

# Test of air cleaners for evaluating the method of perceived air quality assessment

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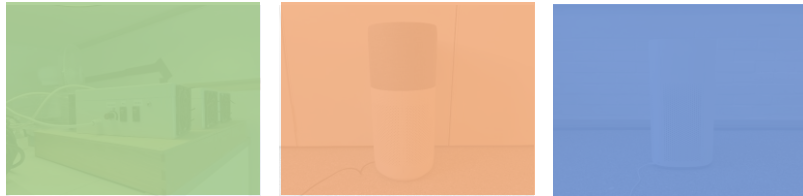
Stage 1: selection of air cleaners for testing

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# Test conditions

Ventilation rate: 7.5 L/s (0.54 1/h)

Air Cleaners (AC)



AC1

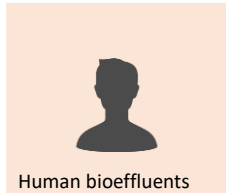
AC2

AC3

Pollution source

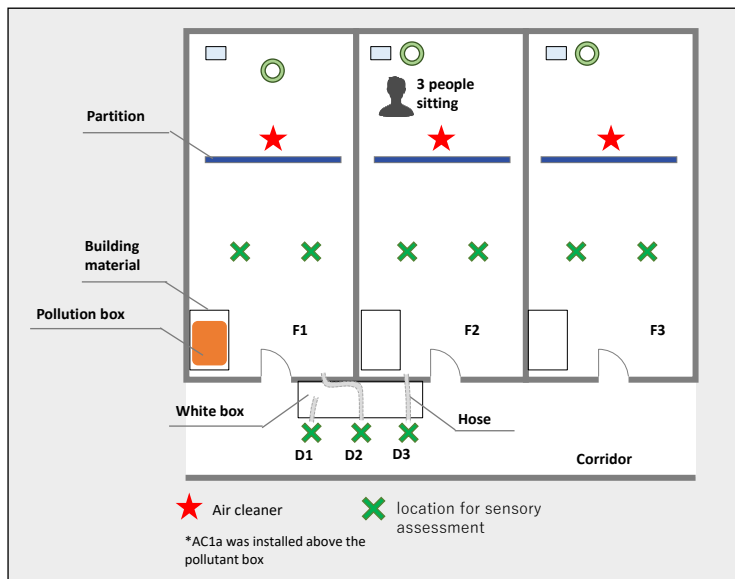


Building material



Human bioeffluents

# Setup

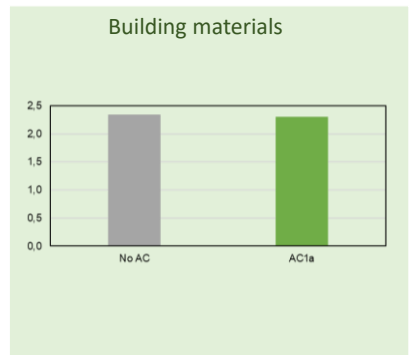
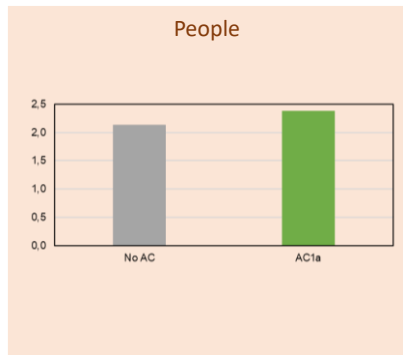
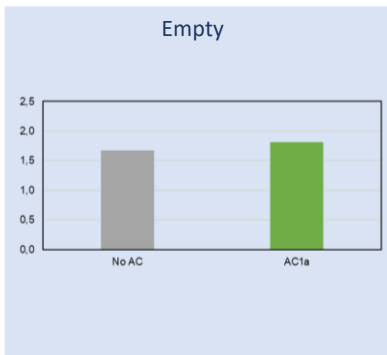


## Whole body vs Facial exposure



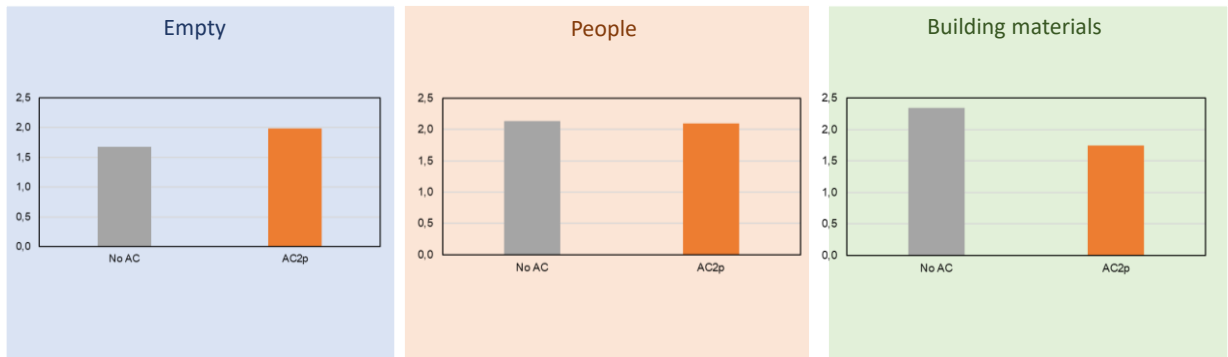
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## Assessment of odor intensity (AC1)



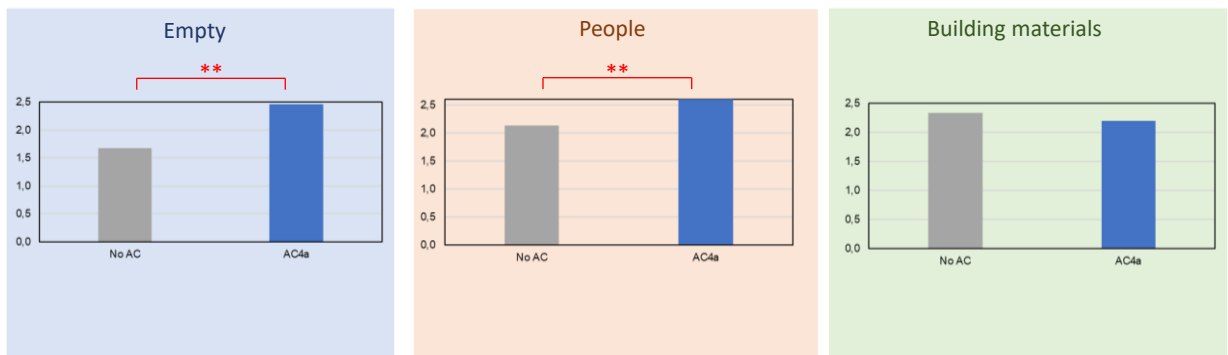
6

## Assessment of odor intensity (AC2)



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## Assessment of odor intensity (AC3)



8

# Stage 2: test of air cleaners

## Test conditions

Ventilation rate [L/s]     7.5 / 12.0 / 21.0 / 30.0  
                                      [1/h]     0.5 / 0.9 / 1.5 / 2.2

Air Cleaners (AC)



AC1



AC2



AC4

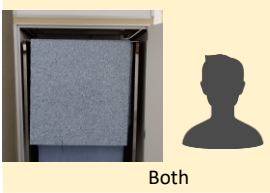
Pollution



Building material

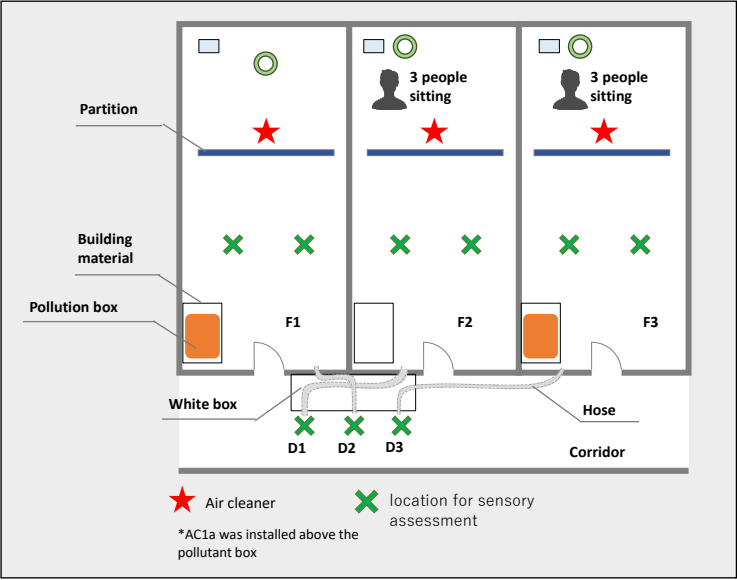


Human bioeffluents



Both

# Setup



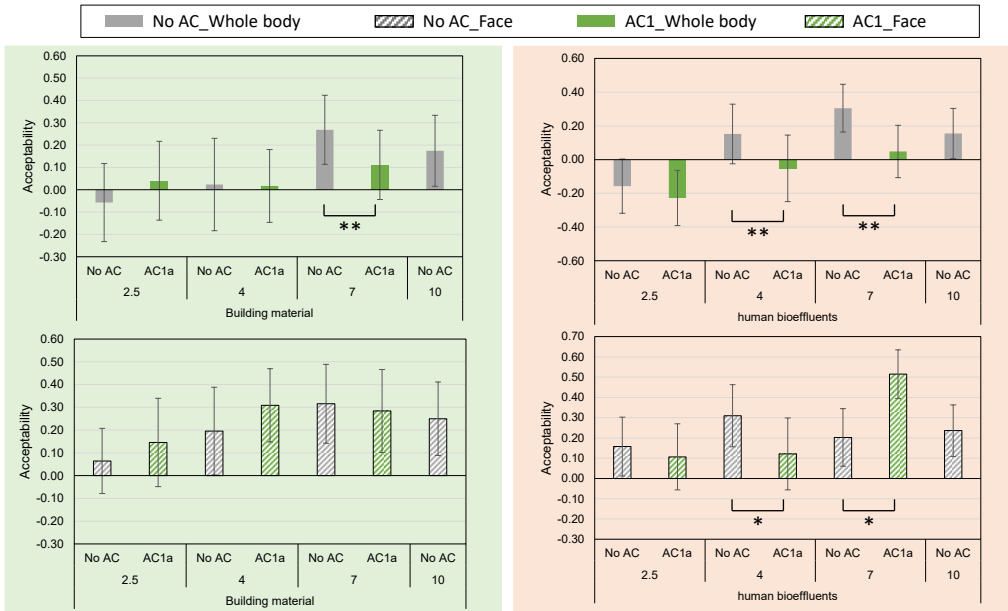
# Results of AC1

■ Results : AC1

Bar means range of 95% Confidence Interval

Wilcoxon signed rank test (\*\*p<.01, \*p<.05)

**Acceptability**



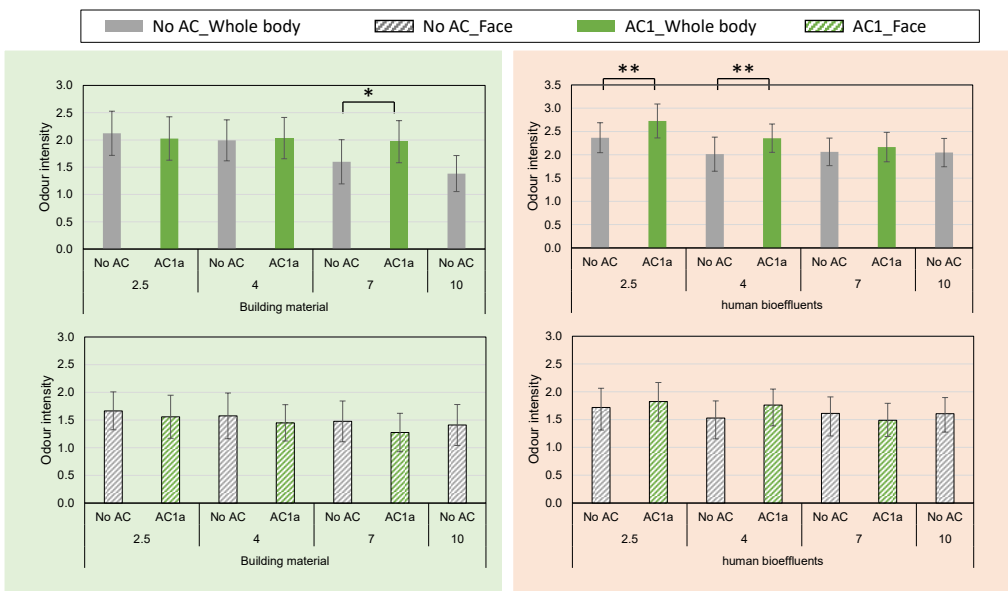
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■ Results : AC1

Bar means range of 95% Confidence Interval

Wilcoxon signed rank test (\*\*p<.01, \*p<.05)

**Odour intensity**

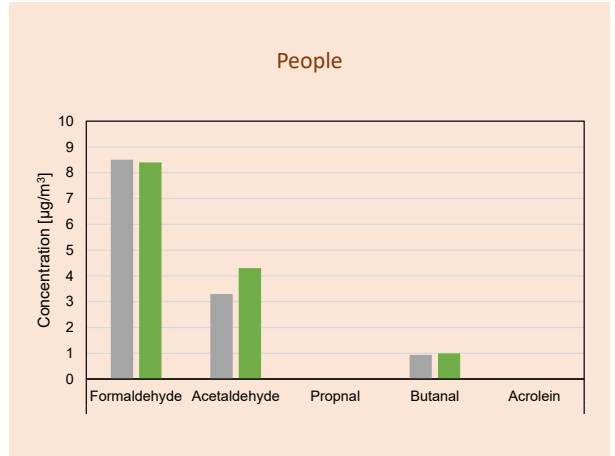
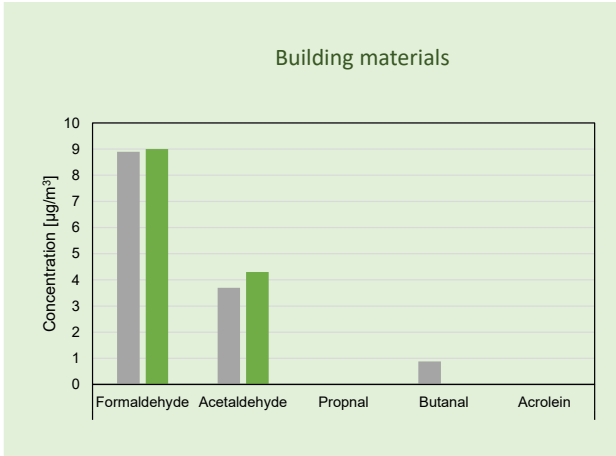


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■ Results : AC1

Chemical compounds - Aldehydes

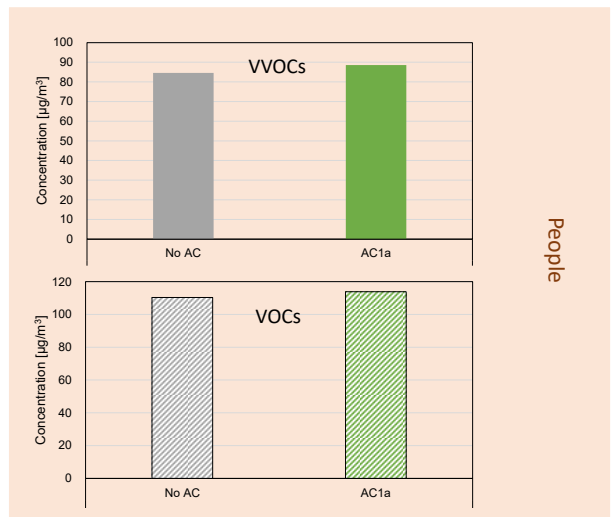
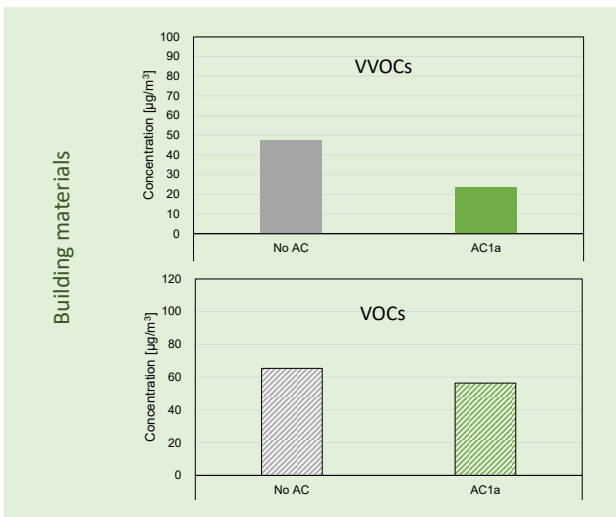
Ventilation rate: 7.5 L/s



■ Results : AC1

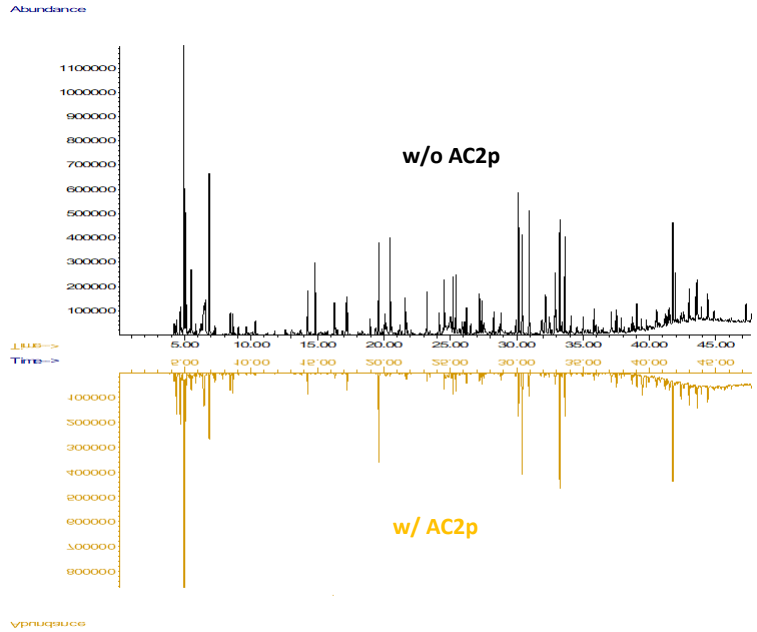
Chemical compounds – VVOCs, VOCs – total sum

Ventilation rate: 7.5 L/s





# Gas chromatograms

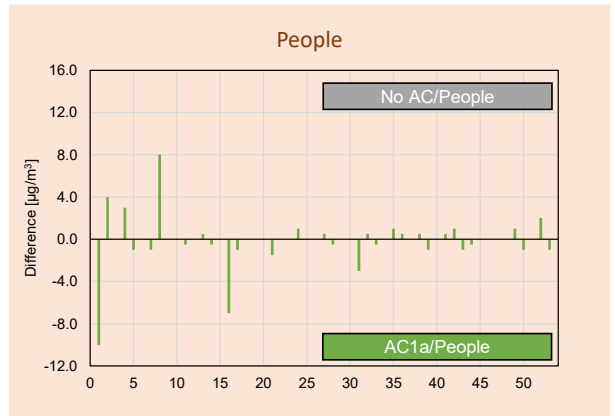
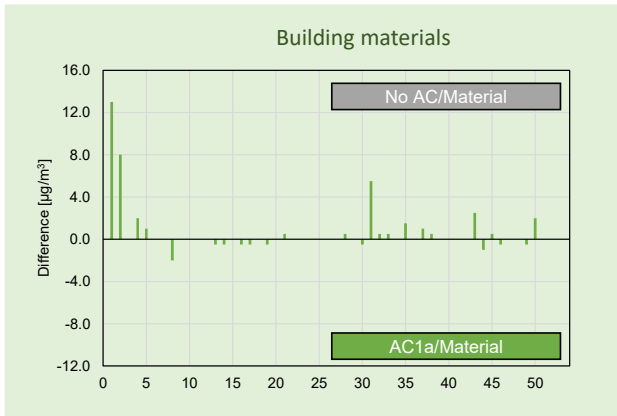


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## Results : AC1

### Chemical compounds – each chemicals

Ventilation rate: 7.5 L/s

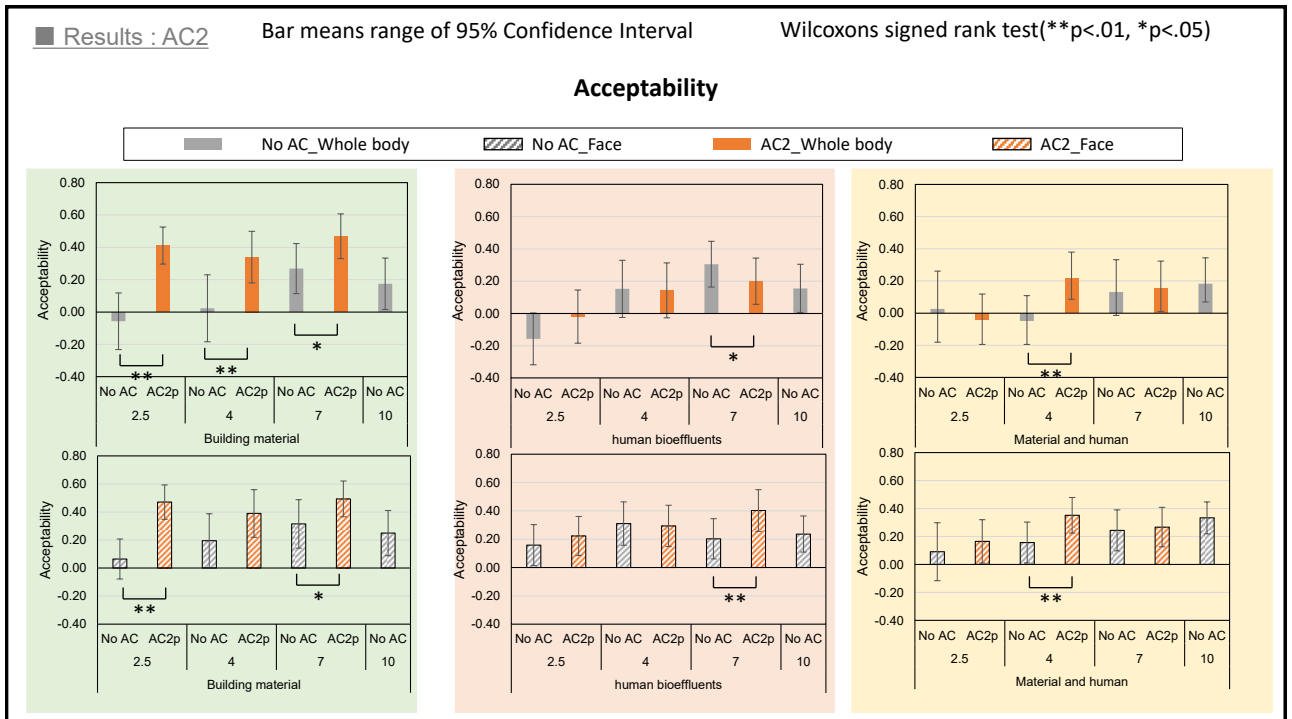


1	Ethanol	11	n-Butanol	21	n-Hexanal	31	Glycerol	41	Acetophenone	51	Nonanoic acid
2	Acetone	12	2-Pentanone	22	n-Butyl acetate	32	Hexanoic acid	42	C11 (Undecane)	52	Dodecamethylcyclohexasiloxane (D6)
3	n-Pentane	13	Propanoic acid	23	Hexamethylcyclotrisiloxane (D3)	33	Phenol	43	n-Nonanal	53	Texanol
4	Isoprene	14	Pentanal	24	m,p-Xylene (m-Xylene)	34	Octamethylcyclotetrasiloxane (D4)	44	Decamethylcyclopentasiloxane (D5)	54	1-Dodecanol
5	3-Butene-2-one	15	C7 (Heptane)	25	iso-Propyl acetate	35	6-Methyl-5-heptene-2-one	45	Benzoic acid		
6	2,3-Butanedione	16	1,2-Propanediol	26	Pentanoic acid	36	2,2,4,6,6-Pentamethylheptane	46	Octanoic acid		
7	2-Butanone (MEK)	17	Toluene	27	C9 (Nonane)	37	Octanal	47	Menthone		
8	Acetic acid	18	n-Butylacetate	28	n-Heptanal	38	DPGME (mixture of isomers)	48	Menthol		
9	Ethyl acetate	19	Butanoic acid	29	alpha-Pinene	39	2-Ethyl-1-hexanol	49	Butyldiglycol		
10	Benzene	20	C8 (Octane)	30	Benzaldehyde	40	Limonene	50	n-Decanal		

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# Results of AC2

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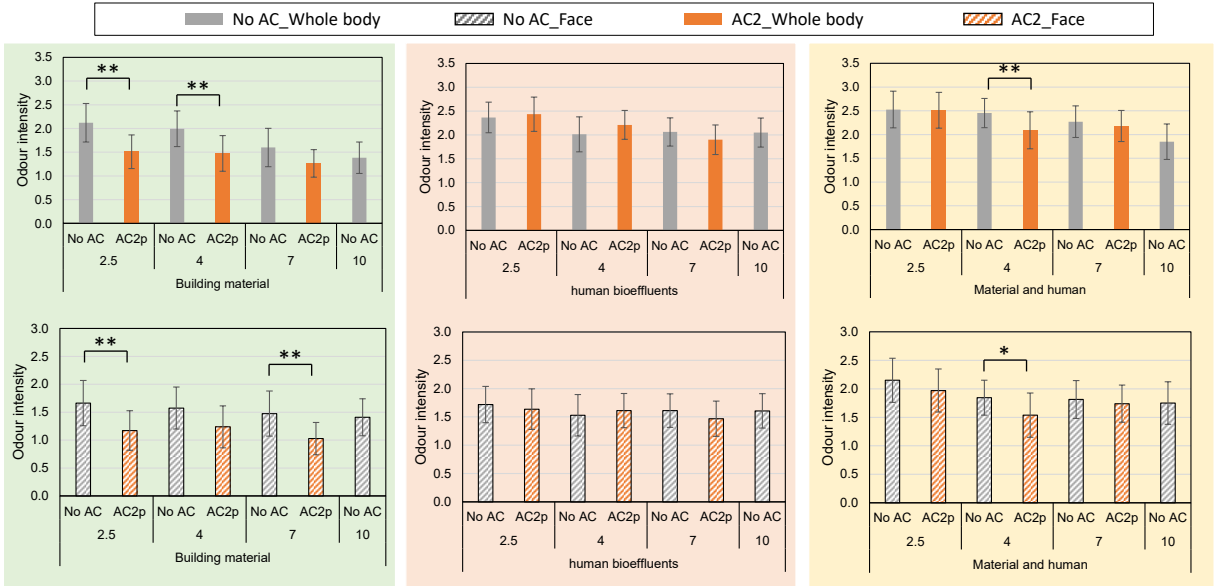
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■ Results : AC2

Bar means range of 95% Confidence Interval

Wilcoxon signed rank test (\*\*p<.01, \*p<.05)

**Odour intensity**

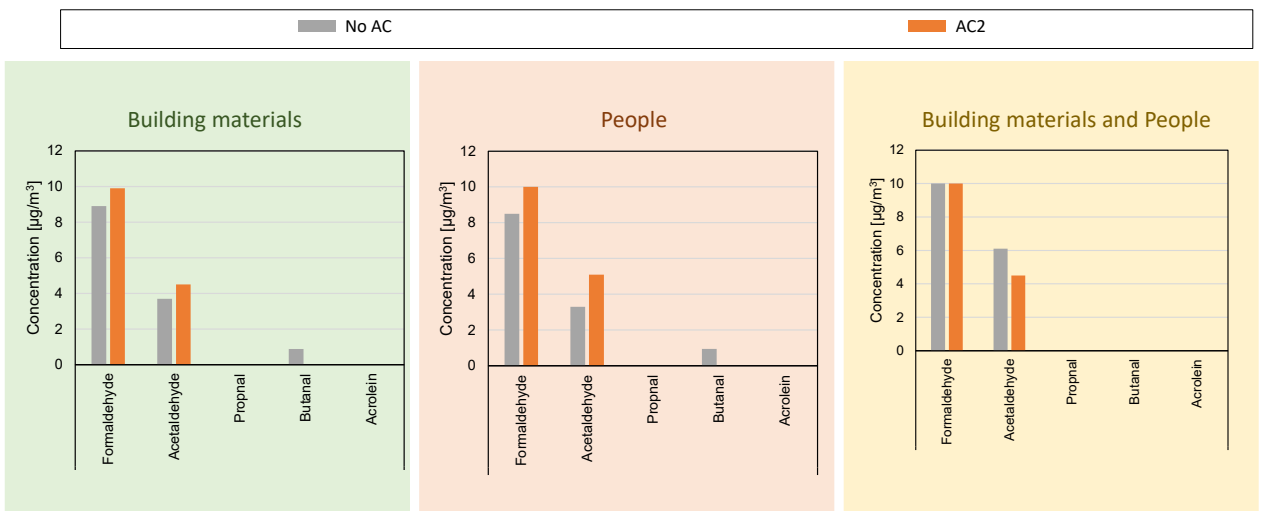


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■ Results : AC2

**Chemical compounds - Aldehydes**

(Ventilation rate: 7.5 L/s)

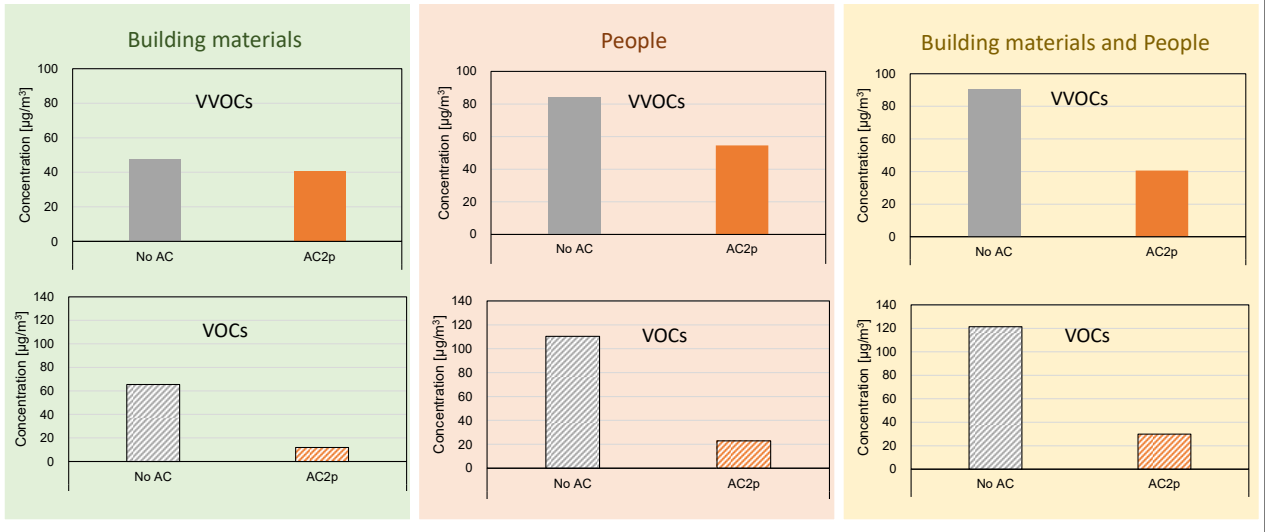


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■ Results : AC

Chemical compounds – VVOCs, VOCs – total sum

(Ventilation rate: 7.5 L/s)

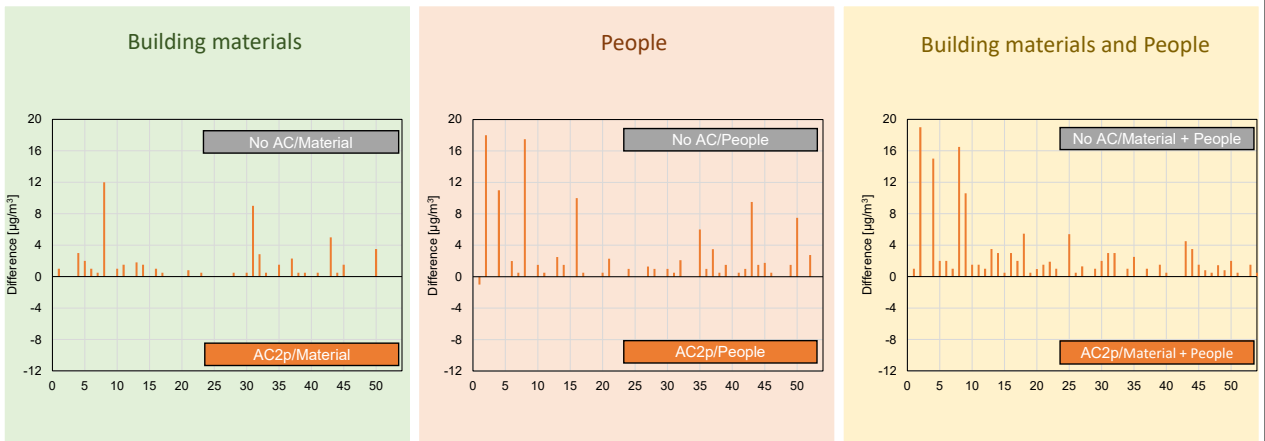


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■ Results : AC2

Chemical compounds – each chemicals

Ventilation rate: 7.5 L/s

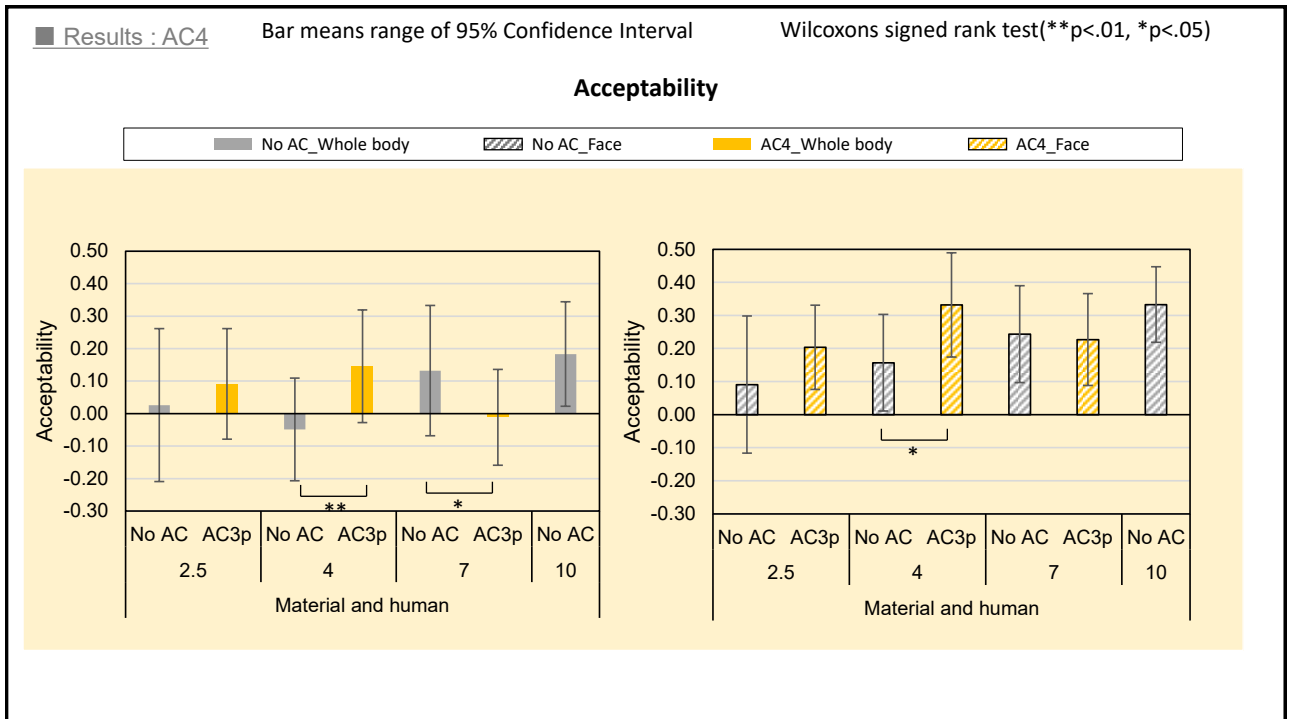


1 Ethanol	11 n-Butanol	21 n-Hexanal	31 Glycerol	41 Acetophenone	51 Nonanoic acid
2 Acetone	12 2-Pentanone	22 n-Butyl acetate	32 Hexanoic acid	42 C11 (Undecane)	52 Dodecamethylcyclohexasiloxane (D6)
3 n-Pentane	13 Propanoic acid	23 Hexamethylcyclotrisiloxane (D3)	33 Phenol	43 n-Nonanal	53 Texanol
4 Isoprene	14 Pentanal	24 m,p-Xylene (m-Xylene)	34 Octamethylcyclotetrasiloxane (D4)	44 Decamethylcyclopentasiloxane (D5)	54 1-Dodecanol
5 3-Butene-2-one	15 C7 (Heptane)	25 iso-Propyl acetate	35 5-Methyl-5-heptene-2-one	45 Benzoic acid	
6 2,3-Butanedione	16 1,2-Propanediol	26 Pentanoic acid	36 2,2,4,6,6-Pentamethylheptane	46 Octanoic acid	
7 2-Butanone (MEK)	17 Toluene	27 C9 (Nonane)	37 Octanal	47 Menthone	
8 Acetic acid	18 n-Butylacetate	28 n-Heptanal	38 DPGMME (mixture of isomers)	48 Menthol	
9 Ethyl acetate	19 Butanoic acid	29 alpha-Pinene	39 2-Ethyl-1-hexanol	49 Butyldiglycol	
10 Benzene	20 C8 (Octane)	30 Benzaldehyde	40 Limonene	50 n-Decanal	

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# Results of AC4

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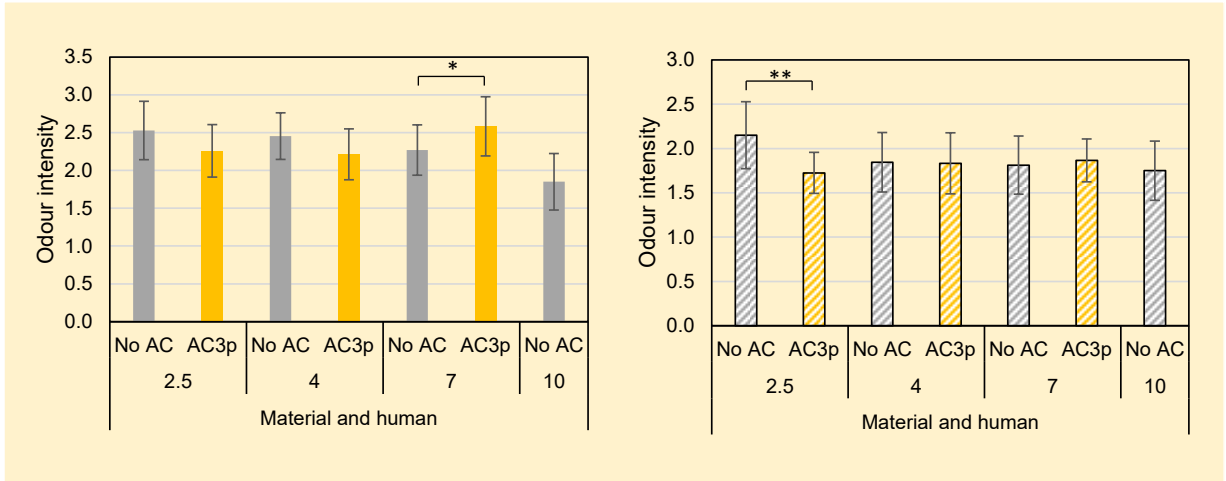
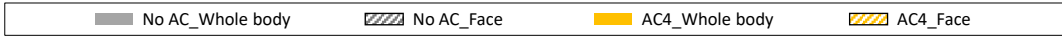
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■ Results : AC4

Bar means range of 95% Confidence Interval

Wilcoxon's signed rank test (\*\*p<.01, \*p<.05)

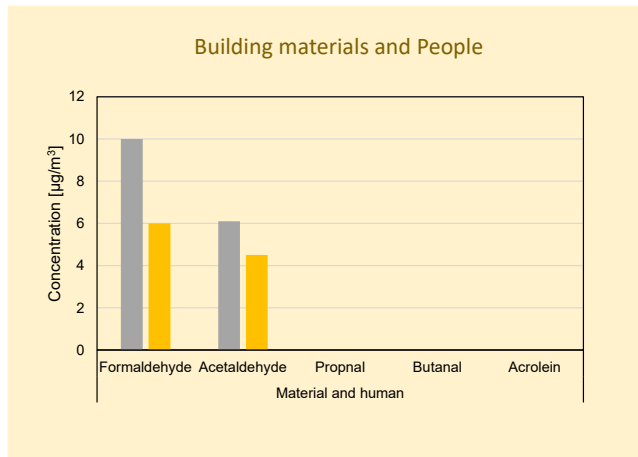
**Odour intensity**



■ Results : AC4

**Chemical compounds - Aldehydes**

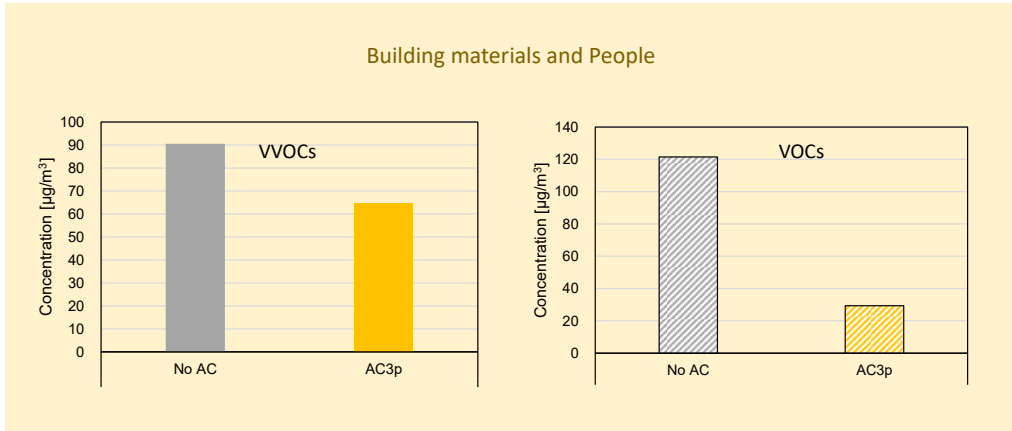
Ventilation rate: 7.5 L/s



■ Results : AC4

Chemical compounds – VVOCs, VOCs – total sum

Ventilation rate: 7.5 L/s

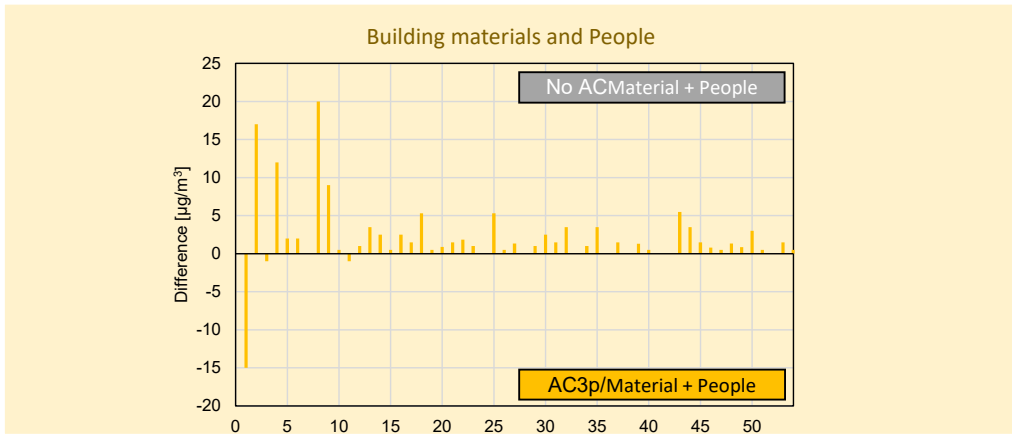


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■ Results : AC4

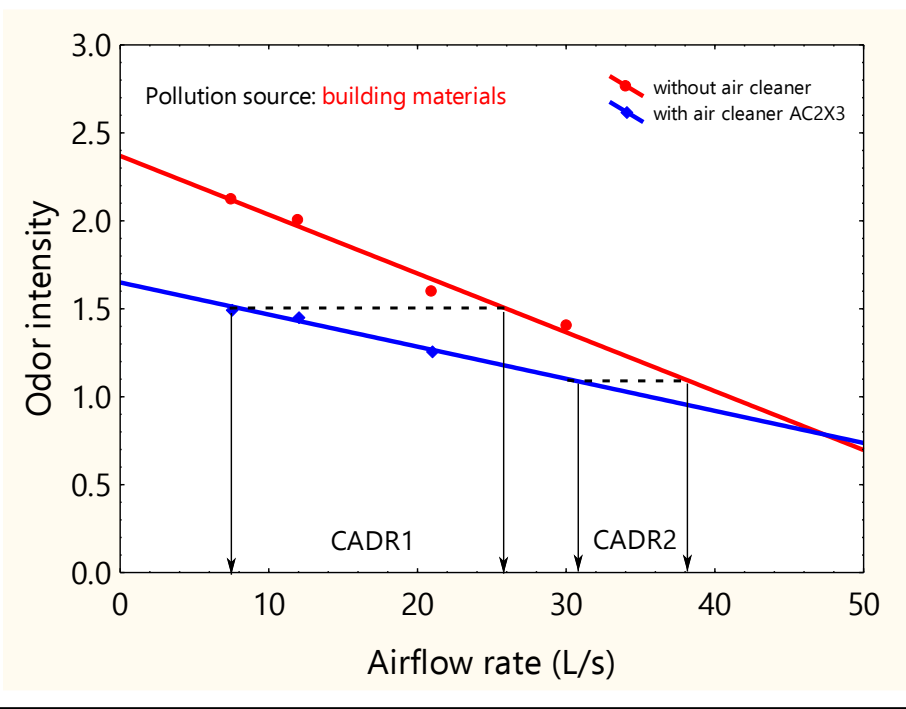
Chemical compounds – each chemicals

Ventilation rate: 7.5 L/s

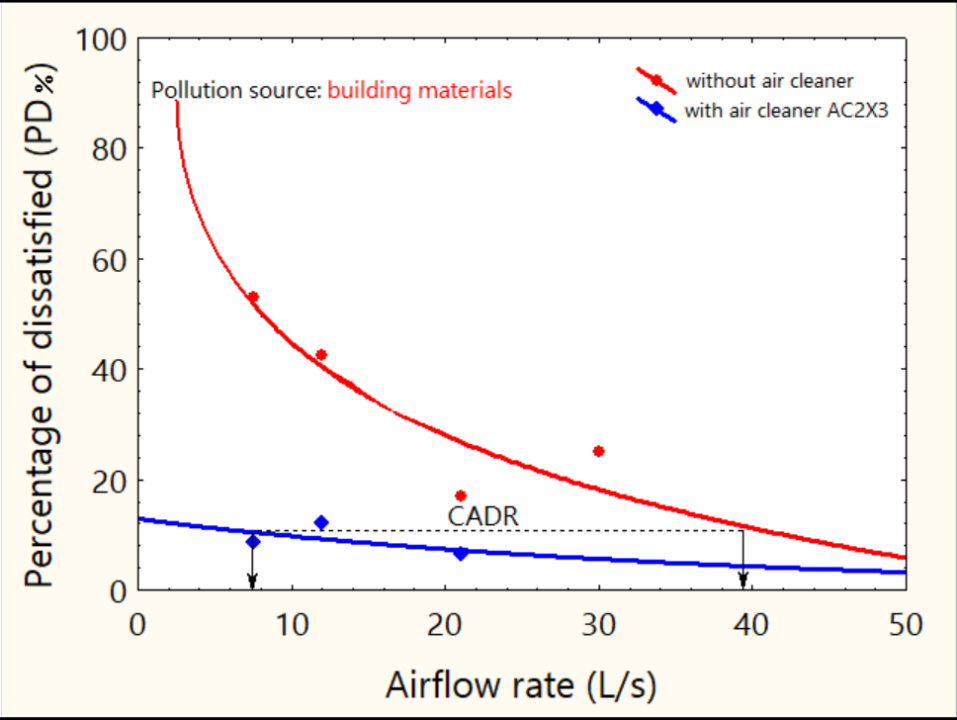


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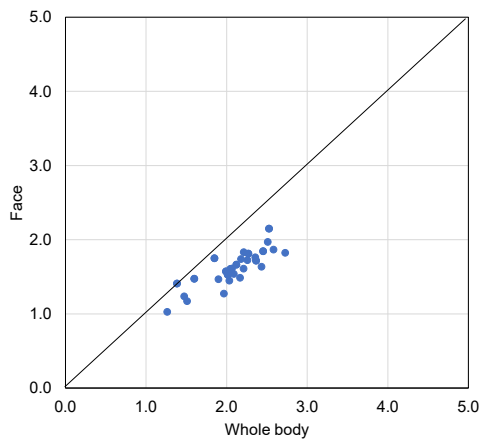
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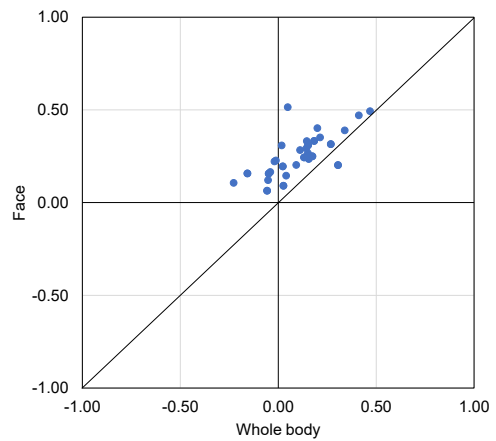
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## Whole body vs Face Assessments



**Odour intensity**



**Acceptability**

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## Conclusions

- Facial exposure assessed lower odor intensity and better air quality compared to the assessment made by whole-body full exposure
- The air cleaners with activated charcoal filters were effective on removing VOCs, reduce odor intensity and improve perceived air quality
- Human bioeffluents are difficult to be controlled as a constant source of air pollution for testing indoor air cleaners

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