RESEARCH REGARDING THE USE OF FAR-INFRARED HEATING TECHNOLOGY OVER THE ENVIRONMENT

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Abstract

This paper presents results obtained in the frame of an applicative research contract upon the use of ecological, biogenetic heating technology of far-infrared kind, with the purpose of using it in Romania in different domains of activity.

For the climatic conditions of our country, we proposed and performed a measurement program in the following fields: electric expenditure, climatic, microbial loading of air, effects over plants, effects over pets and prolusions over general health, and comfort status of human being. In this work we present the results obtained above the micro-climate measurements, effects over plants and over microbial loading of air from the space in which we used this type of heating system during 2007-2008 and 2008-2009 winter.

In the rely of this research, we are in right to affirm that this type of heating technology has benefic effects in preserving the homogeneity of the micro-climate conditions, in the growth of plants and assures an easily growth of hygiene of medium in which it is act.

INTRODUCTION

Infrared is known as a zone in the electromagnetic specter which has been researched for a long time and scientists have determined three infrared segments: A, B, C, [1]. Each letter corresponds to a specific wave length and each has specific applications in industry, agriculture and human health.

Nowadays, the majority of the usual infrared sources emit short frequency waves that work at thousands Celsius degrees and the dark red colored radiation belonging to the visible specter becomes visible near the emission sources (the lamps). Recent research published in the specialty literature [2, 4, 7] inform that emission sources working at the short-wave side of the specter are being made. Infrared that works with long wavelength (about 10 000 nm) have effects over solid bodies and living organisms. In this case, bodies emit the heat absorbed from the panels. Therefore, the space is heated not by lamps, but by the solid corps inside, that creates a great ambient atmosphere.

Because of the intense research done for the developing of this technology, the future picture gives us hope for using infrared technology in heating human ambient space (houses, commercial spaces, industrial production spaces, farms,

saunas, etc.) and for applications in domains that require controlled thermal energy [3]. Actual research is focused both on heating, drying, backing, frying and on cooling, freezing, and transporting products in controlled climate.

MATERIAL AND METHODS

The measurements took place in a room placed on the top floor of an edifice of the North University of Baia Mare, built in 1976. This room is placed in the corner; it has two walls to exterior, which are not isolated, and the ceiling, which is relatively well isolated. The dimensions of the room are: 6.20 m long x 2.95 width x 2.85 height and it is equipped with a new, well-isolating window, which has a North exposition and an entrance door from hall with a South exposition.

The measurements were done in cold period of the winter 2007-2008 and 2008-2009, November-February period.

The measurements had been done in the following domains:
I.Electric expenditure the hourly/daily electric-consumes. The measurements were done using specialized control equipment.
II.Climate
  a) Interior – 3 times a day (7:26; 13:26 and 19:26 hour), in 4 different points (1st point was placed in corner, at 2 meters high, near the sealing; 2nd point was placed in the center of the room on a work table; 3rd point was placed near a wall at a chair level; 4th point was placed the opposite corner of point no. 1, on the floor).
  b) Exterior – near the building – 3 times a day, at the same hours, following the urban microclimate.
  c) Baia Mare Weather Station – 3 times a day, at same hours too, using DigiWeather software and Romanian Meteorological National site, following the regional climate [9].

The meteorological observations were done using a type WMR100 Meteorological station and with common measurement instruments, such as different mercury based thermometers and hygrometers. The data monitoring and evaluation was done using the weather station's PC integrated software.

III. Microbial loading of the air – the analysis and probation had been done in collaboration with an accredited microbiology laboratory. The drawings were taken before long-waved infrared panel started to function, during its running and after turning it off. The working method for analyses was standard „KOCH sedimentation method" [5, 6].

IV.General health and comfort status of human being
There were 14 persons engages in this research work. They were volunteers, and their age and availability were amongst their selection criteria. The research members were selected for having impressions from child's to elder people. As sex

criteria, there were 6 female and 8 male. The group had divers characters and daily activityes.

Each team member managed a „Personal Observation Form" during the project time. In the form they marked personal observations regarding the comfort status, general and particular organic health and sanity [8].

RESULTS AND DISCUSSION

I. Climate
The specialized literature mentions that for the Baia Mare Depression, like for the Romania geographical area, January is the coldest recorded month of winter [9, 10]. Sometimes, the minimum temperature is reached in February or in the long, cloudy time from December, but the strongest frost were registered always on January. Although usually it snows a lot in Baia Mare Depression (medium 109 snow-days/year), on 2007-2008 winter, there were registered few snowing-days [8] and no gust of wind during the measurement period.

In table 1 there are presented the maxim, minimum and medium temperature values for air, registered in the winter seasons comparatively from the two years in which the experiment enrolled.

Table 1

Comparative results of the temperatures

| Month	Temperature weather station (°C)						Temperature university (°C)					
	max		*min*		*med*		*max*		*min*		*med*	
	2008	*2009*	*2008*	*2009*	*2008*	*2009*	*2008*	*2009*	*2008*	*2009*	*2008*	*2009*
Dec.	12.6	13.7	-7.0	-11.2	-1.5	2.8	9.0	17.3	-3.5	-10.4	0.8	3.5
Ian.	8.0	12.3	-7.0	-13.1	-0.07	-1.1	10.6	15.6	-4.0	-13.8	3.2	-0.1

There is to be noticed that urban air temperature is about 2°C higher than the temperature registered by the regional weather station. The thermal amplitude is normal for this year period. The minimum temperatures from the urban environment have to be used in programming the functioning of equipment. Regarding the differences between the year 2008 and 2009 we see that in the current year the temperatures varied on a larger scale, but this aspect did not influenced the interior temperature, as we can see in the comparative figures from above.

Obtaining a temperature in the 19-21°C intervals inside a room is the main objective in the cold periods of the year. Considering the preferences, the comfortable temperature can vary with a couple of grades in a 24 hour cycle.
In figure 1 are shown the daily temperature variation from both inside the room and in the urban environment (outside), comparatively from the both years of the experiment.

It is clear that there were no difficulties in reaching and then maintaining the comfortable temperature. The vast variety is the result of "preference game". Long-waved infrared heating offers flexibility with no effort, this makes it a great surrounding climate, according to the moment demands, but it is marked by the weather evolution, especially when it has to face long severe cold.

It's clearly visible the similarities between the two graphs are clearly visible according to the interior temperature and the outside temperature varies in large amounts, but the inside temperature remains in the same range.
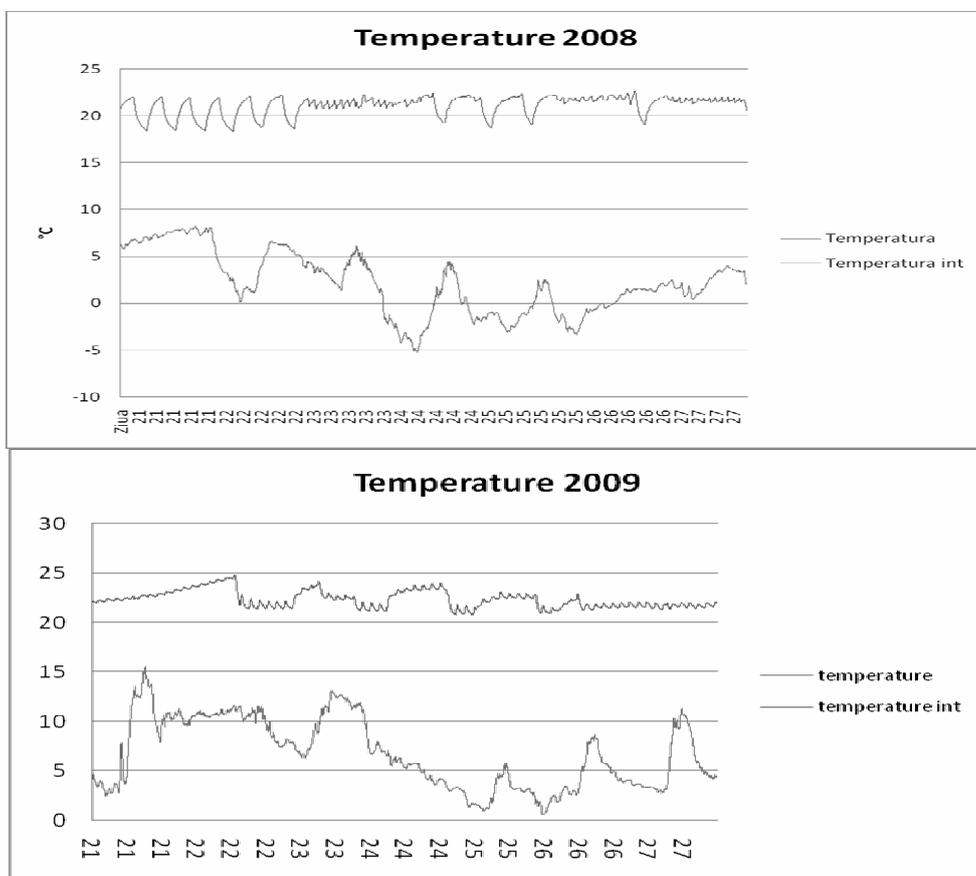
Fig. 1. Temperature variation in the room and outside from January 2008 and January 2009

In figure 2 is shown the daily relative humidity variation inside the room and in the urban environment (outside), the humidity being measured through the both years of the experiment.
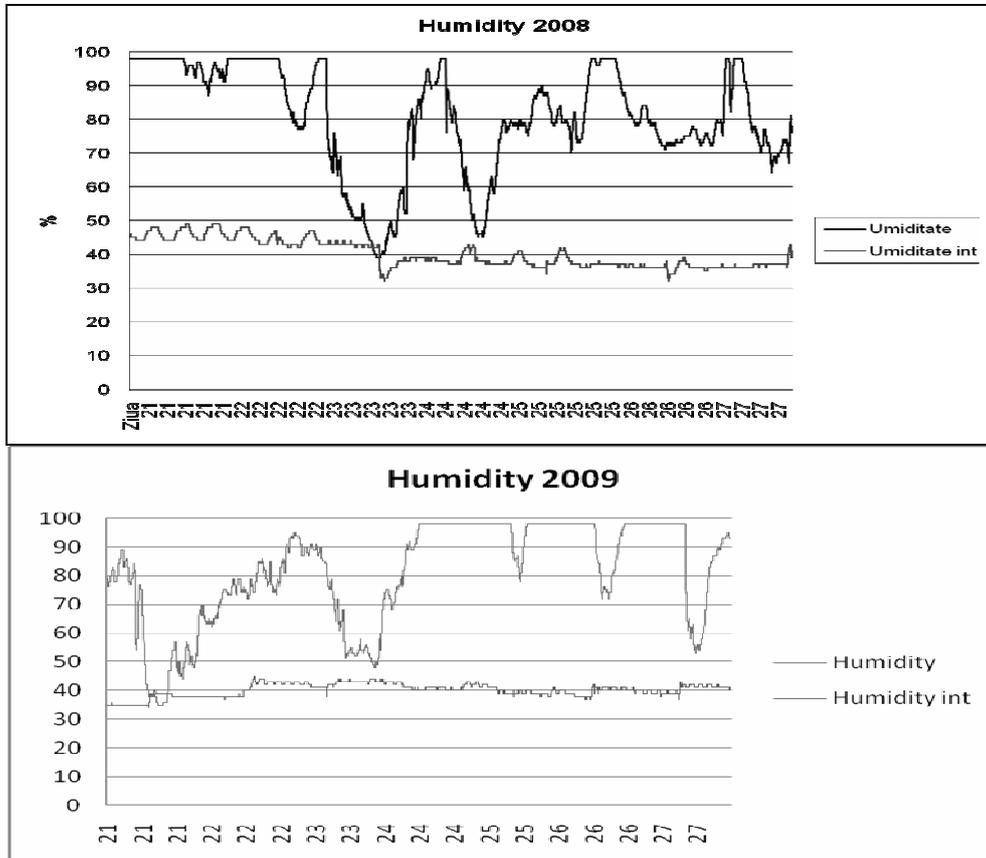
Fig. 2. Humidity variation in the room and outside from January 2008 and January 2009

The relative humidity of the air registered very small variation in the work-room while the relative humidity of the atmospheric air registered normally large variations. This permanently homogeneous environment, created by the relative air humidity makes a microclimate that is well tolerated by the sensitive organisms.

A correlation between the air temperature and the relative humidity in the room shows that for these experimental conditions, maintaining the temperature over 20ºC, the relative humidity of air registers values round 40%. This modification has not been reported as discomfort by the subjects, but it has been registered by the researchers as the object of ulterior studies in which there will also be studied other parameters of the immobile.

CONCLUSIONS

In actual conditions considering the European strategy for the energy and gas emissions domains, the research results show that long-waved infrared technology:

1. is innovative and promising for the future, from ecologic and biogenetic point of view;
2. is clean, efficient, non polluting emission technology;
3. can be used in a very large scale of domains;
4. is just at the beginning when used in the agro-industrial applications;
5. has benefic effects over the organisms, effects that can be fragmental quantified for the moment;
6. can be successfully implemented in Romania.

Research in this domain is to be continued because of the multitude of the less known phenomena and the limits that appear when using a new technology.

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