

Dry indoor climate

– Why and how to prepare for the next cold season?



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It's easy to forget, what you can't see – if we live in the Nordic region or other colder areas, we could acknowledge that the air feels dry and the indoor climate is less comfortable during wintertime, i.e. we experience cold, dry spells. In addition to impaired indoor comfort, research shows that a dry indoor environment is also one of the causes of seasonal illnesses such as influenza. In this article, we will introduce the reasons behind a dry indoor environment and how it affects us and a few simple tips on what we can do to make the indoor climate more comfortable in the winter. We can have the systems/controls for handling humidity indoors in place for the next cold season if we start planning straight away!

Keywords: relative humidity (RH), cold climate, health, indoor air quality

Today, we live for a few months a year in a desert climate!

In the winter months and till late in spring, in modern private households, offices and public spaces the relative humidity could drop to just 15 to 20 percent – comparable to the conditions in the bone-dry desert! Indeed, such climate of 20-26°C and 10-40% RH exists in nature only in winter time in the desert! And in our temperate climate zones, you can find it in buildings only.

The problem of dry indoor air has increased dramatically over the last 50 years partly because of:

- The average indoor temperature has increased by 5°C (remember, for example, grandparents who only heated the living room and only to 18°C).
- The living space per inhabitant increased from 25 m²/p. to 45 m²/p. between 1970 and 2013 (thus less natural moisture input through cooking, washing, showering).

- Loss of healthy practices: recall the wise grandmothers placing wet towels or small ceramic pots onto the heating elements or ovens during the winter season, in order to keep a pleasant air quality, or humidifying especially when children were sick with respiratory diseases, to naturally ease the cough and aid recovery. They knew it, empirically!

How do we notice dry air?

High humidity may cause problems indoors, leading to moisture and damage in case of water condensating onto cold walls— which can be easily avoided, primarily through good wall insulation in combination with sufficient ventilation. However, in winter, when it's cold and freezing, in many parts of the world, we experience the opposite – that the indoor air feels uncomfortably dry. We notice it when our bodies start to itch, our hair feels electric, our hands and lips get chapped, our throats and eyes feel dry, and we easily get an irritating cough. People with asthma, allergies, or other respiratory disorders often have more trouble during the cold season, particularly noticeable symptoms. In addition, a dry indoor climate also affects the building, as laminate flooring cracks and parquet flooring starts to separate or warp. So, what is the reason behind all of this?

The laws of nature rule - How does it work technically?

Dry air in winter is mainly due to our natural laws and the fact that cold air cannot physically contain as much moisture as warm air. In the humidity diagram (Figure 1), the blue line shows the maximum “absolute humidity” of the air (g/m^3), i.e. the maximum amount of moisture the air can contain at a given temperature ($^{\circ}\text{C}$). In simpler terms, the blue line shows when the relative humidity (RH-) is 100% at different temperatures.

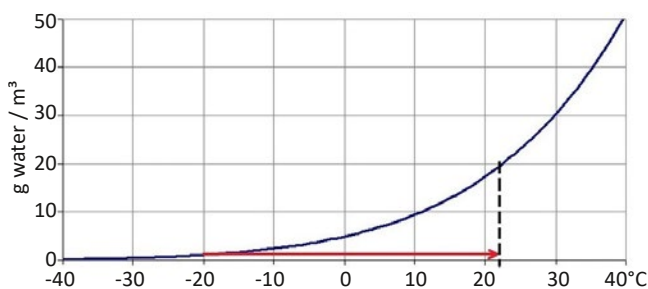


Figure 1. Relative humidity – moisture content in the air at a given temperature.

Example: At minus 20°C , the air’s absolute humidity at most is approximately 1 gram moisture per cubic metre of air. If the air is heated to 22°C (red arrow), the air can contain 15 times more moisture without condensation, i.e. a maximum of about $20 \text{ g}/\text{m}^3$ of water. However, since no moisture is added during the increase in temperature, the relative humidity (RH) will instead drop from $\text{RH} = 100\%$ to only about $\text{RH} = 7\text{-}8\%$. This means that cold air dries when it is heated and we often experience a poor indoor climate in winter.

Humidity and water in your body

The human body is composed of 60-80% of water, which is why people have such an adverse bodily reaction to extremely dry air, see Figure 2. Therefore, to function properly, people need to be in an environment with ample moisture levels in the air.

Did you know that the brain and heart are composed of 73% water, and the lungs are about 83% water? And that the skin contains 64% water, muscles and kidneys are 79%, and even the bones are watery 31%? (Source: H.H. Mitchell, Journal of Biological Chemistry 158).

Humidity and the feeling of cold

In winter, drier air assists evaporation and thus the cooling of the people’s skin. The most immediate effect of this phenomenon is that for the same temperature, the drier the air – the colder we feel.

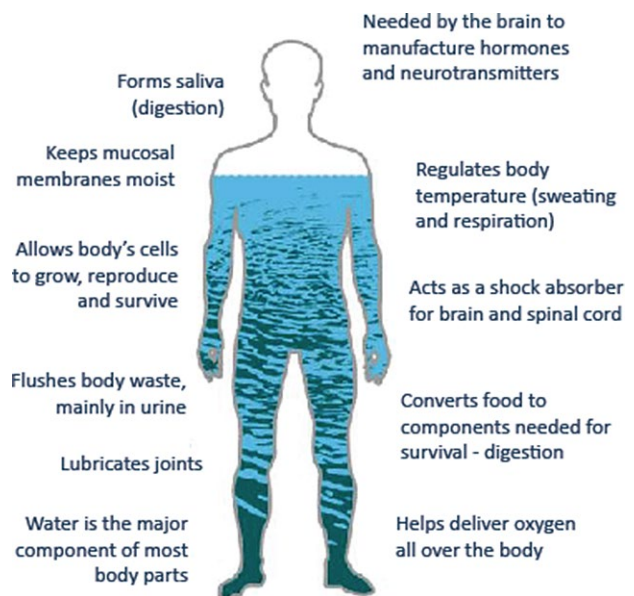


Figure 2. Water in the human body, i.e. what water does for you – just a few examples.

The impact of humidity on indoor climate and health

As stated in the beginning, in homes, but also in other premises such as offices and schools, the relative humidity is often 20-40%, but at times during the winter it can be as low as 10%. The recommended level is often given as between 30% and 60% depending on the season, but there is no set limit for this. At higher levels, the indoor environment can be perceived as damp, close and sticky, while lower levels can be perceived as dry and dusty, and you experience problems with static electricity and itching on the body.

The common problems associated with severely dry air

The effects of low humidity can be expressed in two areas – the skin and respiratory problems.

- Chapped lips, dry and irritated eyes, and dry skin with itching, tiny cracks and even bleeding (cracked skin opens the body up to greater exposure to microbes and illness). Also, dry nasal passages cause nosebleeds. Similarly causing sore or scratchy throat. And in the long-term, it can cause or worsen skin – irritation, inflamed eczema and allergy.
- As your body's ability to trap and filter out the viruses and microbes decreases – it can cause discomfort and also make you more susceptible to sickness. And prolonged stay in low humidity can cause developing respiratory problems such as asthma, bronchitis, sinusitis, etc.

What can be done to counteract dry indoor air in your home and at your workplace?

There is no one-size-fits-all solution, but it's possible to influence the indoor climate to some extent by simple means to reduce the dryness of the air in offices or other premises in winter.

- During periods when humidity is low, you should take care of yourself – drink more fluids, especially water, and surely moisturize your skin and lips. Also make sure that you humidify the air around you, so it does not dry you out!
- The traditional way of increasing the humidity indoors relies on placing large bowls of water in various places in the room, especially near the heat source, to accelerate the evaporation process. And the more modern approach is to use mobile humidifier.
- Living plants increase the sense of well-being and release humidity into the environment through evaporation. The more and larger the plants, the

better (for example green living walls). Also, you may want to close the door to the office in your workplace and at home to preserve the higher humidity level, both during the working day but also overnight. An aquarium can also be an excellent complement in common areas.

- A small humidifier can help to add moisture, but often only works on a room-by-room basis, and this can be a less ideal option in open-plan offices and large classrooms. There are also larger mobile humidifiers, suitable for these setups. Remember that there are different humidifiers and that some of them emit noise, so it's important to choose a model with a low noise level. All humidifiers also need some form of maintenance, such as cleaning, in order not to pose a health risk.
- Control and improve your indoor air quality, you can monitor the overall conditions of the room using either a simple humidistat/hygrometer or use more complex monitoring equipment provided in your office connected to a more advanced building system.
- Invest in your indoor climate system by adding controls and functions for humidity recovery as well as the potential of adding humidity, in order to offer effective and safe protection, via a permanent solution. to achieve a both pleasant and healthy indoor climate.

In conclusion...

Nature is always looking for balance. In the case of relative humidity, this means 100% saturation. The air will therefore always remove moisture wherever it finds it until it is saturated. The scientific evidence [1] is there, controlled and increased relative humidity during our dry season will increase wellbeing and health and levels up to 60 percent relative humidity in central Europe is ideal – this corresponds approximately to the conditions prevailing in the nature. It is considered ideal both for value preservation and more importantly, for the immune system of our respiratory tract. So, let's keep our surrounding air well hydrated over this winter, for us all to keep healthy, merry and radiant as we enter a very good 2022! ■

References

- [1] Indirect health effects of relative humidity in indoor environments. A V Arundel, E M Sterling, J H Biggin, and T D Sterling. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1474709/pdf/envhper00436-0331.pdf>