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HYGIENIC ASSESSMENT OF INDOOR MICROCLIMATE PARAMETERS

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Abstract. Indoor microclimate is one of the important environmental factors affecting the human body. This article describes the main microclimate parameters (air temperature, relative humidity, air movement speed and thermal radiation), the reference values used for residential rooms in the cold period, the methods of measuring these parameters, and the procedure for their hygienic assessment. According to the procedure, the microclimate is classified as optimal, hygienically permissible or non-compliant, depending on how the measured values compare with the relevant sanitary and hygienic standards. Measures for improving unfavorable microclimate conditions are also presented.

Keywords: microclimate, hygienic assessment, air temperature, relative humidity, air movement speed, thermal radiation, ventilation, sanitary standards.

INTRODUCTION

Indoor microclimate is one of the important environmental factors affecting the human body. It consists of a set of indicators in the room: air temperature, relative humidity, air movement speed and thermal radiation. Keeping these factors within the norm is important for a person's heat exchange, work capacity, sleep and overall health.

The hygienic assessment of the microclimate depends on the purpose of the room, the season and the activity of the people who stay in it. An unfavorable microclimate may reduce work capacity and cause discomfort, so its objective assessment is an important task of hygiene.

Aim of the study: to systematize the approaches to the hygienic assessment of indoor microclimate parameters.

Objectives: (1) to describe the main microclimate indicators and their significance for the body; (2) to present the reference values and the methods of measuring the indicators; (3) to define the procedure for the hygienic assessment of the microclimate and the measures for its improvement.

MATERIALS AND METHODS

This work is a theoretical and analytical review based on the analysis of sanitary and hygienic standards and educational literature on general hygiene and ecology. The data were processed using content analysis, comparison and systematization.

Special measuring instruments are used for the hygienic assessment of the microclimate. Air temperature is measured with thermometers, relative humidity with a psychrometer or hygrometer, and air movement speed with an anemometer.

In industrial premises, measurements are taken depending on the nature of the work: at a height of 1.0 m from the floor for work performed in a sitting position and at 1.5 m for work performed in a standing position. The measurement points in a room are selected according to the area of the room and the presence of heat or moisture sources.

The measured values are compared with the relevant sanitary and hygienic standards, taking into account the purpose of the room, the season and the type of activity of the people in it.

RESULTS

Main microclimate indicators

The main indicators used in assessing the microclimate of rooms are the following.

Air temperature is measured in °C. It affects the balance between heat release and heat production in the human body.

Relative humidity expresses the amount of water vapor in the air as a percentage. Very high humidity makes heat release difficult, while very low humidity may lead to drying of the respiratory tract and the mucous membranes of the skin.

Air movement speed is measured in m/s. An increase in air movement intensifies heat loss from the body.

Thermal radiation expresses the amount of heat reaching the human body from surrounding heated surfaces and equipment.

In residential and public rooms, air temperature, relative humidity and air movement speed are considered the main indicators.

Air temperature

Air temperature directly affects the body's heat exchange. Excessively high temperature may cause overheating of the body, increased sweating and reduced work capacity. Low temperature, on the other hand, leads to excessive heat loss and chilling.

In residential rooms in the cold period, an optimal air temperature of approximately 20–22 °C is usually recommended. In public and administrative rooms, the optimal values differ depending on the category and purpose of the room.

Relative humidity

Relative humidity is an important indicator of indoor microclimate. For most rooms, excessively high or low humidity creates an uncomfortable microclimate. In residential rooms, the optimal values of relative humidity are approximately within 30–45%, and in some standards its permissible upper limit is set at up to 60%.

Air movement speed

Air movement speed affects a person's heat exchange. If the air moves too fast, especially in the cold, the body loses more heat. Very low air movement, on the other hand, may increase the feeling of stuffiness in the room. In residential rooms in the cold period, the optimal air movement speed usually does not exceed 0.15 m/s, and the permissible value may be up to 0.2 m/s.

The reference values are summarized in Table 1.

Table 1

Microclimate indicators, measuring instruments and reference values

Indicator	Unit / measuring instrument	Reference value (residential rooms, cold period)
Air temperature	°C / thermometer	Optimal: approximately 20–22 °C
Relative humidity	% / psychrometer or hygrometer	Optimal: approximately 30–45%; in some standards the permissible upper limit is up to 60%
Air movement speed	m/s / anemometer	Optimal: not more than 0.15 m/s; permissible: up to 0.2 m/s
Thermal radiation	Heat from heated surfaces and equipment	Taken into account where heated surfaces or equipment are present

Procedure of the hygienic assessment

In the hygienic assessment of the microclimate, first the purpose of the room, the season and the type of activity of the people in it are determined. Then air temperature, relative humidity and air movement speed are measured, and the results are compared with the relevant sanitary and hygienic standards. The microclimate is classified as follows:

- optimal, if all indicators are within the optimal limits;
- hygienically permissible, if the indicators are within the permissible limits;
- non-compliant, if a significant deviation from the standards is found; in this case, measures to improve the microclimate are recommended.

DISCUSSION

The results show that the microclimate cannot be assessed by a single indicator. Air temperature, relative humidity and air movement speed act on the body together: for example, air movement that is acceptable at one temperature may cause chilling at a lower one, and high humidity makes heat release difficult. Therefore, all indicators must be measured and evaluated jointly.

Reference values depend on the type of room and the season, and the standards in force differ in their permissible limits. This is why measured values should always be compared with the standard that corresponds to the purpose of the room and the period of the year.

The correct choice of measurement points and heights is also important for the reliability of the assessment, since temperature and air movement may differ in different parts of a room, especially near heat or moisture sources.

A limitation of this work is that it is a review and does not present independent measurement data. Practical studies measuring the microclimate of specific rooms are advisable in the future.

Measures for improving the microclimate

To ensure a comfortable microclimate in rooms, it is necessary to use natural and mechanical ventilation, organize heating and cooling systems properly, control humidity and ventilate the room regularly. At high temperature, air conditioning and ventilation can be used, and at low temperature, an effective heating system. Ventilation systems must be properly designed in order to regulate air movement.

CONCLUSION

The hygienic assessment of indoor microclimate is important for human health and comfortable living. Air temperature, relative humidity and air movement speed are the main indicators of the microclimate. Keeping them within the standard limits ensures the body's heat balance, helps to preserve work capacity and prevents the adverse effects associated with an unfavorable microclimate.

Therefore, when assessing the microclimate of any room, the measured indicators should be compared with the type of room, the season and the relevant sanitary and hygienic standards.

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