▪development of highly efficient indoor climate control technology.

The experience of creating the high-performance building envelopes in the world is very large.

The microclimate provision with the use of renewable energy sources is environmentally friendly and it is a modern, highly efficient microclimate technology [2].

One of the promising areas of modern energy development is the use of renewable energy for heat and cooling supply of microclimate systems in buildings based on installations that use insulated combined heat and cold production - absorption heat transformers (AHT). These heat transformers are a thermodynamic system where heat is transformed by means of combined forward and reverse cycles. AHTs have high efficiency, environmental friendliness, quiet operation, ease of maintenance, long service life and full automation.

On the basis of these thermo-transformers, a technology is proposed and a schematic diagram of its operation is developed to ensure year-round microclimate parameters in buildings with the integrated use of solar, wind, and biomass energy, as well as soil and water energy. Due to the instability of this energy, accumulation is provided. Of there is a shortage of renewable energy, a backup energy source is provided.

The analysis of the heat and air balance of the premises showed that the reduction of energy consumption by microclimate systems should be achieved by means of:

▪optimizing air exchange and reducing the amount of supply air to the required minimum,

▪zoning of premises by the area of the working or service area,

▪the use of natural air movement stimuli,

▪monitoring the state of the internal atmosphere and managing its parameters.

In order to solve the problem of reducing energy consumption, it is proposed to provide indoor microclimate by two simultaneously operating systems:

▪a system of year-round provision of thermal comfort in the room due to surface heating (in the transitional and cold periods of the year) and cooling (in the warm period of the year);

▪air conditioning system.

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Ye. Smyrnov (PhD student, PSACEA, Dnipro)
Scientific supervisor: A Belikov Dr. Sc. (Tech), Prof.
I. Kolesnyk, Cand. Sc. (Tech), Assoc. Prof.
Language consultant: K. Sokolova, Cand. Sc. (Phil), Assoc. Prof.

HUMIDITY AND AIR MOVEMENT IMPACT ON THERMAL CONDITIONS

The temperature conditions of the room determine its thermal microclimate and limit the other parameters such as humidity and air movement. It is necessary to consider the values of relative air humidity $\varphi_в$, which, in combination with the temperature of three normalization zones, will not have any adverse effect on human well-being and performance.

The boundaries of the range of permissible combinations $t_в$ - $\varphi_в$ must be also taken into account. It is known that low relative air humidity (20...25%) is one of the causes of colds. In addition, it causes increased dust due to excessive drying of objects made of natural materials (wooden furniture, parquet floors, etc.). High relative air humidity (above 70%) also negatively affects human well-being. Even at a comfortable temperature, it leads to increased heat loss from the body, which makes a person feel chilly.

At the same time, the release of water from the skin and lungs decreases, contributing to the exacerbation and progression of pulmonary diseases. Increased air humidity at more than 22°C makes feel stuffy. Based on subjective assessments, the so-called spirit curves were constructed. In mid-latitudes, this curve corresponds to the maximum moisture content of internal air d = 12 g/kg. [1, 3]

For heated premises of residential and public buildings, according to regulatory guidelines [2], the permissible norm of relative humidity of internal air is no more than 65% at a temperature of 18...22°C, and the optimal one is 30...45% at a temperature of 20... 22° C. However, many researchers believe that the comfortable range of relative humidity can be expanded to 55%. An increase in air temperature requires a corresponding decrease in its humidity to enhance heat transfer by evaporation.

At a relatively low ambient temperature, humid air, due to its high thermal conductivity and heat capacity, further increases the heat transfer of the body, which is extremely undesirable. Therefore, as temperature drops, relative humidity values are limited.

Air movement in the area of residential and public buildings within the range of 0.1...0.15 m/s is considered most favorable at a temperature of 20...22°C, and its increase to 0.2 m/s - at more high temperature [2, 3]. With regard to regulatory guidelines [4], it is permissible to increase air movement to 0.3 m/s in the temperature range of 18...22°C.

In the premises of buildings equipped with natural ventilation systems, air movement values are usually within limits close to normal. Such movement will not change the thermal conditions in the premises with an acceptable decrease in internal temperature. An increase in temperature, as it is known, is accompanied by increased ventilation of premises, and, consequently, an increase in the overall movement of air. Therefore, it is of practical importance to analyze the required relative humidity of indoor air during different periods of the heating season with standard air exchange L_n (3 m^3/h per 1 m^2) as required in the guidelines. [4]

The analysis of the data obtained allows us to draw the following conclusions. In conditions of central heating, there is an excess supply of thermal energy for heating, which allows residents to increase the intensity of air exchange and thereby not only eliminate overheating, but also reduce the relative humidity of internal air (from 65...70%) to optimal values. In spring, the desired increase in internal temperature of approximately 2°C should be taken into account.

During most part of the heating period, the relative humidity of the internal air can be maintained within normal limits due to standard air exchange. At low outside air temperatures, a regulated reduction in air exchange allows eliminating excessively dry air.

An unfavorable factor that has a negative impact on the indoor microclimate is the condensation of moisture on the internal surfaces of external fences when the air temperature in the premises decreases during the period of extreme cold. However, at $t_в$ = 15°C and $\varphi_в$ = 42%, the dew point temperature is approximately 12°C lower than the air temperature, which does not create conditions for moisture condensation, provided the thermal properties of the external fences correspond to the design data. At the same time, with more intense moisture releases compared to the calculated ones, condensation of water vapor is possible on the coldest surfaces: windows, places of heat-conducting inclusions in the structure of the outer wall, etc. However, these phenomena are relatively short-term.

Thus, while ensuring the standard value of indoor air exchange due to external air, in buildings of mass construction such values of humidity and movement of internal air are maintained in order not to change thermal conditions due to temperature indicators. Therefore, to calculate necessary thermal conditions, only the temperature factor of the microclimate can be taken into account.

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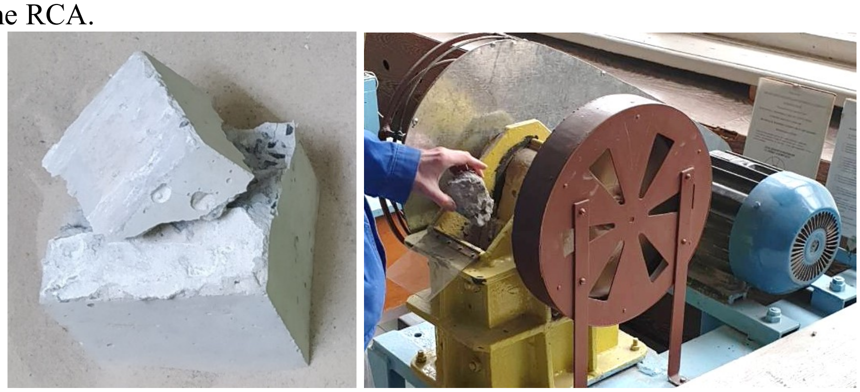
A. Smyrnov, O. Poliakova, N Olhov PSACEA, Dnipro
Scientific supervisor: A. Myslytska, Assistant
Language consultant: L. Druzhinina, Assoc.Prof.

GRAIN SIZE COMPOSITION OF RECYCLED COARSE AGGREGATES

During the design of concrete mixture it is necessary to know such characteristics of aggregates as grain size composition, bulk density, specific density, voids, strength. These properties determine the mass content of the components of the concrete mixture, and also impact its characteristics (W/C ratio, plasticity, density etc.) [1].

A feature of the recycled coarse aggregate (RCA) made from concrete waste is the presence of such new phases as the residual mortar (RM) and the interphase transition zone between it and the natural aggregate [2]. RCA tests were performed to determine the effect of additional components of coarse aggregate on its properties. As a source three series of concrete samples of three different mixtures with different strength classes were made from local materials.

The samples of origin concrete were crushed at the age of 28, 90 and 180 days using a laboratory jaw crusher (Fig. 1). After grinding each mixture was marked according to the following scheme: XX/YY/K, where XX is the number of source mixture, YY is the age at which the source concrete samples and crushed mixes were tested. This work presents the results of determining the grain size composition of the RCA.



a)b)

Fig. 1.a – the split sample a cracked sample of source concrete without structural disturbance; b – laboratory jaw crusher with complex rotation.

Grain size composition of each mix was determined by sieve analysis [3]. Due to the high content of small fractions, unfractionated mixtures of small and large fractions do not meet the requirements [1]. The sieving curves of only the coarse fractions plotted on the standard graph are shown on Fig. 2. As we can see from graph in general, the grain size composition of only coarse fractions meets the requirements of standards in Ukraine.