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MICROBIOLOGICAL QUALITY OF OUTDOOR AIR IN SOME SETTINGS OF ELBASAN CITY

ABSTRACT

The study of infectious agents of air has recently become a serious problem from the point of view of health impact. One kind of air pollutant is airborne micro-organisms such as bacteria and fungi. They are factors of potential infectious to human beings. The quality of bio-aerosols differs with the atmospheric conditions such as pH, UV radiation, temperature and relative humidity and cultural behavior of people. Environmental factors modify the effects of bio-aerosols by limiting the time where aerosolized microorganisms remain viable.

The aim of this study is to value the microbiological quality of outdoor air in some significant settings of Elbasan city in central Albania during the summer 2014. Air samples are taken three times a day: in the morning, midday and in the afternoon. To identify the presence of such air contamination agents is used the sedimentation method in which bacteria and fungi are collected and grown on standard culture media respectively MPA nutrient agar (bacteria) and Czapek-Dox Agar (fungi).The quantitative and qualitative examinations of 150 air samples are done in microbiological laboratory of the University of Elbasan.Thelevel of microbial air contamination is considered high, compared with existing suggestions for microbiological standards and UE demands. The number of microorganisms (colonies) ranged within 19-700 for bacteria, and 16-800 in the case of fungi. The factors that influence this high level of contamination are environmental factors, anthropogenic sources and deposition of biological materials.

Key words: air pollutant, microbiological quality, M.P.A., Czapek, bacteria, fungi.

INTRODUCTION

Microorganisms are present almost everywhere (Bugajny *et al.*, 2005) and exposure to airborne pathogens is a common denominator of all human life (Martin, 2006). A great number of pathogens are transmitted to people through air (Atlas, 1999; Willey,

2011). Study of the processes involved in the movement of microorganisms in the atmosphere from one geographical location to another (Gregory, 1973) and their impact on human, animal and plant life is a main interest of a new area of biology and interdisciplinary science-aeromicrobiology (Bugajny *et al.*, 2005). With the improvement of research methods for studying airborne pathogens (Bloch *et al*., 1985; Coronado *et al*., 1993) has come evidence indicating that many microorganisms present in the air, including viruses, bacteria, fungi, yeasts and protozoa, are associated with diseases occurring in humans, plants and animals (Dowd and Maier, 1999). The spore-forming bacteria and fungi are able to survive in bioaerosols and stay viable for a long time in the air. The concentration of microorganisms in atmospheric air (Bugajny *et al.*, 2005; Dowd and Maier, 1999; Gjyli *et al*., 2011) is very much dependent on different atmospheric factors (high humidity and suitable temperature), and anthropogenic factors (Lin and Li,2000; Mitakakis *et al*., 2001). Transmission of infectious disease by the airborne route is dependent on the interplay of several critical factors, primarily particle size and the extent of desiccation (Cole, 1998). It is generally known that microorganisms present in the air can affect human health, causing mainly respiratory and related diseases transmitted via respiratory route (Fernstrom and Goldblatt, 2013). Many species of bacteria as *Streptococcus pyogenes, Mycobacterium tuberculosis* may cause severe human infection diseases, (Dowd and Maier, 1999) and many genera of fungi as *Cladosporium, Alternaria, Penicillium,* and *Aspergillus* (genera present mainly in the outdoor air) can cause allergic and toxic reactions (Roitt, 1998; Atlas, 1999; Prescot *et al*., 2000; Willey, 2011).

Based on what we said above we undertake this study to value the microbiological quality of outdoor air in some significant settings of Elbasan city in central Albania during the summer 2014.

MATERIALS AND METHODS

This study is to value the microbiological quality of outdoor air in some significant settings of Elbasan city in central Albania during the summer 2014. Outdoor air monitoring was performed Elbasan in five sampling stations. Air samples are taken three times a day: in the morning, midday and in the afternoon.

To identify the presence of such air contamination agents is used the conventional sedimentation method with Petri dishes in which bacteria and fungi are collected and grown on MPA nutrient agar (bacteria) and Czapek-Dox Agar (semi-synthetic medium used for the cultivation of fungi including yeasts and filamentous species or moulds) (Mali, 2008; Willey, 2011). Petri dishes were exposed to the outdoor air for 25 minutes and then incubated for 24-48 hours at 37°C (enumeration of bacteria) and5-7 days for yeasts and molds at 25°C (enumeration of fungi) (Bugajny *et al.*, 2005; Hysko, 2007; Mali, 2008; Whyte, 1995).At the same time, is measured air temperature. The quantitative and qualitative examinations of 150 air samples are done in microbiological laboratory of the University of Elbasan.

There are counted the colonies that are formed in culture media. The number of colonies gives the number of microorganisms in Petri plate. If the number of colonies is till 200, the air is pure (Mali, 2008; Ren and Frank, 1992). If there are over 200 colonies/Petri plate the air is contaminated by microorganisms (Mali, 2008; ISO, 2003).

RESULTS AND DISCUSSION

Data accumulated during July-September period in five stations (Outdoor market; Agro-food market; Used clothes market; Train station; Park) of 150 air samples that are examined in microbiological laboratory of the University of Elbasanare presented in the following tables.

The number of colonies CFU (Colony Forming Units) of microorganisms (bacteria, fungi) according to the analyzed periodis given for Petri dish and air temperatures that are measured every month showing the progress of microbial air pollution in dependence of the air temperature as shown in the tables and graphs below.The high temperatures in the summer favor the growth of microorganisms in the air respectively the number of mesophilic aerobic bacteria and yeasts and molds. There are evidences in literature that the temperature affects the microbial number in the air (Heldman, 1974).

Table 1. Absolute Frequency (CFU) of microorganism according to the analyzed period in the station I.

Station I	*Date*	*T(°C)*	*Morning*		*T(°C)*	*Midday*		*T(°C)*	*Afternoon*	
			Bact.	***Fungi***		***Bact.***	***Fungi***		***Bact.***	***Fungi***
Outdoor Market	03.07.2014	26	360	300	32	700	715	30	560	500
	05.08.2014	27	320	250	34	680	730	31	650	450
	01.09.2014	24	300	200	30	610	600	29	600	400
	07.09.2014	25	240	160	29	500	550	27	480	320
	09.09.2014	26	180	240	30	450	800	28	320	700
Average			**280**	**230**		**588**	**679**		**522**	**474**

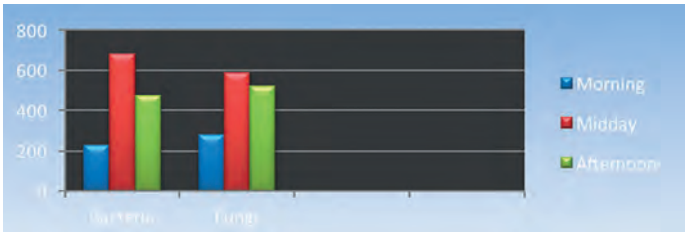

Fig. 1. Absolute Frequency (CFU) of microorganism according to the analyzed period in the station I.

Table 2. Absolute Frequency (CFU) of microorganism according to the analyzed period in the station II.

Station II	*Date*	*T(°C)*	*Morning*		*T(°C)*	*Midday*		*T(°C)*	*Afternoon*	
			Bact.	***Fungi***		***Bact.***	***Fungi***		***Bact.***	***Fungi***
Agro-Food Market										
	01.09.2014	22	150	120	29	400	350	27	320	150
	07.09.2014	23	130	100	28	350	400	29	270	231
	09.09.2014	20	140	150	30	370	300	27	350	210
Average			**140**	**123**		**373**	**350**		**313**	**197**

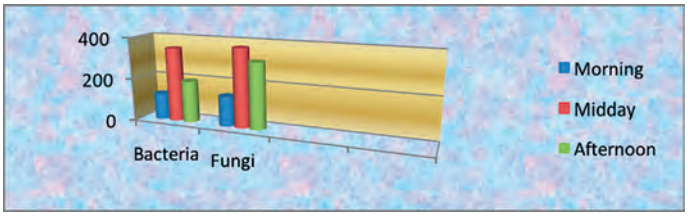

Figure 2. Absolute Frequency (CFU) of microorganism according to the analyzed period in the station II.

Table 3. Absolute Frequency (CFU) of microorganism according to the analyzed period in the station III.

Station III	*Date*	*T(°C)*	*Morning*		*T(°C)*	*Midday*		*T(°C)*	*Afternoon*	
			Bact.	***Fungi***		***Bact.***	***Fungi***		***Bact.***	***Fungi***
Used Clothes Market	03.07.2014	26	300	206	31	670	476	28	670	250
	05.08.2014	27	320	241	34	760	480	29	760	267
	01.09.2014	26	250	150	30	800	350	27	800	200
	07.09.2014	25	310	218	29	800	420	28	800	220
	09.09.2014	26	200	239	30	420	500	27	420	280
Average			**276**	**211**		**690**	**445**		**377**	**244**

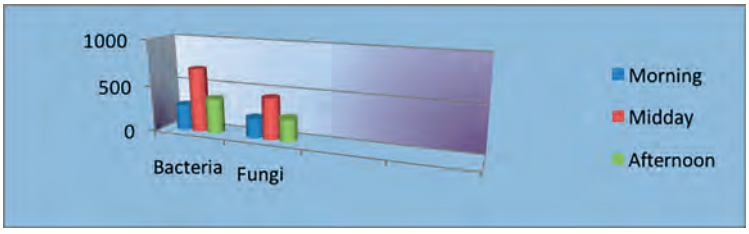

Fig. 3. Absolute Frequency (CFU) of microorganism according to the analyzed period in the station III.

Table 4. Absolute Frequency (CFU) of microorganism according to the analyzed period in the station IV.

Station IV	*Date*	*T(°C)*	*Morning*		*T(°C)*	*Midday*		*T(°C)*	*Afternoon*	
			Bact.	***Fungi***		***Bact.***	***Fungi***		***Bact.***	***Fungi***
Train station	03.07.2014	23	460	158	29	616	250	27	700	200
	05.08.2014	24	480	200	30	620	230	28	670	230
	01.09.2014	25	400	80	30	500	160	26	800	80
	07.09.2014	24	200	139	31	400	200	26	550	120
	09.09.2014	25	140	40	30	180	80	28	300	70
Average			**336**	**124**		**463**	**184**		**604**	**140**

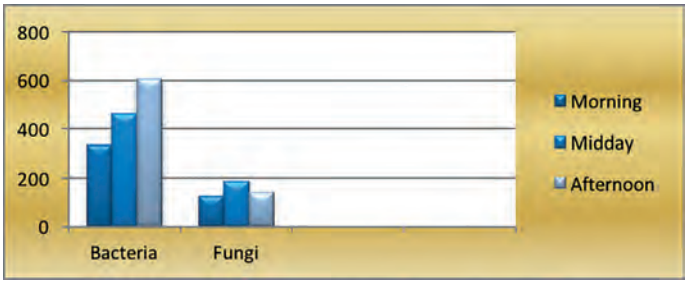

Figure 4. Absolute Frequency (CFU) of microorganism according to the analyzed period in the station IV.

Table 5. Absolute Frequency (CFU) of microorganism according to the analyzed period in the station V.

Station IV	*Date*	*T(°C)*	*Morning*		*T(°C)*	*Midday*		*T(°C)*	*Afternoon*	
			Bact.	***Fungi***		***Bact.***	***Fungi***		***Bact.***	***Fungi***
Parks	03.07.2014	23	20	40	30	50	60	27	80	72
	05.08.2014	25	25	65	30	36	67	28	72	86
	01.09.2014	24	19	24	29	51	20	25	86	50
	07.09.2014	24	32	16	31	50	26	26	63	29
	09.09.2014	25	20	20	30	70	47	28	62	43
Average			**23**	**33**		**52**	**44**		**73**	**56**

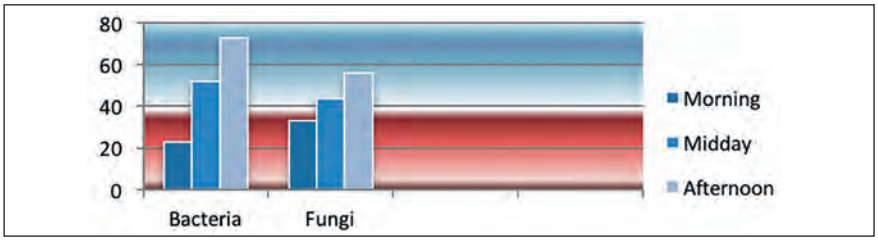

Figure 5. Absolute Frequency (CFU) of microorganism according to the analyzed period in the station V.

By listing the areas studied, from the most contaminated to the cleanest it resulted:

- The outdoor Market (number of colonies ranges from 230 to 679 on a Petri dish).
- The used garments market (number ranges from 211-445 on a Petri dish).
- Train Station (number of colonies varies 124-140 on a Petri dish).
- Agro Food Market (number of colonies ranges from 123 to 350 on a Petri dish).
- Park (number of colonies ranges from 33 to 56 on a Petri dish).

The level of microbial contamination of air at all stations grows from morning to lunchtime and drops in the afternoon. Microorganisms react differently to changes of air humidity and temperature as well as to products traded on the market.

The "Outdoor Market" area throughout the analyzed period has resulted polluted because there are a number of microbial colonies above allowed norms and the Agro-food market results to be less polluted due to high hygiene.

Large microbial contamination also affects the market of used garments, under the influence of other factors such as overcrowding, high level of vehicles, opening of garments in the market etc.

The number of colonies in station IV is lower compared with other three stations, but the number of colonies above the permissible norm of microbial contamination of the air has also influenced the air stream because it is located near the waste disposal site. The reduction of microbial level of contamination occurs in the days of garbage and as a consequence chemical pollution increases.

In conclusion, it turns out that the Park area throughout the analyzed period is considered pure.

CONCLUSION

The level of microbial air contamination is considered high, compared with existing suggestions for microbiological standards and UE demands.

The number of microorganisms (colonies) ranged within 19-700 for bacteria, and 16-800 in the case of fungi.

The factors that influence this high level of contamination are environmental factors, anthropogenic sources and deposition of biological materials.

Recommendations

- Monitoring by the Institute of Public Health control groups.
- Implement and improve laws on environmental protection.
- Improving the service and maintenance of premises by local government.
- Population awareness to maintain public space.

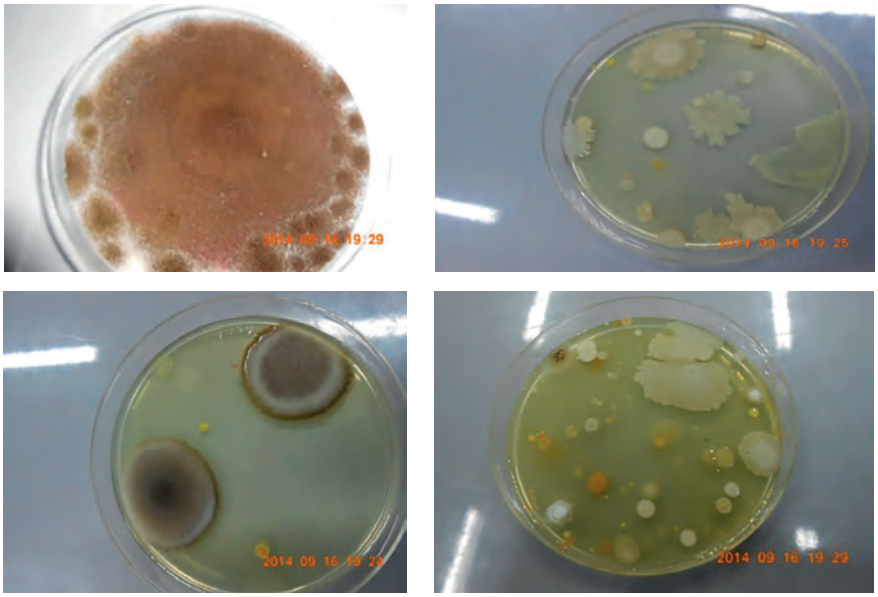

Fig. 6. Fungi and Bacteria (Miraka M.).

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