

November 10<sup>th</sup>, 2020

### **Analysis Report on Determination of Indoor Microbial Load Reduction Effectiveness of Froumann Branded (N80, N90 and N100 Model) Air Purifiers**

In order to determine the microbial load reduction efficiency of Froumann Brand air cleaning devices, the sampling process was carried out in Eskişehir between October 26-27, 2020, and the stages of microbial analysis and evaluation of the results between October 28 and November 6 in the Microbiology Laboratory of the Department of Biology of Hacettepe University. In order to determine the microbial load reduction efficiency of Froumann Brand air cleaning devices, the sampling process was carried out in Eskişehir on October 26-27, 2020, and the stages of microbial analysis and evaluation of the results between October 28 and November 6 in the Microbiology Laboratory of the Department of Biology of Hacettepe University. All stages were carried out by Dr. Aygün Schiesser.

Three different closed areas with no air circulation were selected in accordance with the model feature of the device. Devices were positioned in the middle of the areas with a volume of 300 m<sup>3</sup> for the N80 model, 600 m<sup>3</sup> for the N90 model and 1000 m<sup>3</sup> for the N100 model. All air samples were taken with the MAS-100 Eco air sampling device using the 500-liter option. In each of the selected areas, 2 repetitive air samples were taken from the middle point where the device was located and at the wall edge of the area (at a height of 150 cm from the ground) before the device was operated. Then the device was operated for 1 hour and air samples were taken from the same points. Brain Hearth Infusion Agar and Potato Dextrose Agar were used as general bacteria and general fungi (mold-yeast) media. All procedures were repeated on two separate days for 3<sup>th</sup> and 5<sup>th</sup> levels of devices. After sampling, the petri dishes were transferred to the Hacettepe University Biology Department Microbiology Laboratory. The number of colony forming unit per m<sup>3</sup> (CFU/m<sup>3</sup>) was calculated by counting colonies in petri dishes after incubation for 24 hours at 37 °C for bacteria and 24 hours at 25 °C for fungi. The change in the number of colonies was calculated statistically and the decrease in the microbial load as a percentage value is presented below also graphs and tables presented in the appendix.

As a result of the analysis, Froumann N80 model air cleaning device reduces the bacterial load in the indoor air by 91.02% and the fungal load (yeast-mold) by 96.61% after working for 1 hour at the 3rd level. It reduces the bacterial load in the indoor air by 82.45% and the fungal load (yeast-mold) by 89.20% after 1 hour of working in the 5th level.

Froumann N90 model air cleaning device reduces the bacterial load in the indoor air by 65.24% and the fungal load (yeast-mold) by 94.50% after working for 1 hour at the 3rd level. It reduces the bacterial load in the indoor air by 72% and the fungal load (yeast-mold) by 80.60% after 1 hour of working in the 5th level.

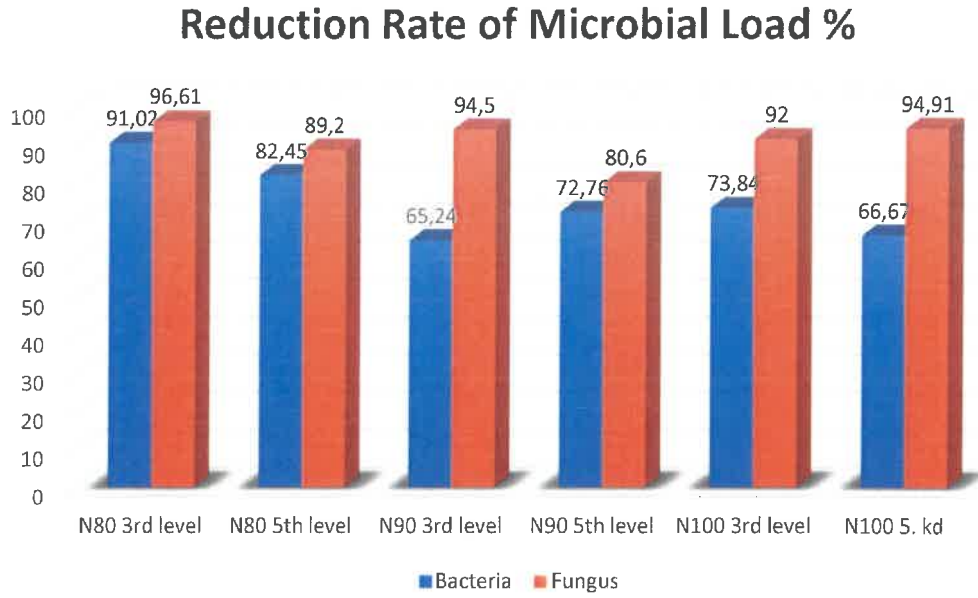
Froumann N100 model air cleaning device reduces the bacterial load in the indoor air by 73.84% and the fungal load (yeast-mold) by 92.00%, after working for 1 hour at the 3rd level. It reduces the bacterial load in the indoor air by 66.67% and the fungal load (yeast-mold) by 94.90% after 1 hour of working in the 5th level.



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Appendix 1.



  
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## Appendix 2.

Table 1. Frouman N80 Device Test Results

		Bacteria (CFU/m³)			Fungus (CFU/m³)				
		b.o.	a.o.	%reduction			b.o.	a.o.	%reduction
3. level	middle point	128	12	-90,63	middle point	5256	262	-95,02	
	edge	206	18	-91,26	edge	5256	94	-98,21	
	average	167	15	<b>-91,02</b>	average	5256	178	<b>-96,61</b>	
		b.o.	a.o.	%reduction			b.o.	a.o.	%reduction
5. level	middle point	270	60	-77,78	middle point	1030	88	-91,46	
	edge	448	66	-85,27	edge	878	118	-86,56	
	average	359	63	<b>-82,45</b>	average	954	103	<b>-89,20</b>	

\*b. o.: before device was operated; a.o.: after device was operated for 1 hour

Table 2. Frouman N90 Device Test Results

		Bacteria (CFU/m³)			Fungus (CFU/m³)				
		b.o.	a.o.	reduction%			b.o.	a.o.	reduction%
3. level	middle point	112	26	-76,79	middle point	1626	74	-95,45	
	edge	216	88	-59,26	edge	1538	101	-93,43	
	average	164	57	<b>-65,24</b>	average	1582	87,5	<b>-94,50</b>	
		b.o.	a.o.	reduction%			b.o.	a.o.	reduction%
5. level	middle point	224	70	-68,75	middle point	578	106	-81,66	
	edge	356	88	-75,28	edge	638	130	-79,62	
	average	290	79	<b>-72,76</b>	average	608	118	<b>-80,60</b>	

\*b. o.: before device was operated; a.o.: after device was operated for 1 hour

Table 3. Frouman N100 Device Test Results

N100		Bacteria (CFU/m³)			Fungus (CFU/m³)			
		b.o.	a.o.	reduction%		b.o.	a.o.	reduction%
3. level	middle point	160	18	-88,75	middle point	1156	66	-94,29
	edge	184	72	-60,87	edge	1190	122	-89,75
	average	172	45	<b>-73,84</b>	average	1173	94	<b>-92,00</b>
		b.o.	a.o.	reduction%		b.o.	a.o.	reduction%
5. level	middle point	184	64	-65,22	middle point	1284	40	-96,88
	edge	104	32	-69,23	edge	994	76	-92,35
	average	144	48	<b>-66,67</b>	average	1139	58	<b>-94,91</b>

\*b. o.: before device was operated; a.o.: after device was operated for 1 hour

  
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## **Microorganism Filtering Efficiency Analysis Report of Froumann Brand (N80, N90 and N100 Model) Air Purifiers**

In order to determine the efficiency of Fraumann brand air purification devices in filtering bacteria and fungi in the air the sampling process was carried out in Eskişehir between October 26-27, 2020, and the stages of microbial analysis and evaluation of the results between October 28 and November 6 in the Microbiology Laboratory of the Department of Biology of Hacettepe University. All stages were carried out by Dr. Aygün Schiesser.

Three different closed areas with no air circulation were selected in accordance with the model feature of the device. Devices were positioned in the middle of the areas with a volume of 300 m<sup>3</sup> for the N80 model, 600 m<sup>3</sup> for the N90 model and 1000 m<sup>3</sup> for the N100 model. All air samples were taken with the MAS-100 Eco air sampling device using the 500-liter option. In each of the selected areas, 2 repetitive air samples were taken from the middle point where the device was located and at the wall edge of the area (at a height of 150 cm from the ground) before the device was operated. Brain Hearth Infusion Agar and Potato Dextrose Agar were used as general bacteria and general fungi (mold-yeast) media. A sterile aluminum pipe with a diameter of 12 cm was mounted at the clean air discharge point of all 3 devices, and after the device was started, the filtered air was transferred to the air sampling device without mixing with the indoor air. All procedures were repeated on two separate days for 3<sup>rd</sup> and 5<sup>th</sup> levels of devices. After sampling, the petri dishes were transferred to the Hacettepe University Biology Department Microbiology Laboratory. The number of colony forming unit per m3 (CFU/m3) was calculated by counting colonies in petri dishes after incubation for 24 hours at 37 °C for bacteria and 24 hours at 25 °C for fungi. The change in the number of colonies was calculated statistically and the decrease in the microbial load as a percentage value is presented in the appendix as tables and graphs.

As a result of the analysis, the filtration rate of microorganisms in 1 m<sup>3</sup> of air is between 98.84% minimum and 100% maximum. Froumann N80 model air purifier eliminates 98.44% of bacteria in the 3<sup>rd</sup> level, while reducing mold and yeast by 99.89% by filtering. It filters and reduces bacteria by 98.52% and fungal load by 99.22% in the 5<sup>th</sup> level. The average filtering rate of the Froumann N100 device for 1 m<sup>3</sup> of airborne microorganisms is 99.02%.

Froumann N90 model air purifier eliminates 98.21% of bacteria in the 3<sup>rd</sup> level, while reducing mold and yeast by 99.63% by filtering. It filters and reduces bacteria by 100% and fungal load by 99.82% in the 5<sup>th</sup> level. The average filtering rate of the Froumann N100 device for 1 m<sup>3</sup> of airborne microorganisms is 99.42%.

Froumann N100 model air purifier eliminates 98.75% of bacteria in the 3<sup>rd</sup> level, while reducing mold and yeast by 99.48% by filtering. It filters and reduces bacteria by 100% and fungal load by 99.47% in the 5<sup>th</sup> level. The average filtration rate of the Froumann N100 device for 1 m<sup>3</sup> of airborne microorganisms is 99.50%.



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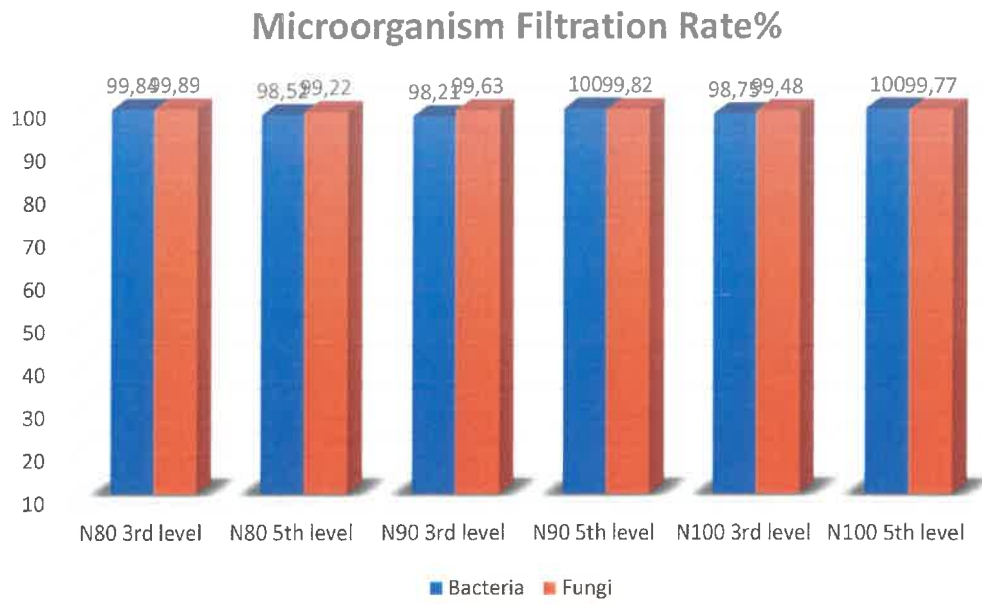


Figure 1. Filtration rate graph of Fraumann N80, N90 and N100 model devices in 3<sup>rd</sup> and 5<sup>th</sup> level



Figure 2. Closed circuit sampling setup

  
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## Appendix 2.

Table 1. Microbial load values and percentage reduction rates in samples taken before and while the N80 device is running

N80	Bacteria (CFU/m <sup>3</sup> )			Fungus (CFU/m <sup>3</sup> )		
	b.o.	w.o.	reduction%	b.o.	w.o.	reduction%
3rd level	128	2	-98,44	5256	6	-99,89
5th level	270	4	-98,52	1030	8	-99,22

\*b. o.: before device was operated; w.o.: while operating

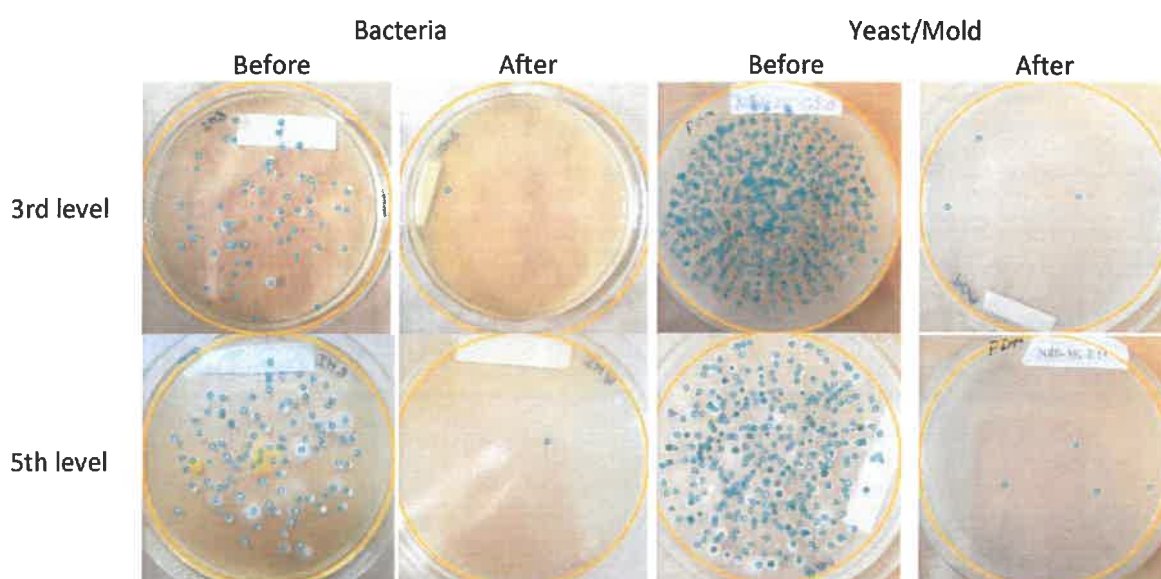


Figure 3. Microbial load in samples taken before the N80 device is running and while the device is running

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## Appendix 3

Table 2. Microbial load values and percentage reduction rates in samples taken before and while the N90 device is running

N90	Bacteria (CFU/m <sup>3</sup> )			Fungus (CFU/m <sup>3</sup> )		
	b.o.	w.o.	reduction%	b.o.	w.o.	reduction%
3 <sup>rd</sup> level	112	2	-98,21	1626	6	-99,63
5 <sup>th</sup> level	224	0	-100	1626	3	-99,82

\*b. o.: before device was operated; w.o.: while operating

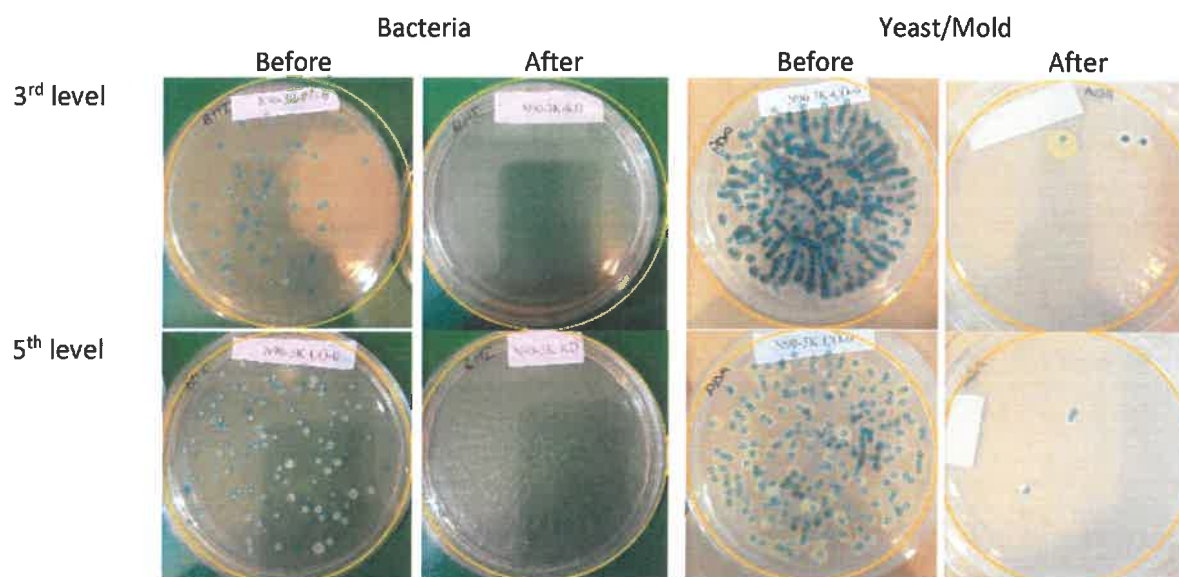


Figure 4. Microbial load in samples taken before the N90 device is running and while the device is running

  
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## Appendix 4

Table 3. Microbial load values and percentage reduction rates in samples taken before and while the N100 device is running

N100	Bacteria (CFU/m <sup>3</sup> )			Fungus (CFU/m <sup>3</sup> )		
	b.o.	w.o.	reduction%	b.o.	w.o.	reduction%
3 <sup>rd</sup> level	160	2	-98,75	1156	6	-99,48
5 <sup>th</sup> level	284	0	-100	1284	3	-99,77

\*b. o.: before device was operated; w.o.: while operating

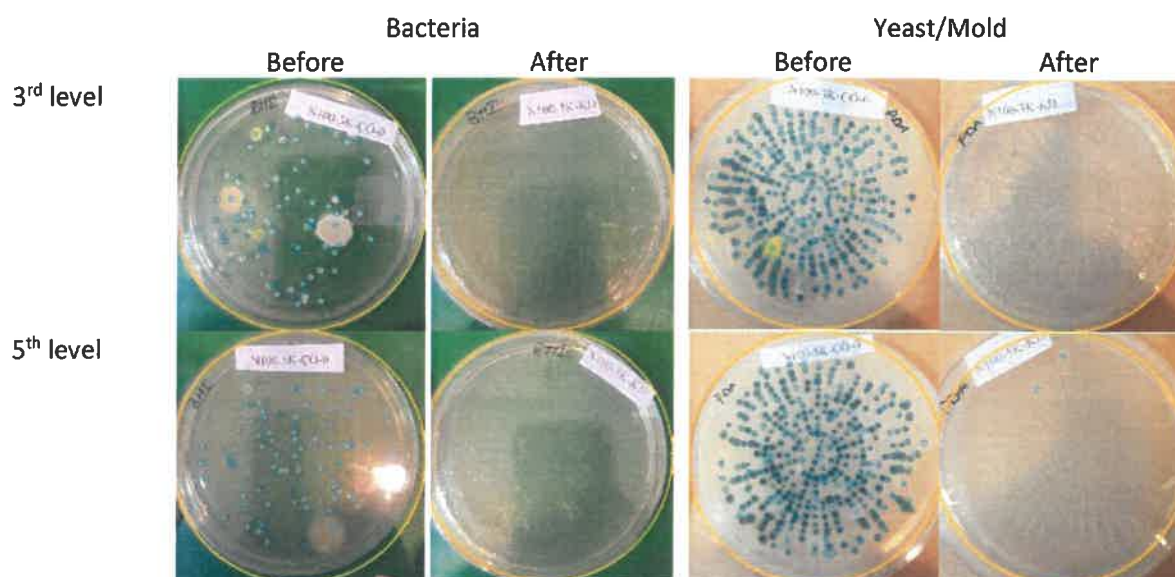


Figure 5. Microbial load in samples taken before the N100 device is running and while the device is running

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