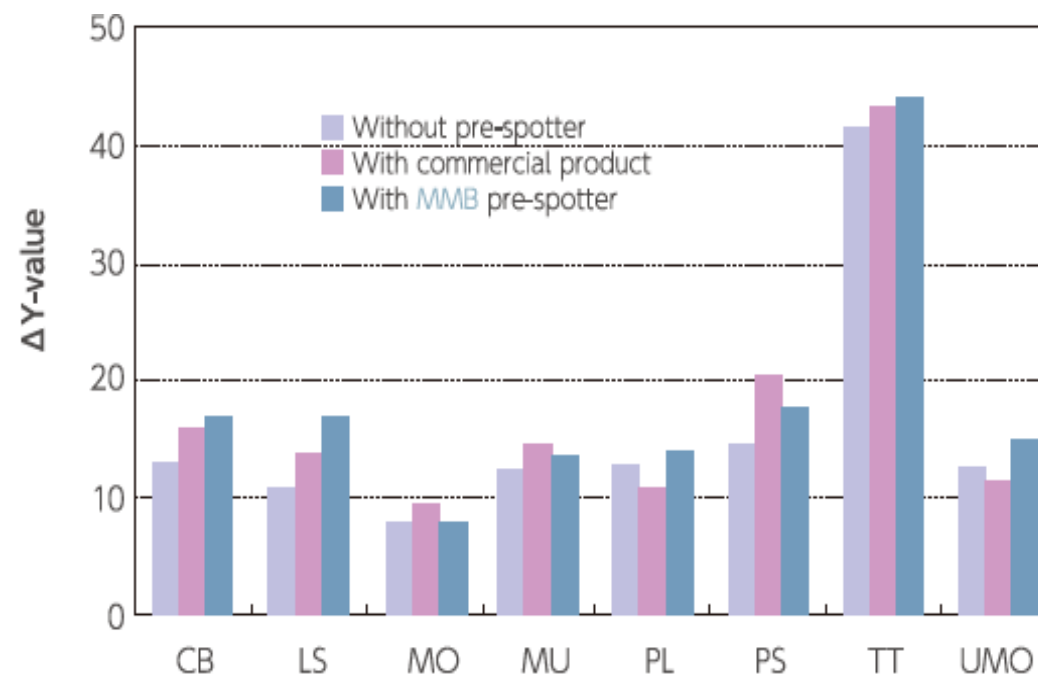
Formulation

Dehydol LT7	nonionic surfactant	(1.5 wt%)
Petresul 550	anionic surfactant	(9 wt%)
Emulan HE50	emulsifier	(2 wt%)
Palmiste	fatty acid	(1 wt%)
NaOH	pH adj	(Adj pH11)
Sodium carbonate	pH adj	(0.5 wt%)
Acticide BB	preservative	(23 ppm)
MMB		(1.0 wt%)
Water		(balance to 100%)

Stains

Carbon black / olive oil	CB	Pigment / lanolin	PL
Lipstick (pink)	LS	Pigment / sebum	PS
Used motor oil	MO	Stain for surfactant test	TT
Make up	MU	Carbon black / mineral oil	UMO

Results :The highest value = best result



Products tested	Without pre-Spotter	With commercial product	With MMB pre-Spotter
Average ΔY-value	15.66	17.47	18.37

→ MMB based pre-spotters help remove stains more easily.

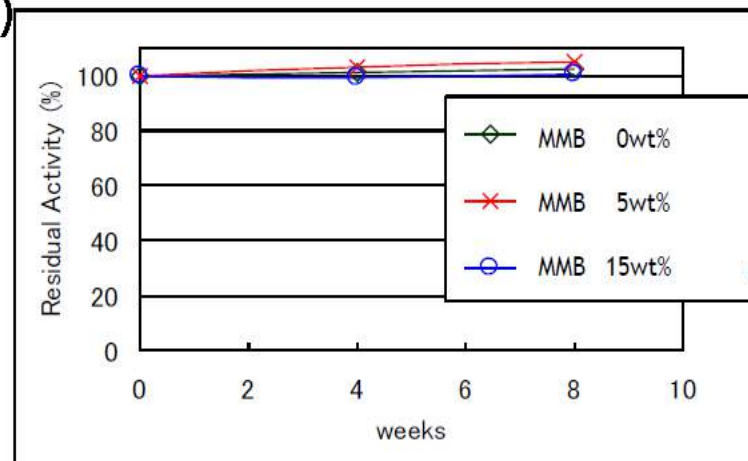


MMB in enzyme-based laundry detergents

- Protease* (protein soil removal enzyme)

Liquanase 2.5L	<1wt%
Calcium chloride	1wt%
PG	25wt%
Sodium formate	5wt%
MMB	0,5,15wt%
Water	rest

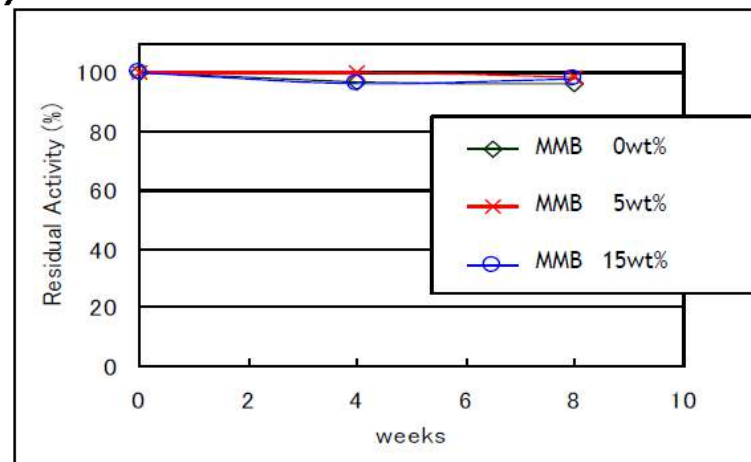
Condition 30°C (86F)



- Amylase* (starch soil removal enzyme)

Stainzyme 12L	<1wt%
Calcium chloride	1wt%
PG	25wt%
Sodium formate	5wt%
MMB	0,5,15wt%
Water	rest

Condition 30°C (86F)



MMB in enzyme-based laundry detergents

- Protease* (protein soil removal enzyme)

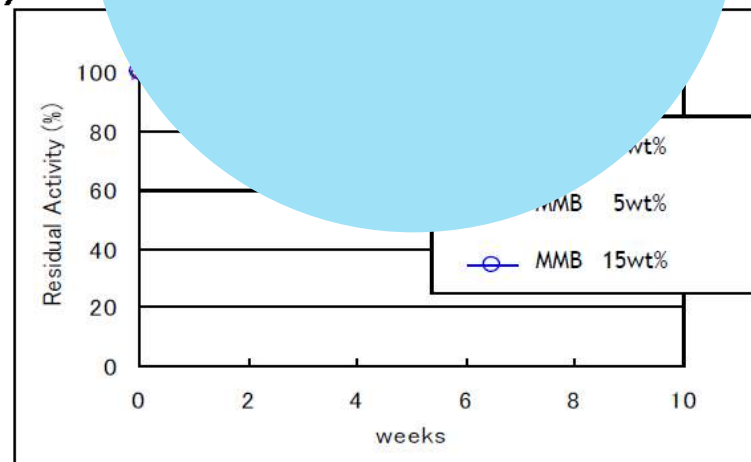
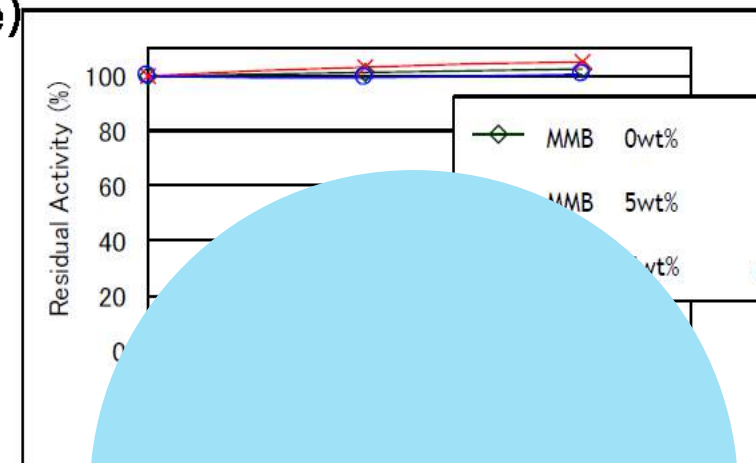
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Water	rest

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Stainzyme 12L	<1wt%
Calcium chloride	1wt%
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Sodium formate	5wt%
MMB	0,5,15wt%
Water	rest

Condition 30°C (86F)



NO INHIBITION



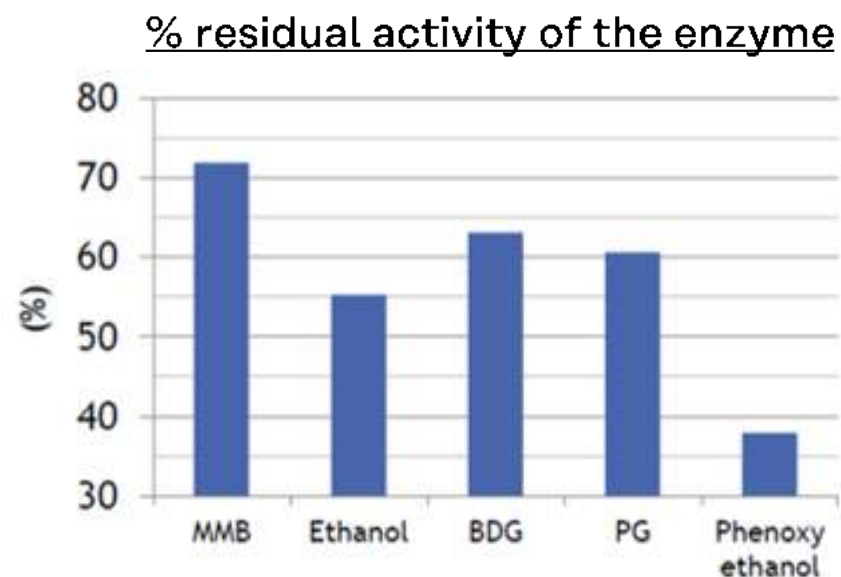
Impact of other solvents on enzyme activity

Protease (protein soil removal enzyme)

	wt%
27% SUNNOL LMT-1430(AES)	37.0
Dodecylbenzenesulfonic Acid	5
90% LEOFAT LA-110M-90R(MEE)	33
Emulgen 108	5
Monoethanolamine	2
Lauric acid	2
Sokalan HP25	1.2
PPG4000	0.5
Sodiumu lactate	0.5
Sodium benzoate	0.3
Para-toluenesulfonicacid	0.2
Calcium chloride	0.01
Solvent	6
Alcalase 2.5L	0.3
Water	6.99

Condition

37°C (99F) 4 weeks



The activity of the enzyme is evaluated by measuring the absorbance of tyrosine released by decomposition of the protein.

➔ MMB does less damage on the activity of the enzyme than other solvents.

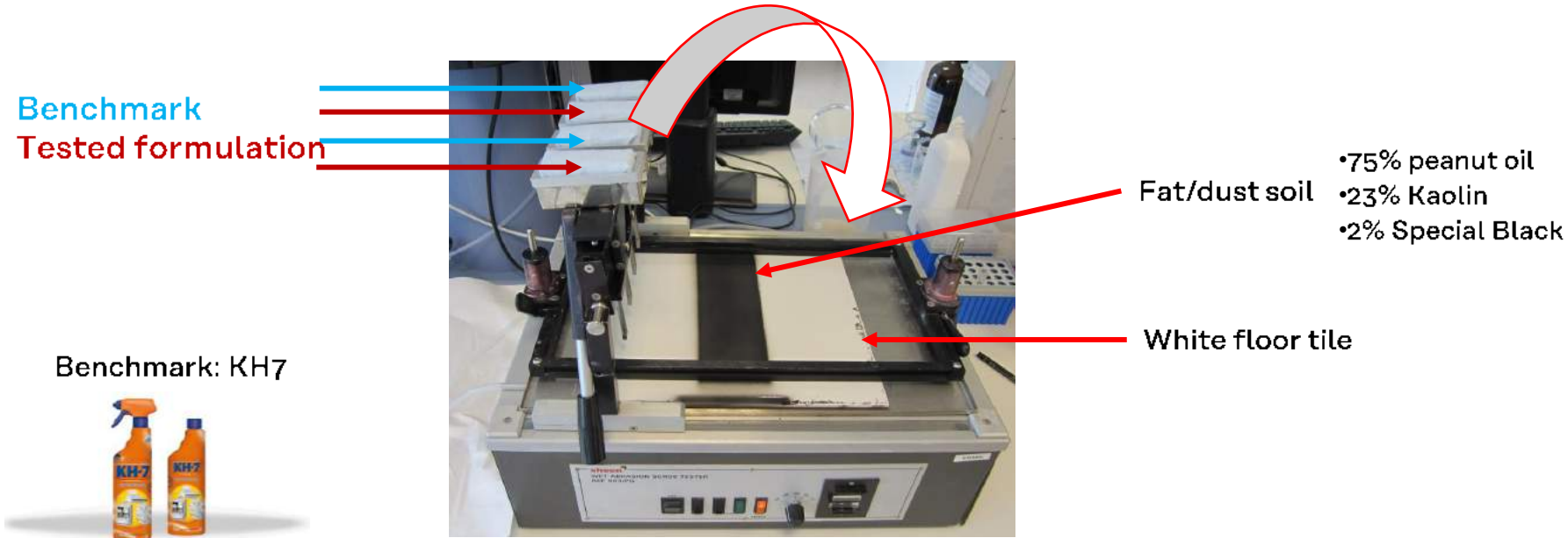
Multi-purpose cleaners



Multi-purpose cleaners

- **Goal:**

Compare cleaning efficiency of formulations containing different hydrotropes with a market reference as a benchmark.



- The test is stopped when we see a difference between the benchmark and the tested formulation.

Multi-purpose cleaners

- Measurement of grease removal efficiency for various hydrotropes

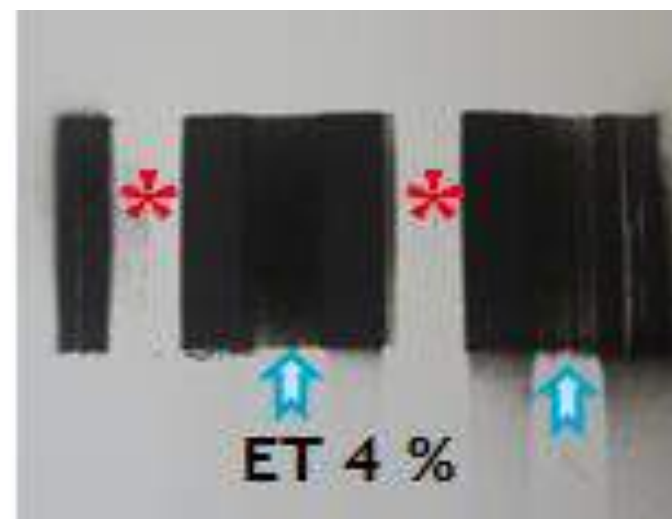
	MMB	Ethanol	ButylGlycol	ButylDiGlycol	MethoxyPropanol
HYDROTROPE	1%	4%	2,30%	2,10%	2,20%
Anionic Surf.*	9%				
Non Ionic Surf.**	1,5%				
Palmistic fatty Acid	1%				
Emulsifier***	2%		Same		
Preservative	0,0023%				
Water	QSP (a.m.)				

All formulations have similar cost

Multi-purpose cleaners

- Measurement of grease removal efficiency for various hydrotropes

	MMB	Ethanol	ButylGlycol	ButylDiGlycol	MethoxyPropanol
HYDROTROPE	1%	4%	2,30%	2,10%	2,20%
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Emulsifier***	2%				
Preservative	0,0023%				
Water	QSP (a.m.)				

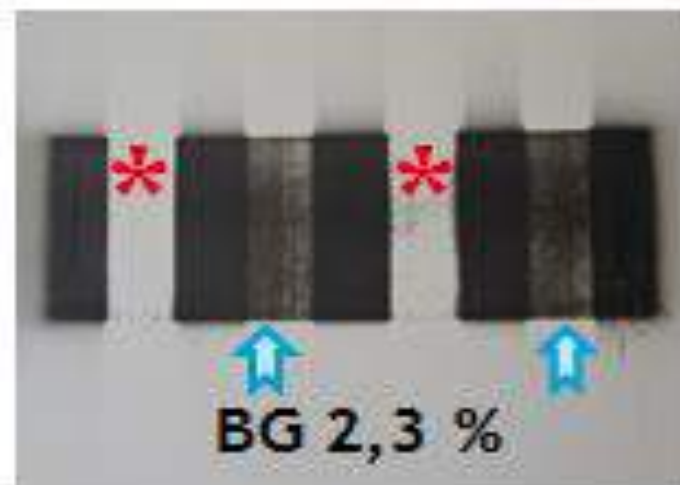


* KH7 > ET 4%

Multi-purpose cleaners

- Measurement of grease removal efficiency for various hydrotropes

	MMB	Ethanol	ButylGlycol	ButylDiGlycol	MethoxyPropanol
HYDROTROPE	1%	4%	2,30%	2,10%	2,20%
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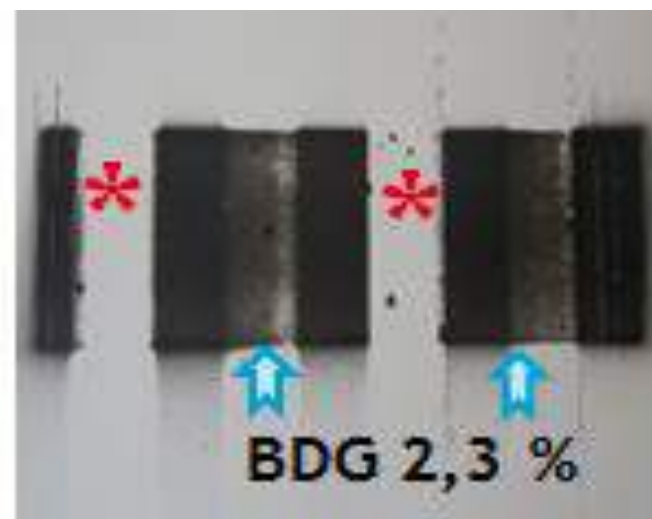


* KH7 > BG 2,3%

Multi-purpose cleaners

- Measurement of grease removal efficiency for various hydrotropes

	MMB	Ethanol	ButylGlycol	ButylDiGlycol	MethoxyPropanol
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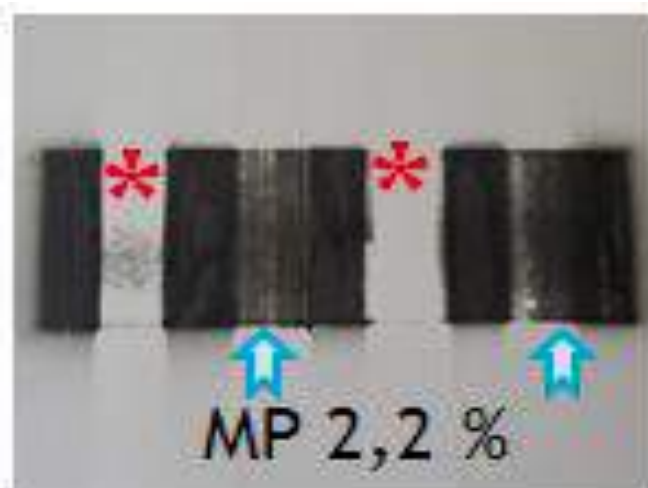


* KH7 > BDG 2,3%

Multi-purpose cleaners

- Measurement of grease removal efficiency for various hydrotropes

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Palmistic fatty Acid	1%				
Emulsifier***	2%				
Preservative	0,0023%				
Water	QSP (a.m.)				



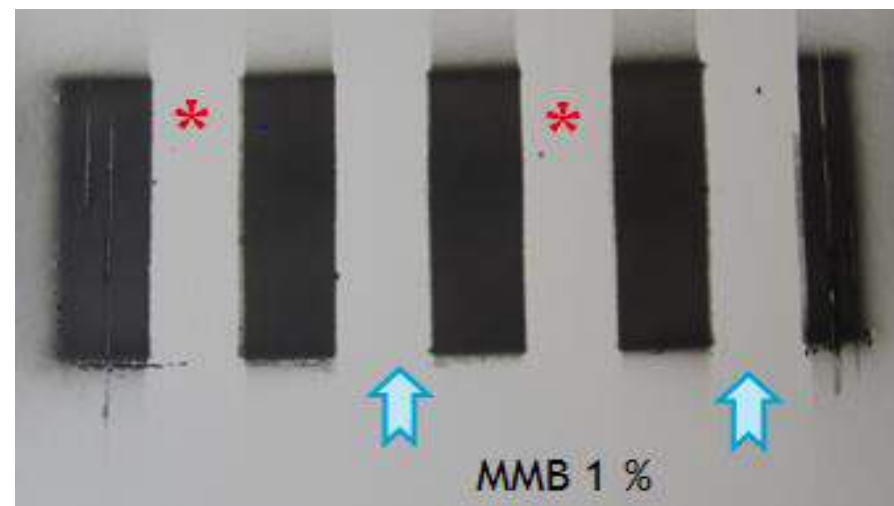
* KH7 > MP 2,2 %



Multi-purpose cleaners

- Measurement of grease removal efficiency for various hydrotropes

HYDROTROPE	MMB	Ethanol	ButylGlycol	ButylDiGlycol	MethoxyPropanol
	1%	4%	2,30%	2,10%	2,20%
Anionic Surf.*	9%				
Non Ionic Surf.**	1,5%				
Palmistic fatty Acid	1%				
Emulsifier***	2%				
Preservative	0,0023%				
Water	QSP (a.m.)				



* KH7 = MMB 1%

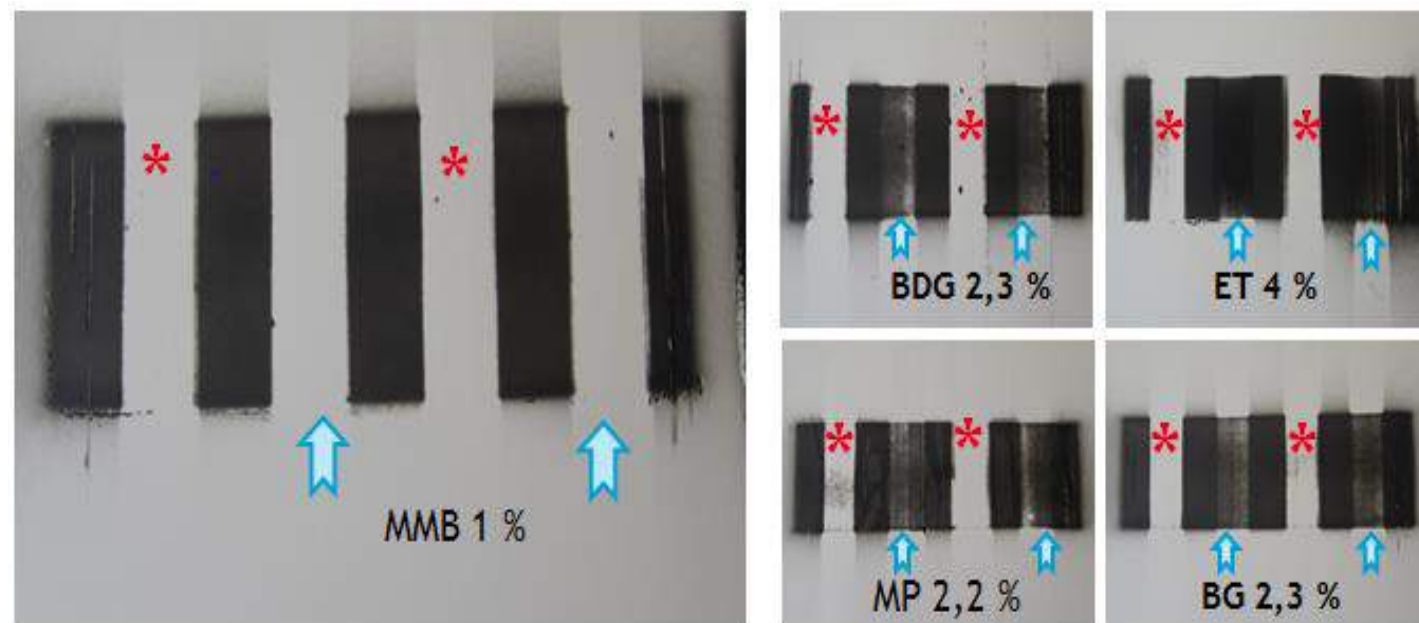
Multi-purpose cleaners

- Measurement of grease removal efficiency for various hydrotropes

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Anionic Surf.*	9%				
Non Ionic Surf.**	1,5%				
Palmistic fatty Acid	1%				
Emulsifier***	2%				
Preservative	0,0023%				
Water	QSP (a.m.)				

Hydrotrope % = to have
formulations with similar cost

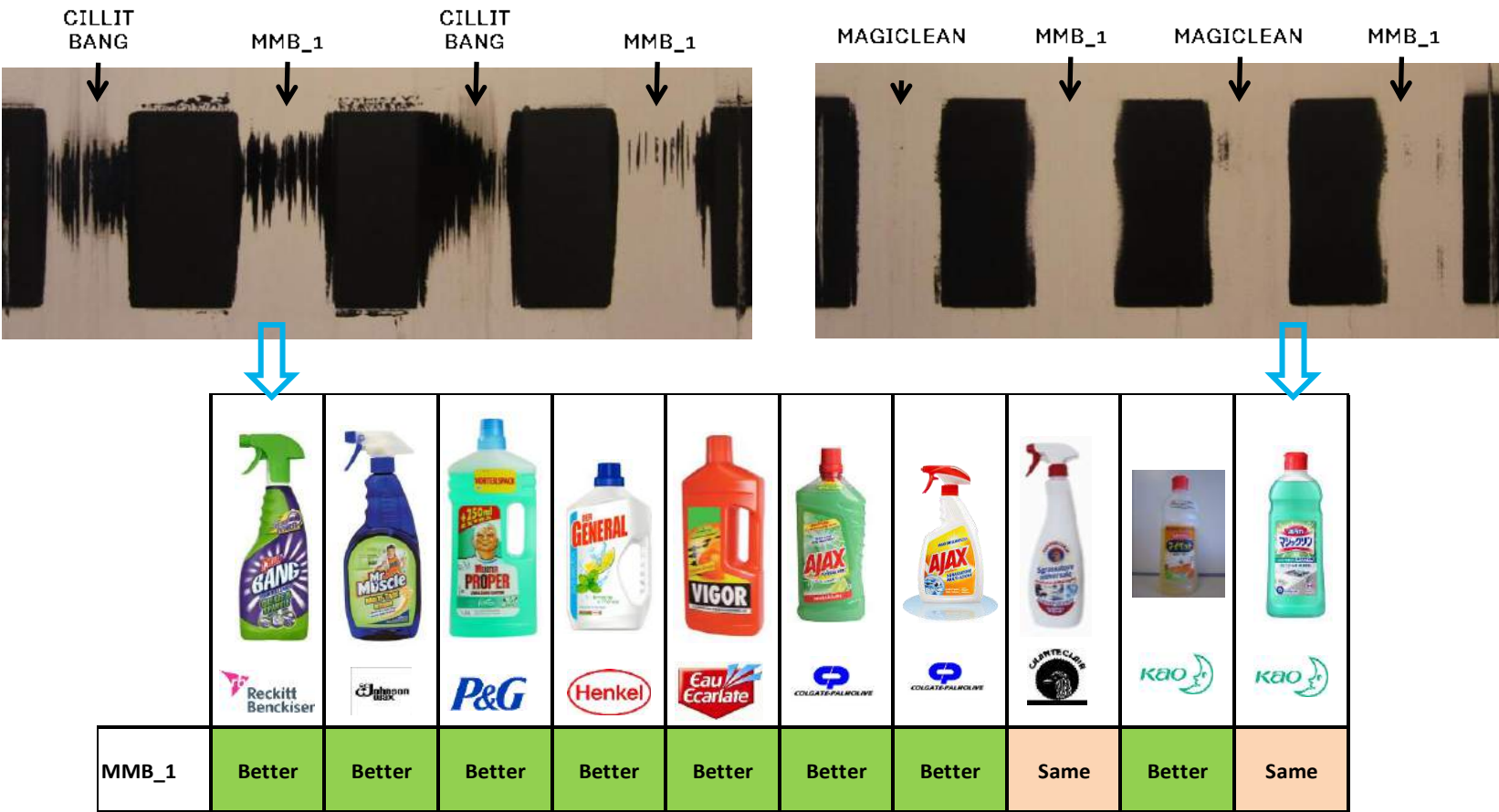
* KH7



→ Even though there is only 1% of MMB, the formulation is by far the most efficient.

Multi-purpose cleaners

- Comparison of 1% MMB formulation to commercial “All Purpose Cleaners”



→ The MMB formulation is more or at least as efficient as commercial products.

Degreasers & Oven cleaners

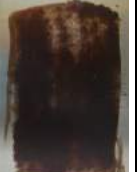




Efficiency of MMB in oven cleaner

Comparison between 2 commercial products and two formulations containing 5% of MMB with (OC4) or without (OC5) surfactants.

PREMIUM CLEANER	PRIVATE LABEL
CILLIT BANG DEGREASING (Reckitt Benckiser) pH= 11,05	CARREFOUR DEGREASING (CIM) pH= 10,72
	

Product	Gravy sauce before cleaning		Gravy sauce after soft rubbing		Average
OC-4					3,38
OC-5					3,25
Cillit Bang					1,63
Carrefour					1,5

pH 11,73
With surfactants

pH 11,60
Without surfactants

➔ MMB boosts the degreasing effect even without any surfactant.



MMB as an alternative to D-Limonene

Why replace D-Limonene ?

- Price
- Labelling
- Allergenic

Regulation (EC) No. 1272/2008

Hazard components for labelling

Limonene

Signal word:

Danger

Pictograms:



Hazard statements

H222

Extremely flammable aerosol.

H229

Pressurised container: May burst if heated.

H315

Causes skin irritation.

H317

May cause an allergic skin reaction.

H410

Very toxic to aquatic life with long lasting effects.

Advantages of MMB :

- Better Labelling
- Not classified as allergenic
- Not skin irritant
- Good synergy with / replacer of D-Limonene
- Cheaper
- Eco-friendly

Disadvantage : No Citrus fragrance.

Air Fresheners



Commercial air fresheners using MMB



Also: Car plugs, aerosols, automatic diffusers, air freshener gels, candles...

Benefits of MMB for air care

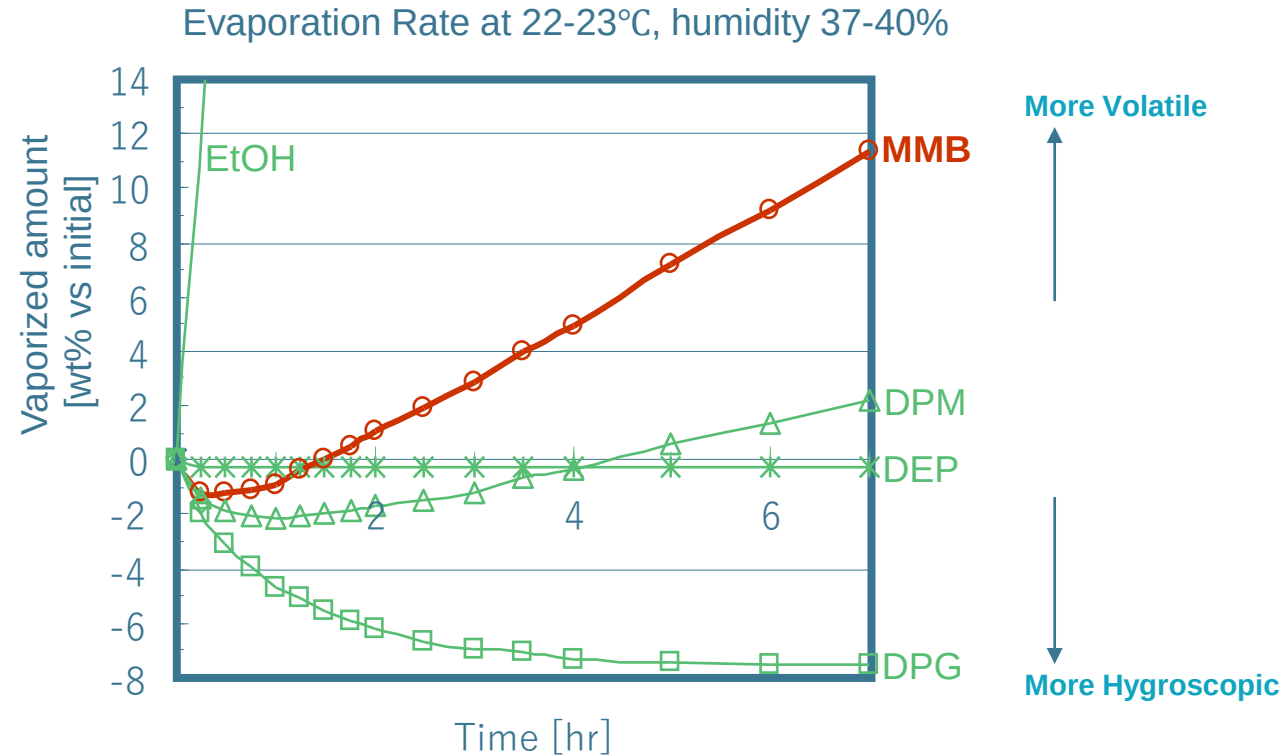
- Good solvency properties
- High flash point (71°C)
- Unique evaporation profile
- Low sensitivity to humidity
- Mild odor
- Low toxicity
- Compatibility with a wide range of aroma chemicals

	MMB content
▪ Gel	4%
▪ Liquid	5-25%
▪ Fan-Plug	45-80%
▪ Pump-Spray	10-30%
▪ Reed diffuser	60-80%



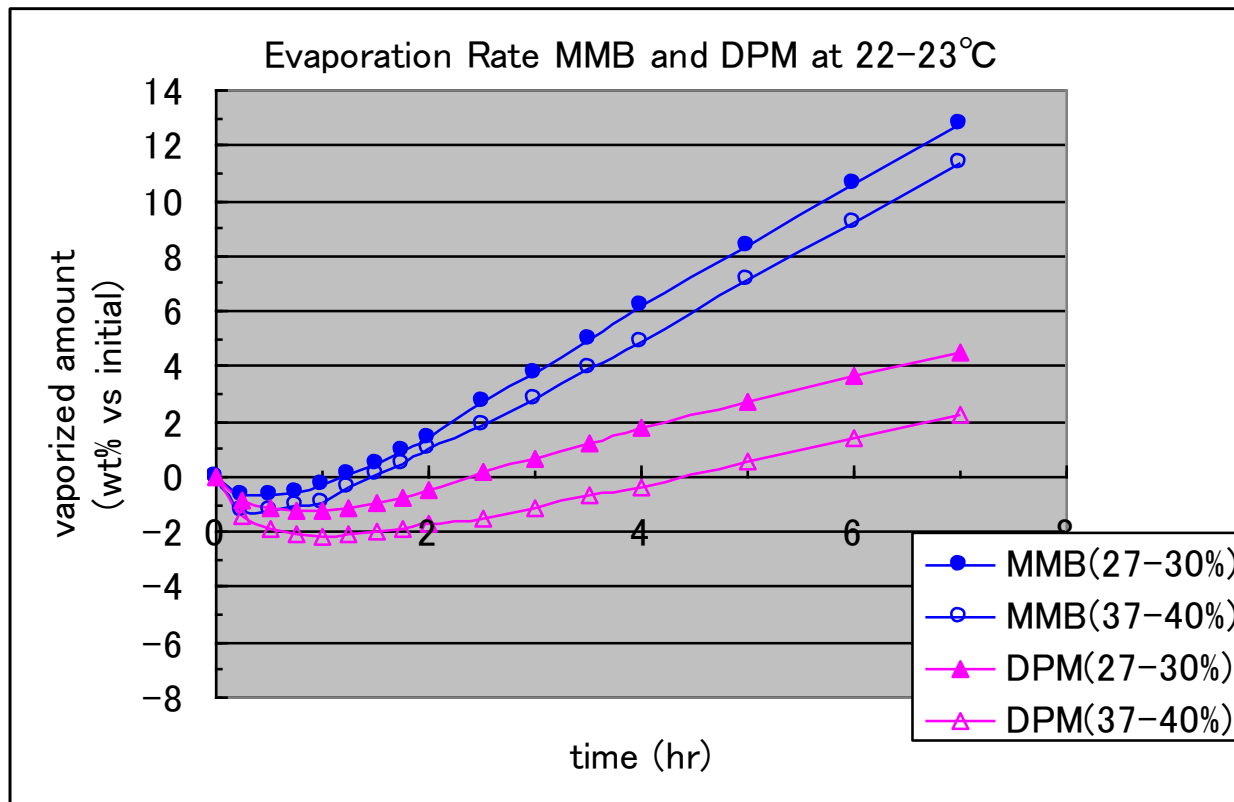
Historically the first use of MMB

Unique Evaporation profile



➔ MMB can be used to adapt the evaporation profile of air fresheners.

Low sensitivity to humidity



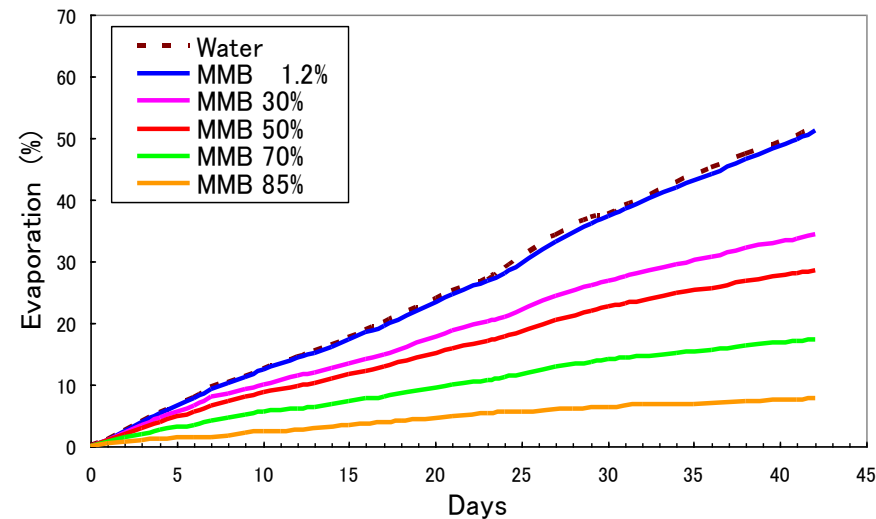
→ Less hygroscopic than other molecules.

→ Humidity has less impact on the evaporation profile of MMB.



MMB and Water

→ Evaporation rate of MMB controlled with water.



→ The flash point can be increased with water.

→ Azeotrope Water/MMB : 85/15.

% MMB / %Water	Flash Point
100 / 0	71 ° C
99 / 1	72 ° C
97 / 3	75 ° C
95 / 5	80 ° C
90 / 10	Not measurable



A tool to solve formulation problems

Water based air fresheners for wick type
(same Fragrance)



MMB based

DPM based

Ethanol based

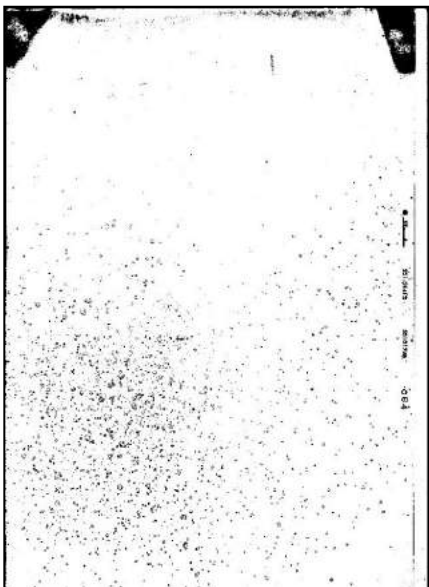
- Helps solubilizing most of fragrance components.
- Helps getting clear solutions. (i.e. D-Limonene)
- Prevents from recrystallization problems. (i.e. Vanilin)
- Enables to decrease the amount of surfactant in formulations (less clogging of the wick) .



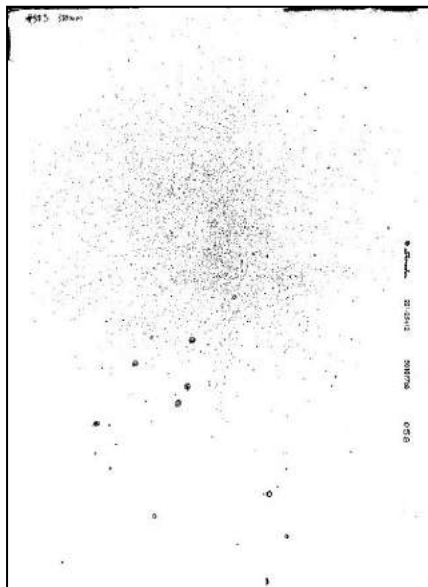
Other benefits

Spray

▪ Sample A (no MMB)



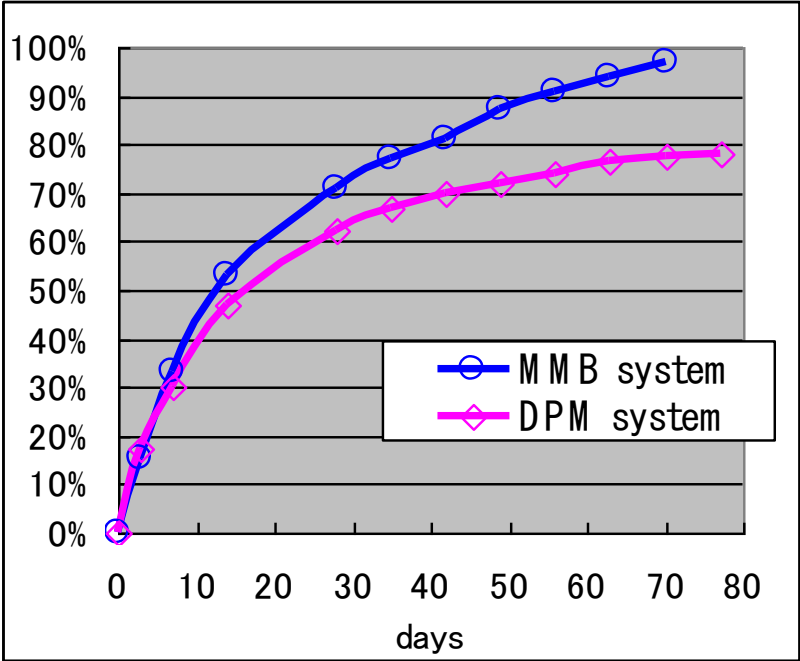
• Sample B (MMB)



	A	B
water (wt%)	40	4
MMB (wt%)	0	30
EtOH (wt%)	38	50
Surfactant(wt%)	5 ~ 8	0%
others (wt%)	3 ~ 5	16

Reed diffuser

● MMB system : MMB(80%)、Fragrance(20%)
● DPM system : DPM(80%)、Fragrance(20%)



Conditions of the test : Liquid (25g) in a bottle(110ml)
with 5 reeds (25cm in length) At room temperature(17-25°C)

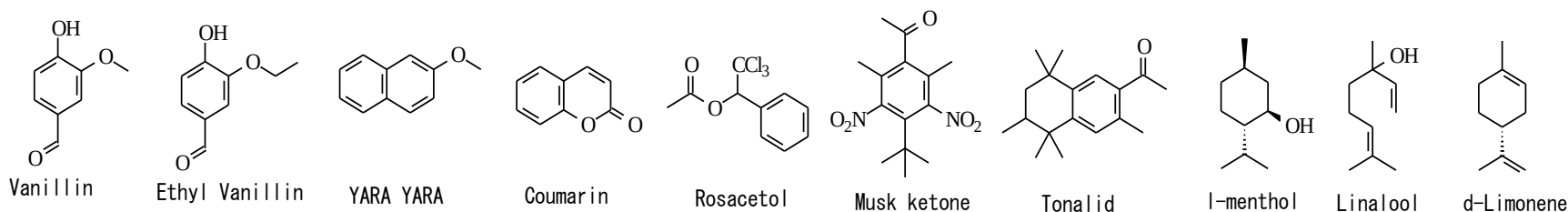
➡ Sample B: Size of the particles are **finer**.

No surfactant = No more white marks on the surfaces.

➡ Evaporation of 100% in 70 days.

Solubility of aroma chemicals

(in wt%)	Vanillin	Ethyl vanillin	YARA YARA	Coumarin	Rosacetol	Musk ketone	Tonalid	Menthol	Linalool	d-Limonene
MMB	36	39	12	19	11	9	45	46	∞	∞
DPG	29	27	8	14	4	2	5	42	∞	32
PG	36	15	2	8	1	1	1	42	∞	2
IPD	41	20	2	8	2	1	5	43	∞	10
DPM	35	35	17	23	16	9	40	45	∞	∞
Isopar-M	<1	<1	2	<1	1	<1	50	∞	∞	∞
Isopar-M/MMB 50/50	4	4	9	3	7	5	50	∞	∞	∞



➔ MMB is compatible with a wide range of aroma chemicals.



Air fresheners typical content

Type	MMB	Fragrance	Water	Surfactant	Other solvents	Others
Reed diffuser	70~90%	~20%			DPMA 0~20%	
Water based wick	~3%	~2%	95%	~1%		
Water based gel	10~15%	2~5%	balanced	nonionic 5~10%	EtOH 2~5%	Water absorbing resin 1%
Fan	~90%	~10%			DPM 0~20%	
Automotive	~90%	~10%			DPM 0~20%	
Plug-in	~80%	~20%			PG or DPG 0~20%	
Aerosol	1~5%	2~5%			EtOH balanced	Propellant 50~70%
Pump-spray	~30%	~2%	5~20%	~1%	EtOH ~70%	

Other applications



Soap bars



- The presence of MMB in soap bars is useful to solubilize anti-oxidants such as O-tolyl biguanide (OTB).
- MMB has also proven to have good grease removing and cleansing properties. Moreover, it is listed CTFA.

Liquid hand soap / hand sanitizer

- Degreasing benefits
- Gentle on the skin
- Good substitute of D-Limonene
- Eco-friendly



Window cleaners

- Removes dirt, fingerprints, water and oil residues ...
- Less streaks after use.
- Less surfactants.

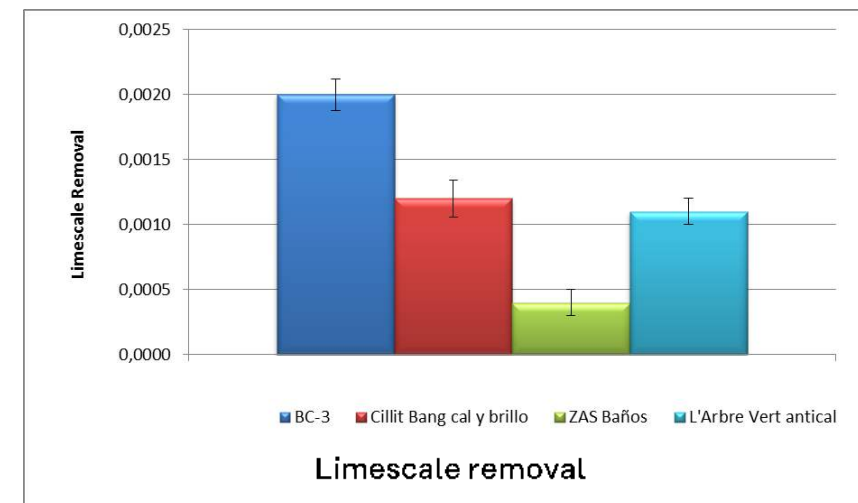
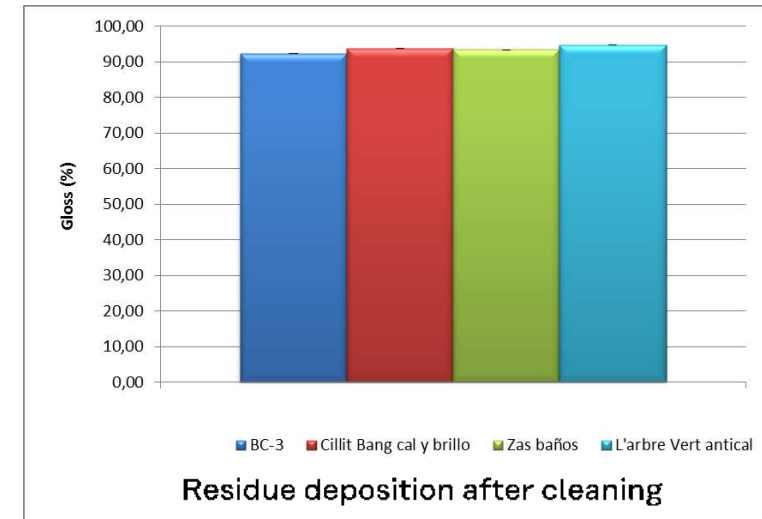


Bathroom cleaners – Anti-limescale

Comparison of 3 commercial products with a 3% MMB formulation (without surfactants).

PREMIUM CLEANERS		ECO CLEANER
		
Cillit Bang cal y brillo pH = 0,75	ZAS Baños pH = 3,80	L'Arbre Vert antical pH = 2,90
RECKITT BENCKISER PLC	KH LLOREDA S.A.	NOVAMEX S.A.

- MMB is stable at very low pH (pH = 2,98).
- A 3% MMB formulation without surfactant enables efficient limescale removal and low residue deposition on hard surfaces.



Nail polish remover



Acetone / MMB

MMB-based nail polish removers are a good **alternative to acetone-based** ones because :

- Low odor
- No dry feeling, no weakening of the nails
- No whitening of the skin nor nails

If the customer cannot replace all acetone then a mix acetone / MMB reduces the dry feeling and the whitening.



Acetone Free

Perfumes for personal care



Roll-on



Mist



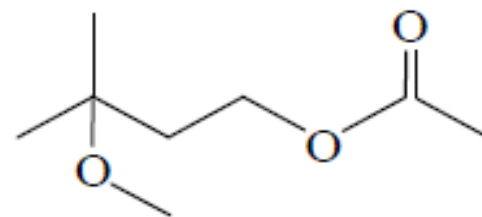
Fine Fragrance

MMB-AC



MMB-AC at a glance

- Name: Acétate 3-methoxy-3-methyl-1-butanol
- Transparent and colorless
- Mild odor
- Partially water soluble (6,8%)



➔ No label

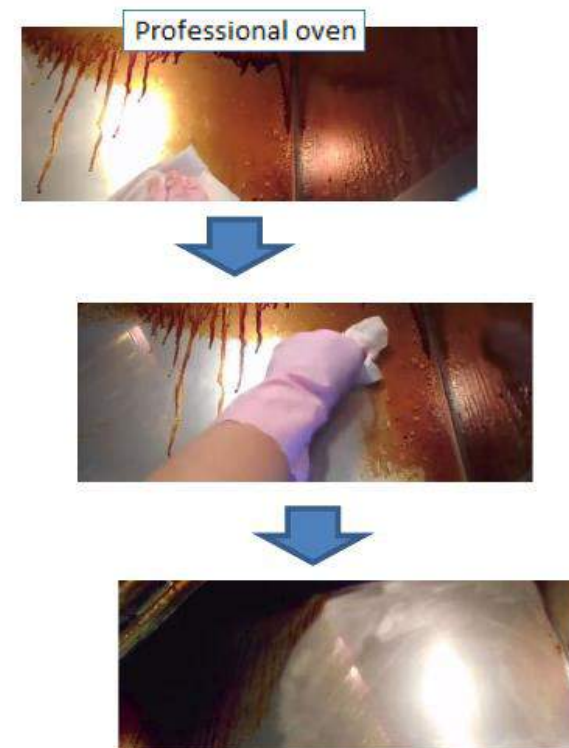
Applications:

- Paint stripper
- Adhesive stripper
- Degreaser in cleaning products
- Alternative to labelled solvents

Heavy duty degreasers

Success story : Bakuochi Tiger – Wipes

Composition : Water, Ethanol (30%), MMB-AC (10%),
Biocide, Fragrance



➔ MMB-AC has strong degreasing properties and doesn't contain any hazardous substances.



Thank you!

kuraray

Effect on plastics & elastomers

<u>Plastics</u>	MMB	BDG	BEG	PM	DPM
rigid PVC	8	15	10	30	15
soft PVC	9	9	-9	-11	-5
PE (Low Density)	0	0	0	0	0
PE (High Density)	0	8	0	0	0
PP	0	0	0	0	0
PS	19	Dissolved	Partially Dissolved	Partially Dissolved	Dissolved
PC	0	Whitening	Whitening	Whitening	Whitening
Polyacetal	0	0	0	4	0
PET	0	0	0	2	0
PBT	0	0	0	0	0
PPS	0	0	0	0	0
PA-6	0	0	0	0	0
PA-6,6	0	0	0	0	0
Teflon	0	0	0	0	0
Epoxy glass	0	0	0	0	0
Acrylic resin	Partially Dissolved	Partially Dissolved	Partially Dissolved	Partially Dissolved	Partially Dissolved
Phenol resin	0	0	0	0	0
ABS	63	47	44	Partially Dissolved	Partially Dissolved

Swelling [volume % vs initial] at 50° C during 7 days

<u>Elastomers</u>	MMB	BDG	BEG	PM	DPM
Fluoro rubber	82	32	24	97	84
Chloroprene rubber	64	99	66	39	65
Butyl rubber	0	6	14	9	6
Nitrile rubber	115	97	80	104	112
Silicone rubber	6	3	14	8	7
EPDM	7	9	10	7	7
Natural rubber	17	63	52	17	22
Urethane rubber	129	127	72	178	162
SBR	26	52	30	25	37