MMB
for Air Fresheners

Isoprene Chemical Division

Kuraray Co., Ltd.





MMB & Air Fresheners

Functions and Benefits of MMB

- Stable in formulation of Air Fresheners

- Constant and controlled diffusion / evaporation of fragrances from Air Fresheners

- Good solvent for Fragrances compatible with wide range of aroma chemicals

- Low risk of oxidation of fragrances and change in scent

Applicable types of Air Fresheners with MMB

Passive

Reed diffuser

Water based wick

Water based Gel

Active Fan　Fan and Heat (～60℃)　Heat (60～80℃)

Fan

Automotive

Plug-in

Spray

Aerosol

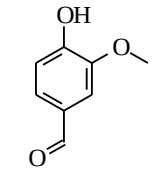
Pump spray

Functions of MMB in Air Fresheners by type

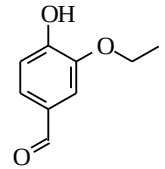
performance requirement	Function of MMB	Reed Diffuser	Water based wick	Water based Gel	Fan	Car	Plug-in	Pump Spray
Stabilization of Formulation	Solvent for Fragrance	✔	✔	✔	✔	✔	✔	✔
	Anti-Freeze		✔	✔				
Constant diffusion of Odor	Controlled and constant evaporation	✔	✔	✔	✔	✔	✔	
	Less effect of humidity on evaporation rate	✔						
	Less oxidation of Aroma chemicals	✔	✔	✔	✔	✔	✔	✔
	Reduce surfactant In water based formulations which causes clogging at wick		✔	✔				

Compatibility of MMB & Aroma chemicals

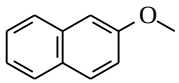
(in wt%)	Vanillin	Ethyl vanillin	YARA YARA	Coumarin	Rosacetol	Musk ketone	Tonalid	Menthol	Linalool	d-Limonene
MMB	36	39	12	19	11	9	45	46	∞	∞
DPG	29	27	8	14	4	2	5	42	∞	32
PG	36	15	2	8	1	1	1	42	∞	2
IPD	41	20	2	8	2	1	5	43	∞	10
DPM	35	35	17	23	16	9	40	45	∞	∞
Isopar-M	<1	<1	2	<1	1	<1	50	∞	∞	∞
Isopar-M/MMB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



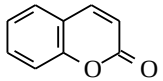
Vanillin



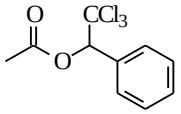
Ethyl Vanillin



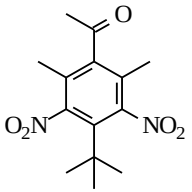
YARA YARA



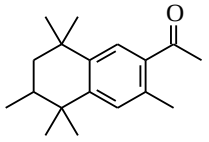
Coumarin



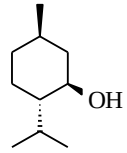
Rosacetol



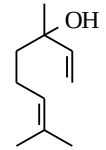
Musk ketone



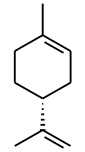
Tonalid



l-menthol



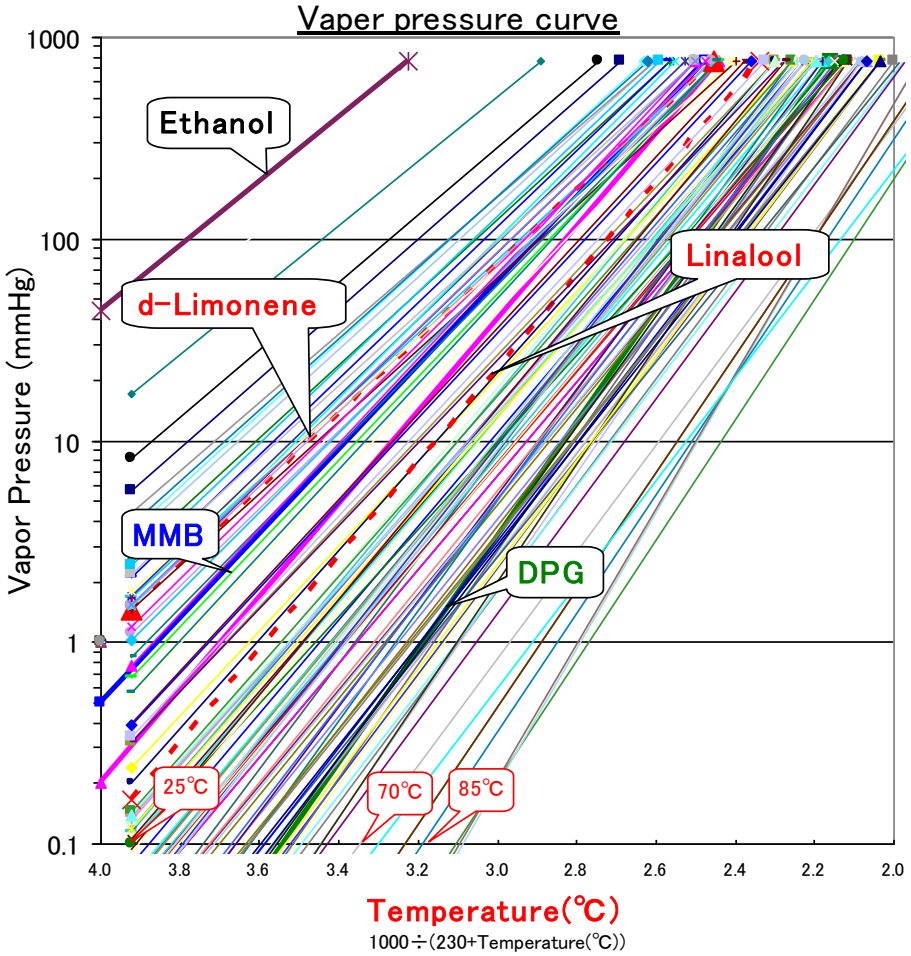
Linalool


d-Limonene

- MMB is better in compatibility with aroma chemicals than DPG.
- MMB has loss odor than DPM.

Evaporation profile-1

Vapor pressure vs Temperature of Aroma chemicals and solvents

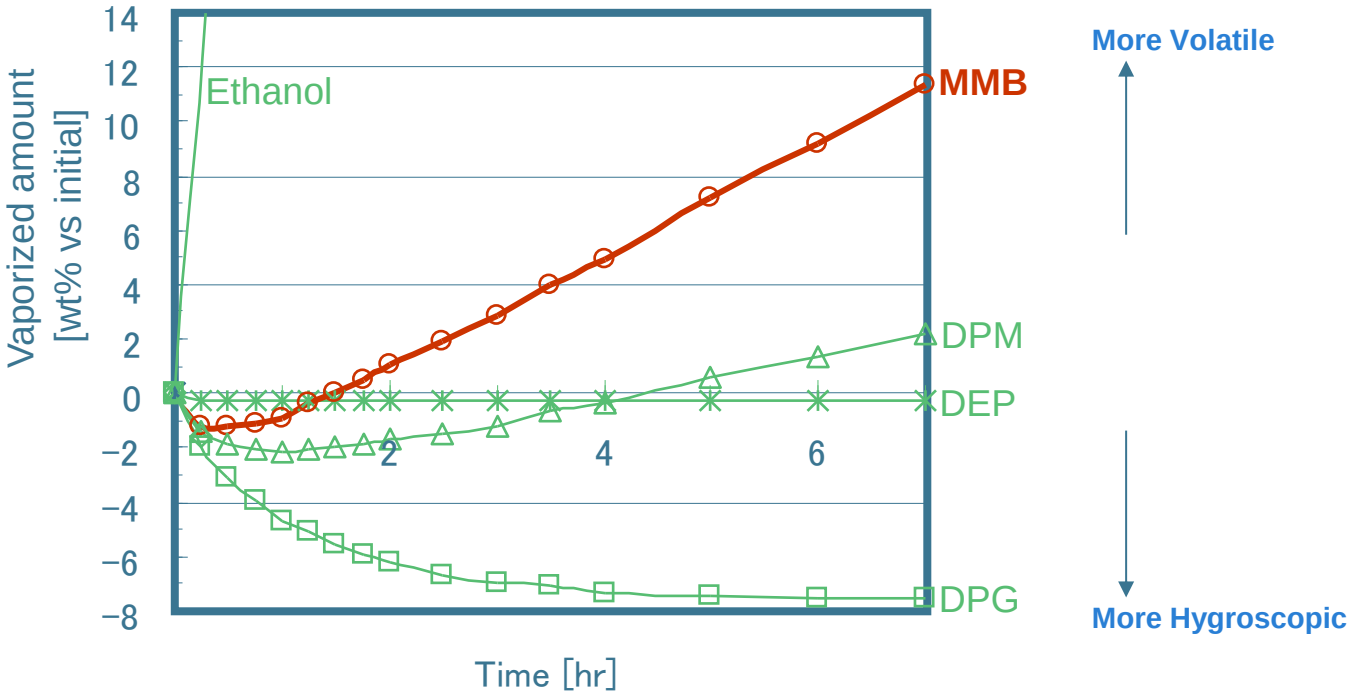


Evaporation profile of MMB is
same as that of Linalool and d-Limonene,
major components of fragrances
for air fresheners.

Evaporation profile-2

Evaporation of solvents at room temperature

Solvent (5.0g) in Petri dish (9cm in diameter)
At room temperature (22—23℃), humidity (37-40%)



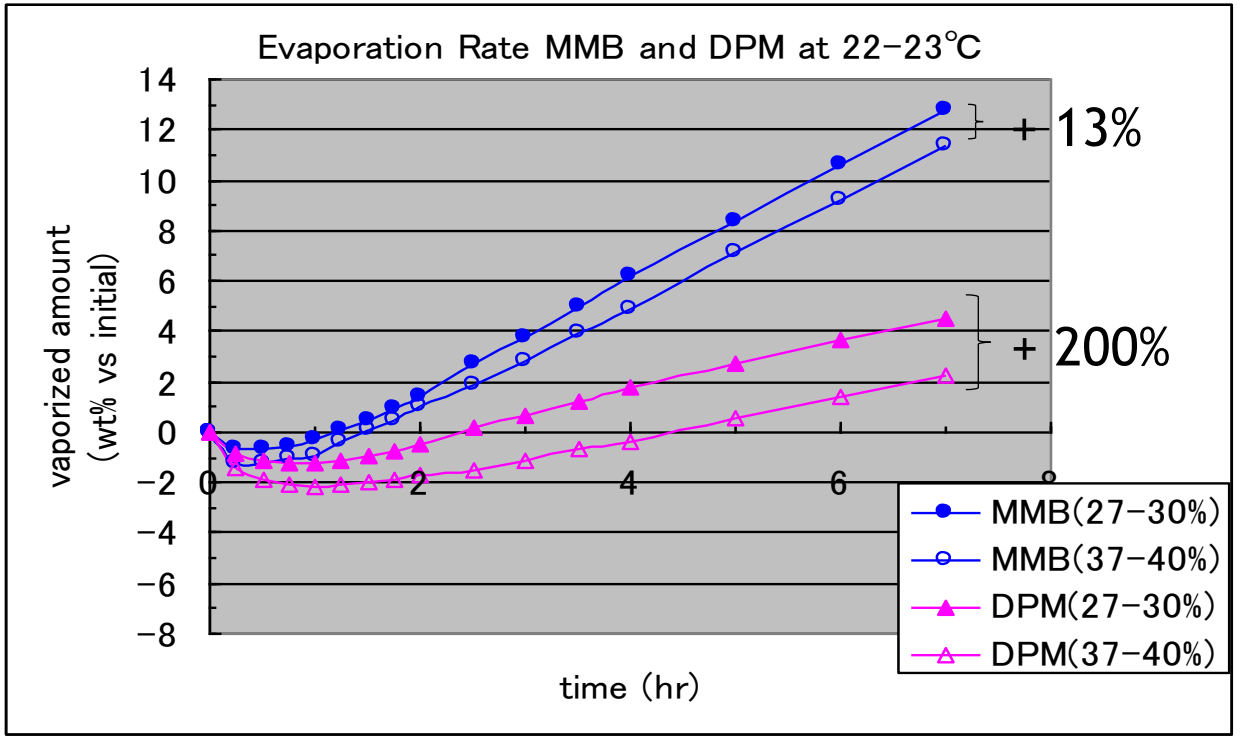
MMB is less hygroscopic than DPM and DPG.

→ Evaporation profile of MMB system is more linear from starting point.

Evaporation profile-3

Impact of humidity on evaporation profile

Solvent (5.0g) in Petri dish (9cm in diameter)
At room temperature (22—23℃), humidity (37-40% / 27-30%)

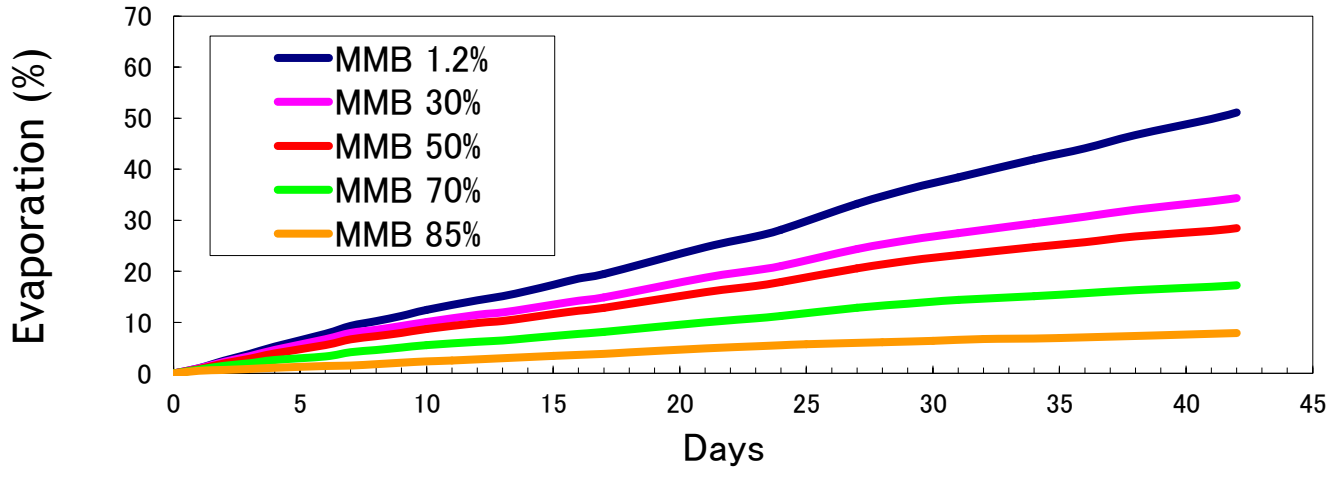


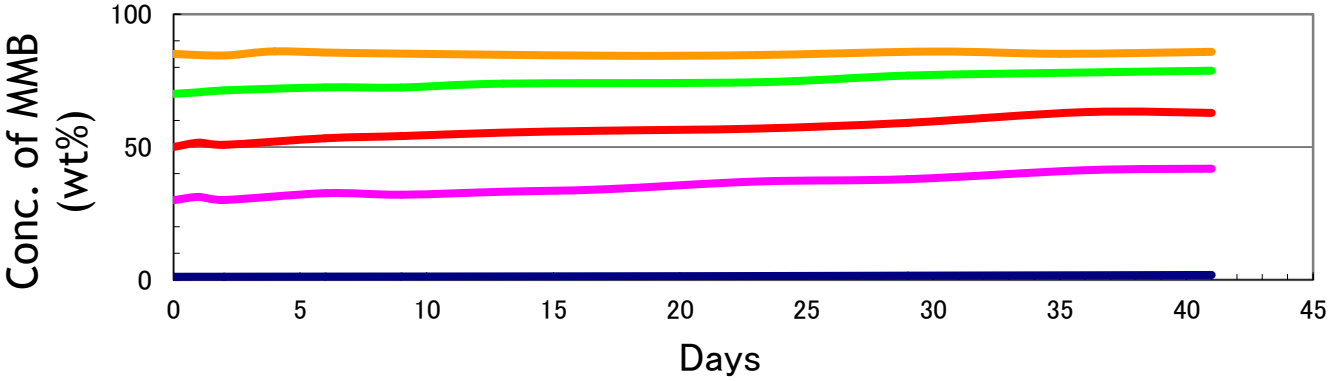
Humidity has less impact on the evaporation profile of MMB vs DPM

Evaporation profile-4

Evaporation of MMB water solution system

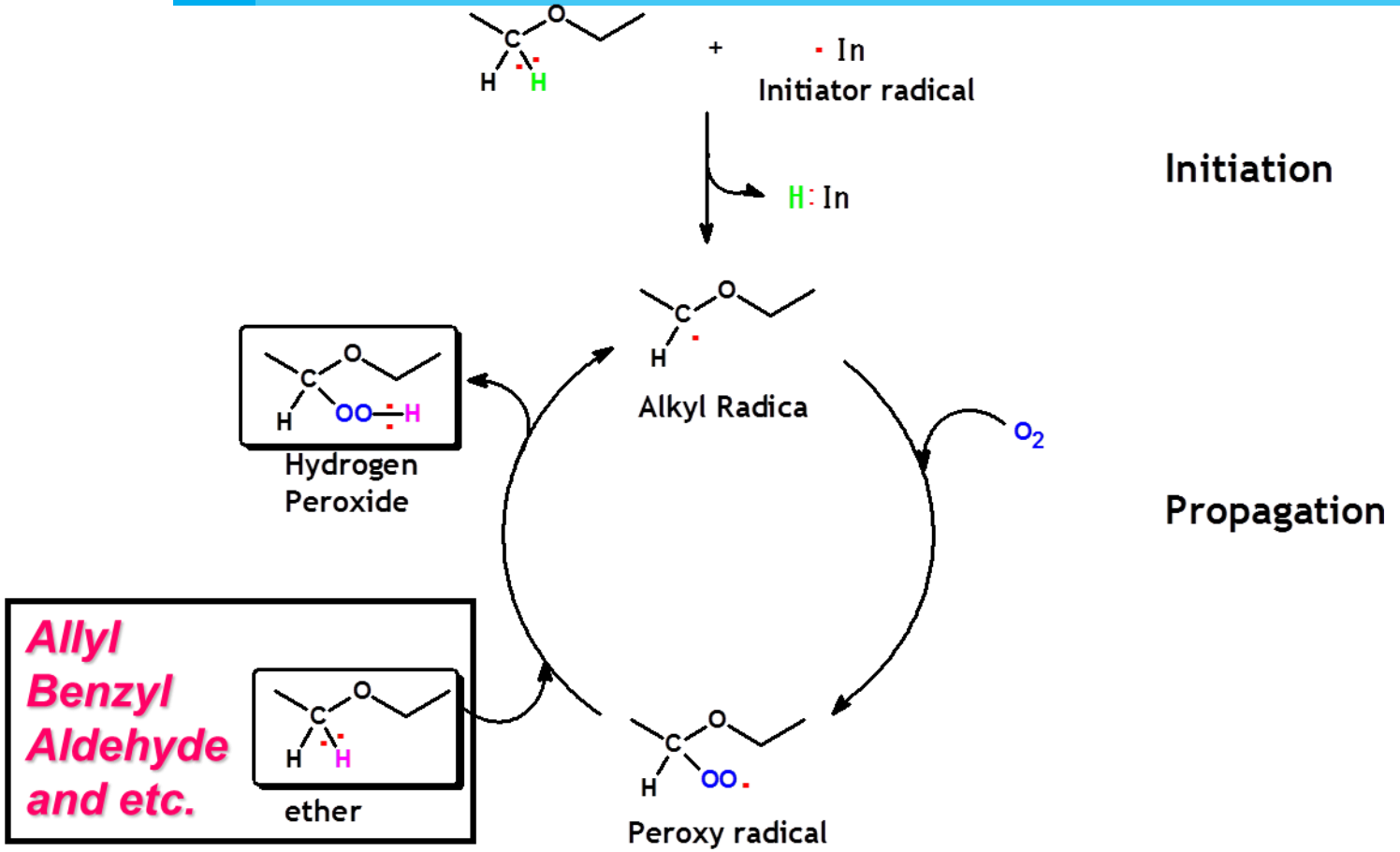
MMB water solution (200ml) in Beaker (300ml) at 25℃





- Evaporation rate can be controlled by concentration of MMB
- No large change in component during the evaporation test.

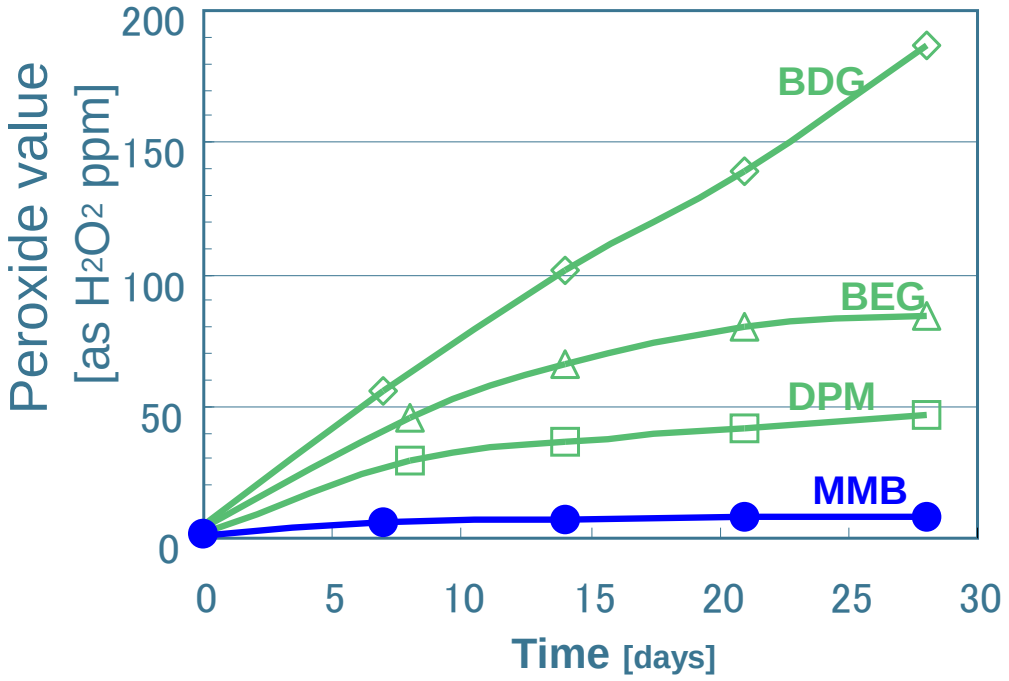
Oxidation of chemicals



If the type of solvent used, is easily oxidized
then oxidation of the other ingredients, Fragrance , will increase.

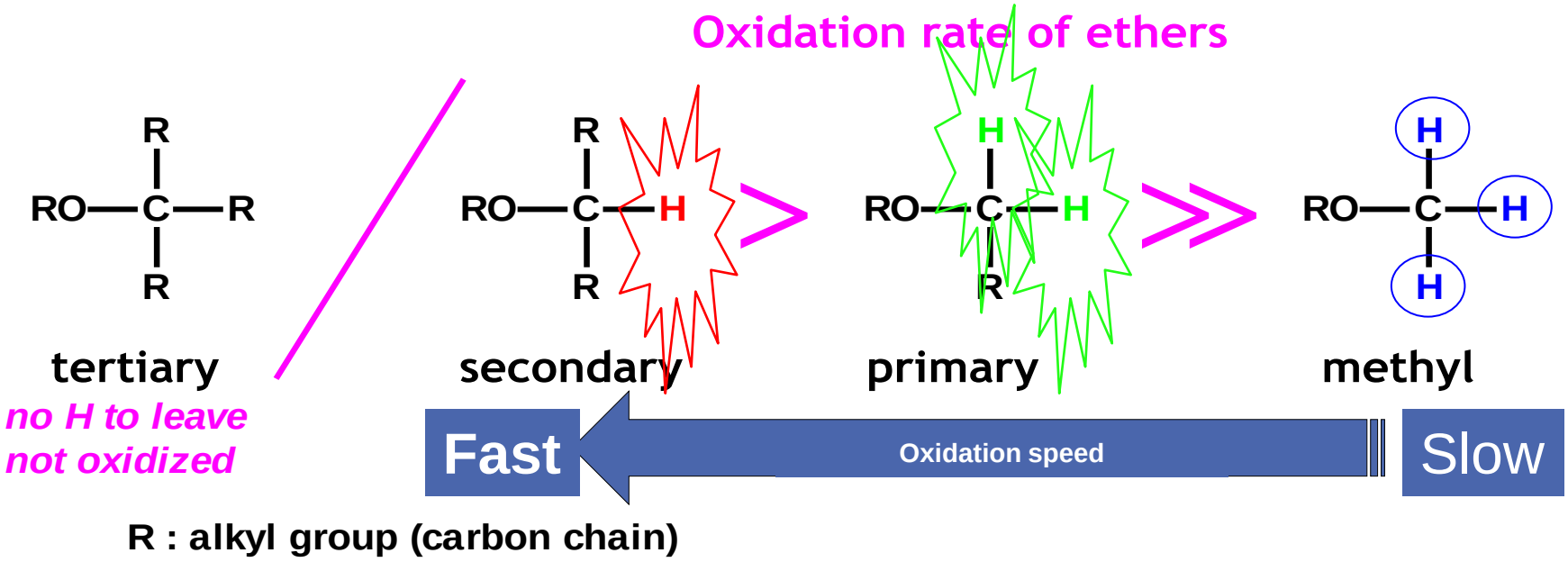
Oxidation of Solvents by the air

Solvent in beaker was exposed to the air at room temperature (22—23℃)
Amount of peroxides in the solvents was measured



MMB does not increase it's peroxide value while the others increase.
→ MMB is stable against oxidation by the air.
→ MMB base air freshener is low in risk of change in scent.

Our chemical understanding about oxidation



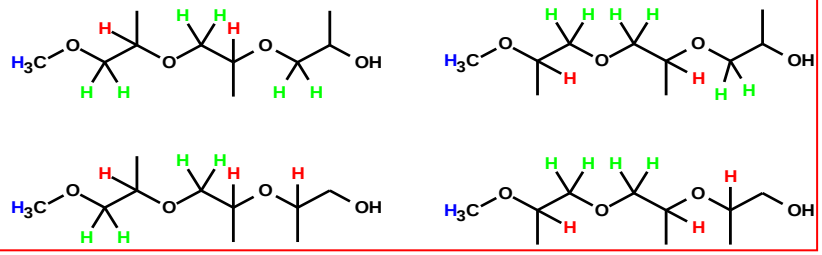
T.A.Eastwood et al., JCS733(1952)

Naito.M et al., Journal of Loss Prevention in the Process Industries 18 (2005) 469

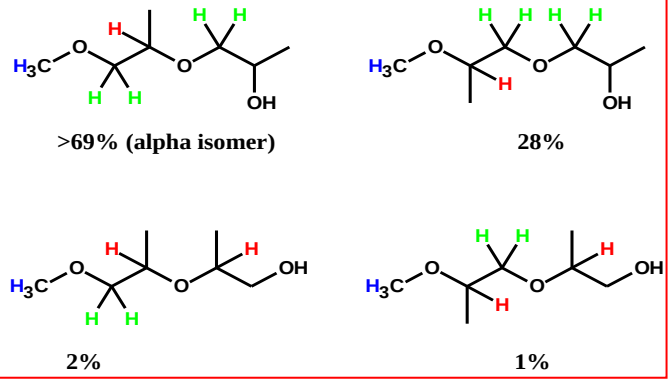
Web site of Sigma-Aldrich: http://www.sigmaaldrich.com/Area_of_Interest/Research_Essentials/Solvents/Key_Resources/Peroxide_Formation.html

Some examples

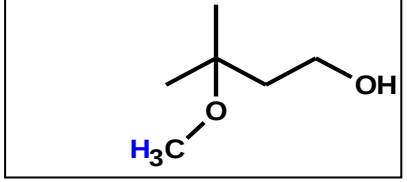
TPM (tripropylene glycol monomethyl ether)



DPM (dipropylene glycol monomethyl ether)



MMB

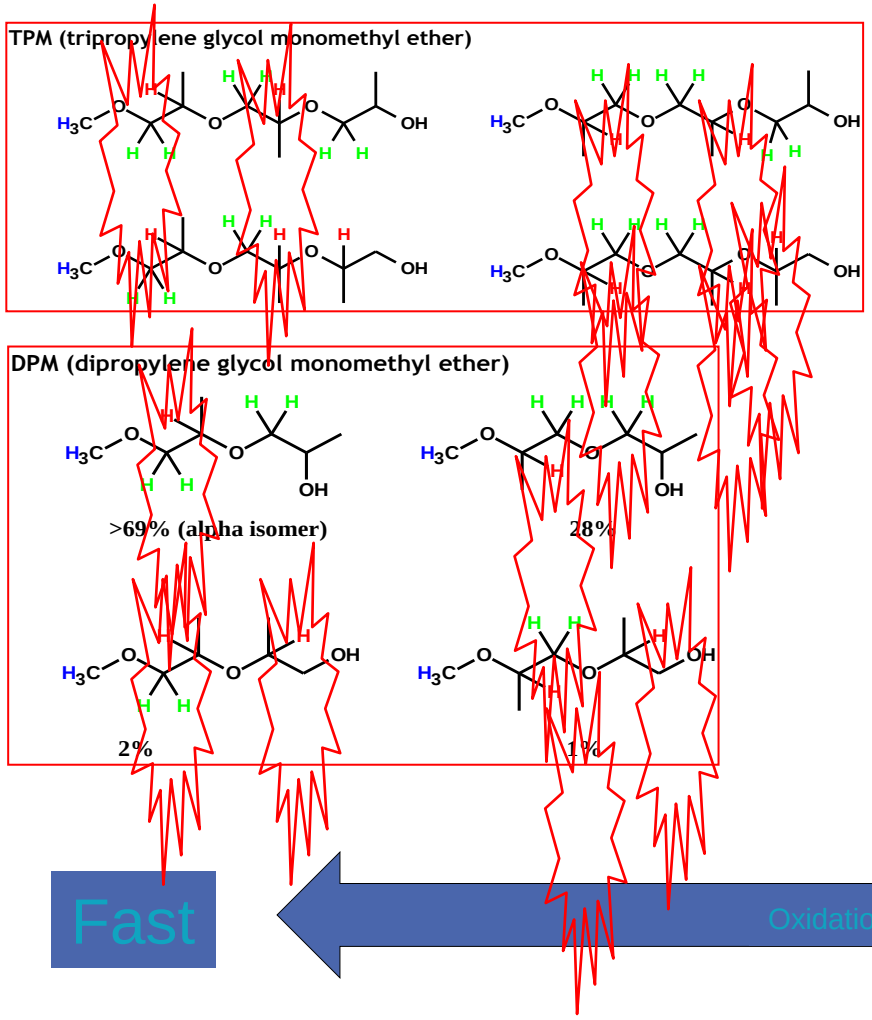


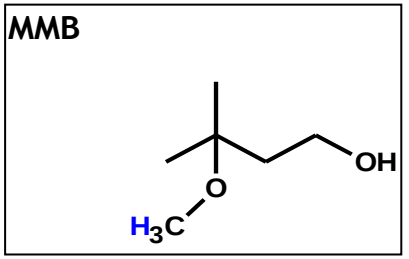
Fast

Oxidation

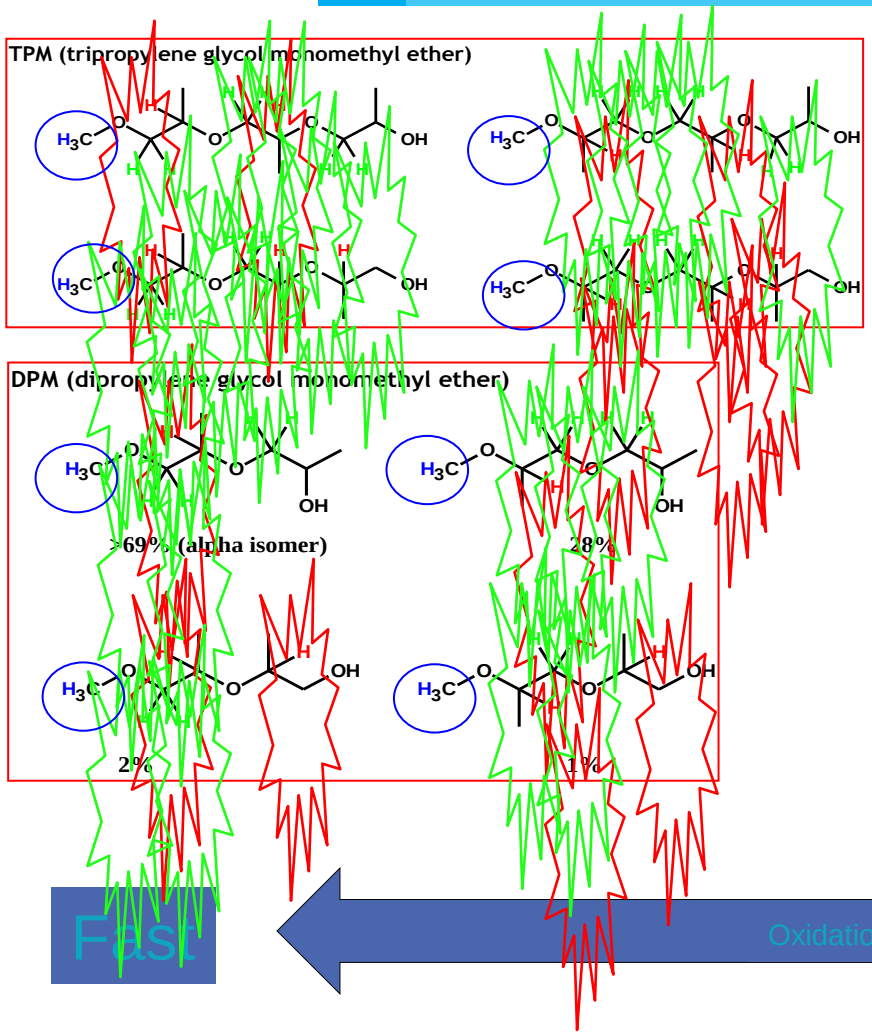
Slow

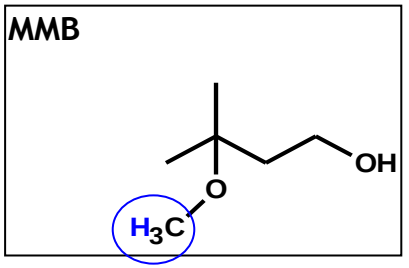
Some examples





Some examples





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Type of Air Fresheners using MMB





1) Water based Wick

Stability of formulation

Appearance of water based air fresheners
With different solvents in a same formulation next page.

MMB based DPM based Ethanol based

1) Water based Wick

1. Formulation and Procedure

	Name of Product	Note	(g)
1)	Emulgen 108	Surfactant Kao	3.5
2)	PELEX OT-P	Surfactant Kao	3.0
3)	Solvent	Solvent Kuraray	3.0
4)	Deionized Water	Deionized Water	5.0
5)	Rose JT10374	Fragrance Symrise	1.5
6)	Denicide EF	Antiseptics Nagase Chemtech	0.1
7)	Deionized Water	Deionized Water	20.0
8)			36.1
9)	Deionized Water	Deionized Water	63.8
10)	**Mixture Liquid A**		36.1
11)	Dye	Colorant	0.1
12)	Total		100.0

Vessel having agitating function

Premix of 1), 2), 3) & 4) is chaged to the vessel

Charge dropwise with vigorous agitation for 30min at r.t.

Mixture Liquid A

Vessel having agitating function

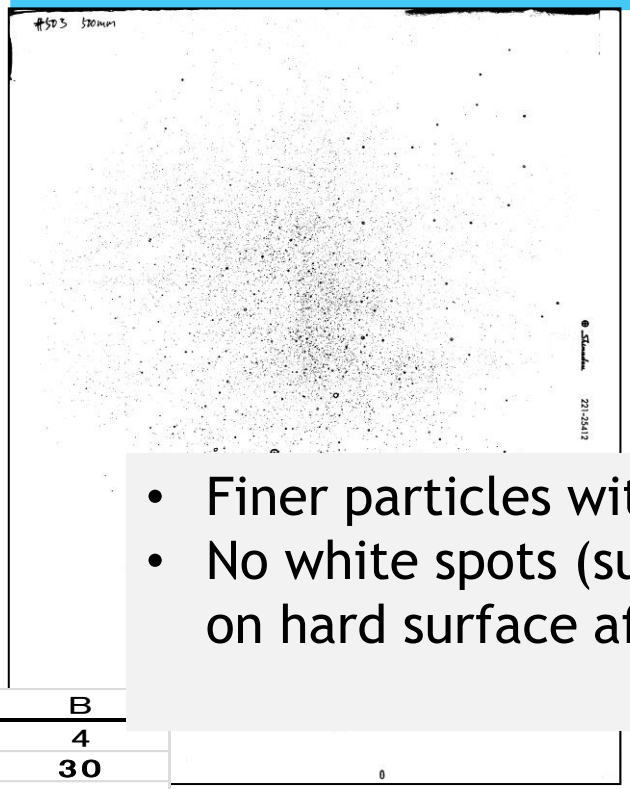
Charge dropwise with vigorous agitation for 30min at r.t.

2) Pump spray
Particle size

Particle size of two spays, with & without MMB, was checked.

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

Tested on thermal paper

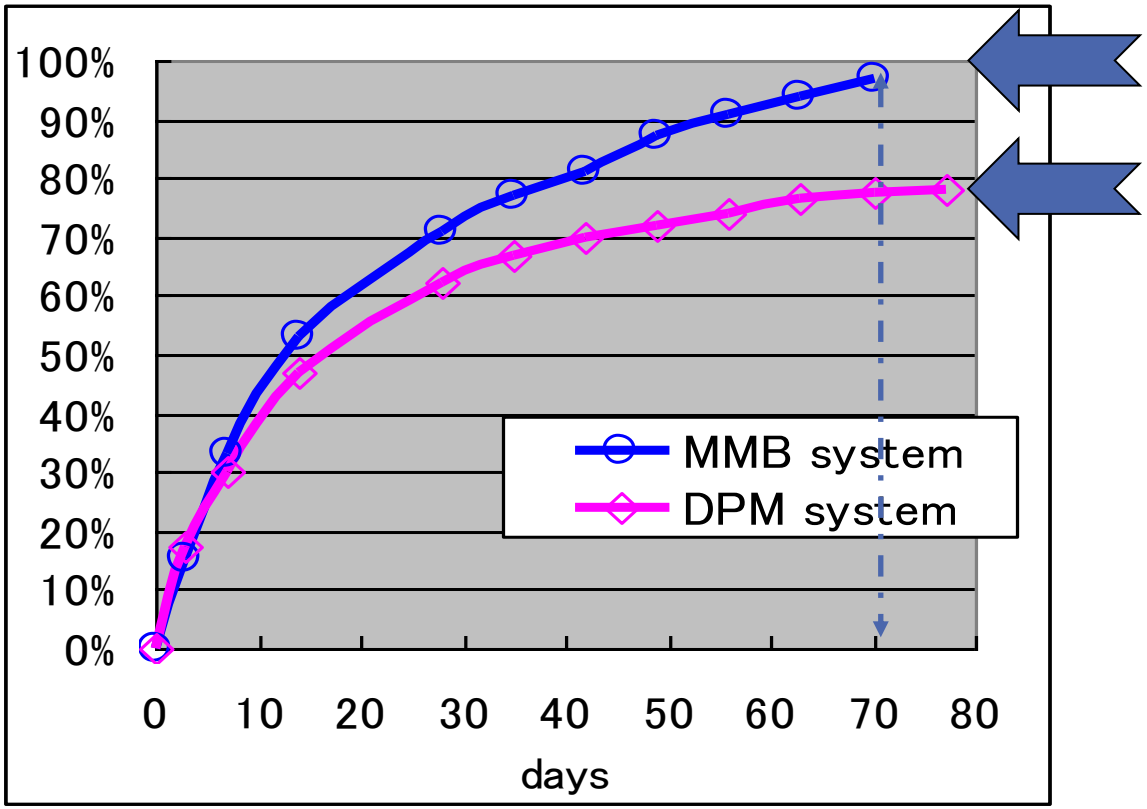
- Finer particles with MMB system
- No white spots (surfactants) on hard surface after spaying

3) Reed Diffuser

Evaporation profile of MMB system vs DPM system

●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℃)



100% of evaporation

Evaporation stopped at 80% of the total !

Analysis of Air Fresheners from the market-1

			content (%)						
type	country	scent	water	EtOH	MMB	DPM	PG	DPG	total
Fan	USA	citrus	1.4	n.d.	19.1	22.8	n.d.	n.d.	43.3
Fan	USA	out door	0.8	n.d.	30.1	n.d.	n.d.	n.d.	30.9
Fan	EU	citrus	1.6	n.d.	18.9	21.6	n.d.	n.d.	42.1
Fan	Asia	papaya	3.6	n.d.	32.4	37.4	n.d.	n.d.	73.4
Fan	Asia		72.4	n.d.	23.3	n.d.	n.d.	n.d.	95.7
Fan	Asia	crisp breeze	2.9	n.d.	15.3	20.5	n.d.	n.d.	38.7
Fan	Asia	lavender	0.1	n.d.	7.2	13.2	n.d.	n.d.	20.5
Fan	Asia	fruit	0.2	n.d.	7.4	11.4	n.d.	n.d.	19.0
Fan	Asia	green	0.2	n.d.	6.7	n.d.	n.d.	n.d.	6.9
Fan	Asia	aqua	0.3	n.d.	6.7	n.d.	n.d.	n.d.	7.0
Reed diffuser	USA	citrus	1.5	21.8	66.1	n.d.	n.d.	n.d.	89.4
Reed diffuser	USA	orchard	2	24.4	66.2	n.d.	n.d.	n.d.	92.6
Reed diffuser	USA	apple oak	0.2	n.d.	15.3	n.d.	n.d.	n.d.	15.5
Reed diffuser	USA	cotton flower	0.1	n.d.	87.2	n.d.	n.d.	n.d.	87.3
Reed diffuser	USA	lemon sage	0.1	n.d.	85.7	n.d.	n.d.	n.d.	85.8
Reed diffuser	EU	blackcurrant	3.9	59.3	17.7	n.d.	n.d.	n.d.	80.9

n.d. : not detected

Analysis of Air Fresheners from the market-2

			content (%)						
type	country	scent	water	EtOH	MMB	DPM	PG	DPG	total
Car	USA	tropical	0.4	n.d.	81.6	n.d.	n.d.	n.d.	82.0
Car	Asia	citrus	0.5	n.d.	81.8	n.d.	n.d.	n.d.	82.3
Car	Asia	tropical	0.2	n.d.	81.6	n.d.	n.d.	n.d.	81.8
Car	Asia	lily	2.5	24.8	10.6	7.7	n.d.	n.d.	45.6
Plug	USA	vanilla	1.3	n.d.	75.3	7.6	n.d.	n.d.	84.2
Plug	USA	cinnamon	1.2	n.d.	45.5	n.d.	n.d.	n.d.	46.7
Plug	USA	Floral	0.5	n.d.	1.3	1.5	n.d.	n.d.	3.3
Plug	EU	citrus	1	n.d.	25.4	n.d.	n.d.	n.d.	26.4
Plug	Asia	rose	1.1	n.d.	24.5	n.d.	47	14.9	25.6
Plug	Asia		0.8	n.d.	5.2	n.d.	20.3	24.7	6.0
Plug	Asia		0.3	n.d.	13.6	n.d.	n.d.	9.7	13.9
Plug	Asia		0.3	n.d.	28.9	n.d.	n.d.	11.1	29.2

n.d. : not detected

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Basic formulations of Air Fresheners

Type	MMB	Fragrance	Water	Surfactant	Other solvents	Others
Reed diffuser	～90%	～20%			DPMA 0～20%	
Water based wick	～3%	～2%	95%	～1%		
Water based gel	10～15%	2～5%	balanced	nonionic 5～10%	Ethanol 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%			Ethanol balanced	Propellant 50～70%
Pump-spray	～30%	～2%	5～20%	～1%	Ethanol ～70%	