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Biological Efficiency Testing According ISO 14698-1

Roberto Ligugnana[1*]
Roberto Montagna[1]

[1]Villa Cella Applied Microbiology Laboratory Environmental Monitoring, State University of Milan, Milan, Italy

Summary

The biological collection efficiency of the active multi-nozzle impactor air sampler TRIO. BAS MINI was compared to the efficiency of the slit to agar air sampler called CASELLA type that is used as traditional reference air sampler device. The TRIO.BAS biological efficiency was 82% vs Casella microbial air sampler [1,2]. Considering that the evaluation of biological efficiency between different microbial air samplers is always difficult and relative, the two results can be considered statistically comparable.

Glossary/Keywords

Active sampling, Agar desiccation, Airborne particles, Airborne microbes, Air flow rate, Airborne microbial concentration, Agar medium, Bacterial cell, Biological agent, Bio sampler, Biological efficiency, Collection efficiency, Collection surface, Culture plate, Cut-off size, d_{50}, Effective collection efficiency, Experimental d_{50}, Physical collection efficiency, Fungal spore, Impactor, Impact on agar medium, Impaction velocity, Jet to plate distance, Microbe-carrying particles, Microbial air sampler, Microbial Air Sampling efficiency, Environmental microbial population, Passive sampling, Particles, Petri dish, Physical Air Sampling efficiency, Multi nozzles impactor, Stokes number, Theoretical d_{50}, Viable microorganism, Viable particles.

Material and Methods

Casella type slit–to–agar sampler

Large Petri dishes (14.5 cm in diameter) are filled with agar medium to within 5 mm. of the top of the dish, (approx. 200ml) and allowed to cool at room temperature. Tryptic Soy Agar (TSA) medium is used to collect total bacteria. The air flow is 28 l/min [3]. The sampler works by drawing air through the narrow slit positioned 0.2 cm above the surface of the agar plate. While the air is being drawn through the air sampler, the plate is rotated through 360° so that the captured microorganisms are evenly distributed over the surface of TSA agar medium.

TRIO.BAS Sieve Impaction to agar active Sampler

A known volume of air is aspirated inside the chamber of the sampler. The micro-organisms are captured by impact on the agar surface of a plate (Contact Plate or Petri dish). Different media are used for different micro-organisms (i.e.: Sabouraud Dextrose Agar (SDA) for yeast and molds, Tryptic Soy Agar (TSA) for total bacterial count). The air flow is set to 100 l/min (Figure 1-2).

Experimental Protocol

The comparative tests were performed in an indoor room (7.0x 4.5x 4.0 m.) with doors and windows closed with the purpose to evaluate the microbial population in the room's atmosphere [4-6]. No people were present during the tests.

The two air samplers were positioned in the center of the room at a distance of 1 m and 70 cm high. Both instruments were used according to the instructions of the manufacturers.

The aspirated volume of air was 1.000 l. (38 minutes for Casella sampler; 10 minutes–Interval fractioned sampling 3x 3x 3 - for TRIO.BAS). The comparison was therefore considering about 1.000 l. of aspirated air.

For both devices the culture media was the TSA (Trypticase Soy Agar with Lecithin and Polysorbate 80, in Petri dish manufactured by BD). The incubation time was for 48 hours at the temperature of 32°C. The numbers of Colony Forming Units (CFU) were counted manually.

Results

Triplicate tests were performed for seven consecutive days and the results are reported in table 1 as CFU /Petri dish / 1.000 l. of air

Conclusions

The biological efficiency was monitored as the comparative efficiency of collection

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***Corresponding author:**
Roberto Ligugnana
Villa Cella Applied Microbiology Laboratory
Environmental Monitoring
State University of Milan
Milan, Italy
Tel no: 39 02 487791
Fax no: 39 02 40 09 00 10
E-mail: roberto.ligugnana@gmail.com

Figure 1: "Slit to agar" air sampler and "Sieve Impaction Active agar" air samplers

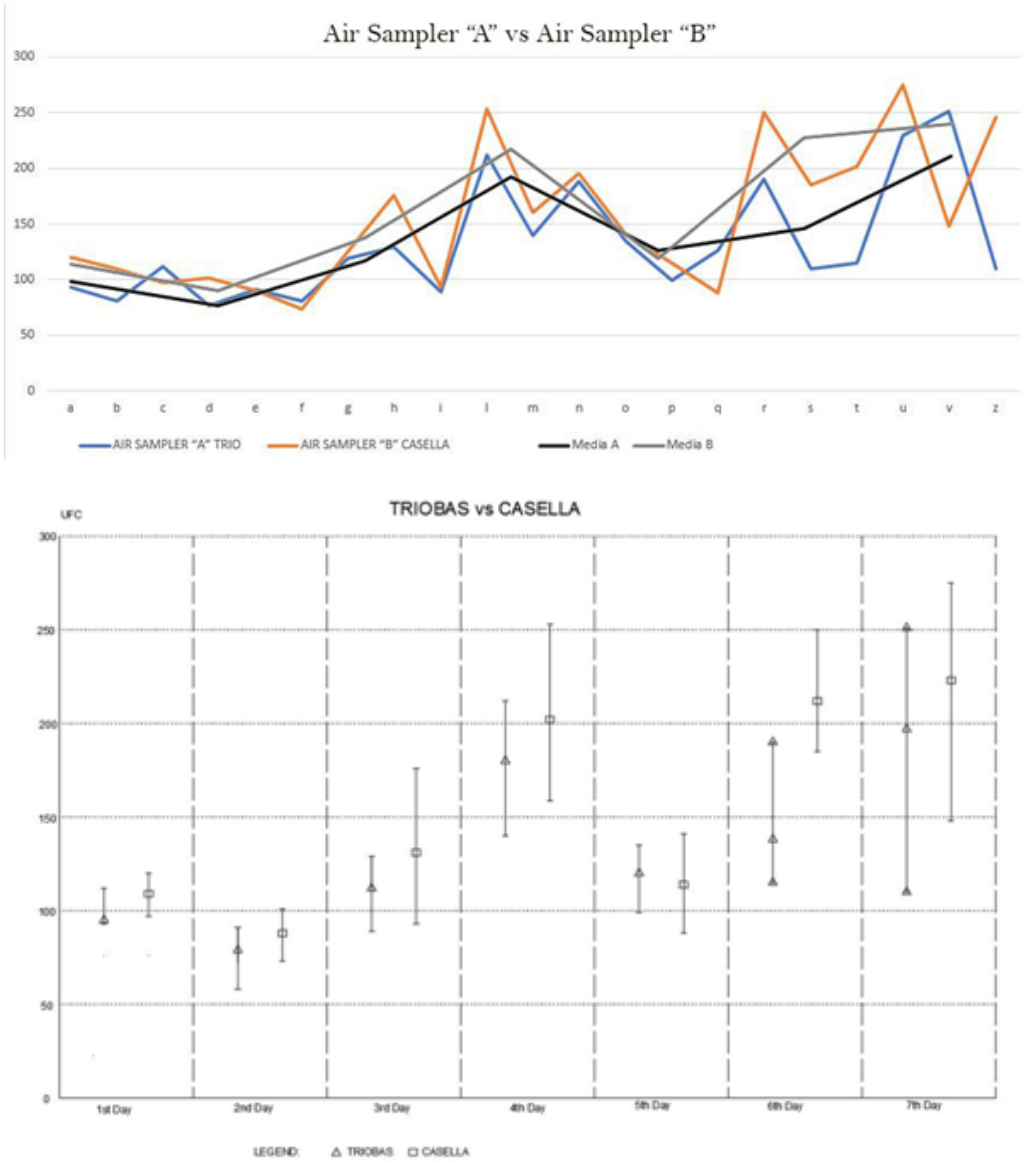

Figure 2: Air sampler "A" Vs Air sampler "B"

	AIR SAMPLER "A" TRIOBAS			Average	AIRSAMPLER "B" CASELLA			Average
1st Day	a	b	c		A1	B1	C1	
	93	81	112		120	110	97	
		MIN	MAX	95	MAX		MIN	109

	AIR SAMPLER "A" TRIOBAS			Average	AIRSAMPLER "B" CASELLA			Average
2nd Day	d	e	f		D1	E1	F1	
	77	91	81		101	90	73	
	MIN	MAX		83	MAX		MIN	88

	AIR SAMPLER "A" TRIOBAS			Average	AIRSAMPLER "B" CASELLA			Average
3rd Day	g	h	i		G1	H1	I1	
	119	129	89		125	176	93	
		MAX	MIN	112		MAX	MIN	131

	AIR SAMPLER "A" TRIOBAS			Average	AIRSAMPLER "B" CASELLA			Average
4th Day	l	m	n		L1	M1	N1	
	212	140	188		253	160	195	
	MAX	MIN		180	MAX		MIN	202

	AIR SAMPLER "A" TRIOBAS			Average	AIRSAMPLER "B" CASELLA			Average
5th Day	o	p	q		01	P1	Q1	
	135	99	126		141	115	88	
	MAX	MIN		120	MAX		MIN	114

	AIR SAMPLER "A" TRIOBAS			Average	AIRSAMPLER "B" CASELLA			Average
6th Day	r	s	t		R1	S1	T1	
	190	110	115		250	185	202	
	MAX	MIN		138	MAX	MIN		212

	AIR SAMPLER "A" TRIOBAS			Average	AIRSAMPLER "B" CASELLA			Average
7th Day	u	v	z		U1	V1	Z1	
	230	251	110		275	148	246	
		MAX	MIN	197	MAX	MIN		223

Table

of normal indoor microbial population in a closed room of house. The biological efficiency of the air sampler "A" TRIO BAS was 82% vs air sampler "B" Casella. Considering that the biological efficiency between different air samplers is always difficult and relative, the two results can be considered statistically comparable.

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