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Most protective equipment will not stop viruses. Czech nanofiber brings safety and comfort.

The coronavirus, which has been spreading from Asia since December, has infected more than 4,500 people and roughly a hundred of patients have died. Its symptoms are similar to the symptoms of influenza and the infection is transmitted in the same way – by droplets. People try to protect themselves from inhaling the droplets by various types of face masks or respirators. But most of the time they don't orientate themselves on the market with protective equipment, and they reach for ineffective solutions. The most reliable type of effective protection are face masks with nanofiber filters.

Who is protected by face masks?

Respiratory protective equipment can be divided into equipment for medical (face masks) or professional (respirators) use. Both groups is governed by their relevant standards (of certification) and their purpose also differs. Face masks (commonly confused with cloth face masks) are used in particular by hospital staff – e.g. dentists or surgeons. But face masks were not designed to protect doctors or medical staff, they were designed to protect a patient who could be in danger of getting infected by a doctor or the medical staff during a medical procedure. Therefore, face masks are designed to intercept droplets exhaled by a user whereas the user him/herself is protected minimally. Face masks usually work on mechanical principle - as a sieve which should let the air in and stop any harmful substances. But face masks are usually made from a non-woven fabric which is breathable, but its pores between the fabric's fibres are too big and any bacteria or viruses can penetrate such face masks. The CEO of the company RESPILON, Roman Zima, adds: *"Many people believe that when they cover their nose and mouth with a textile face mask they are protected from an infection. Sadly, it is only a placebo effect – pathogens are so minuscule that a non-woven fabric is no barrier for them."*

What about a respirator? The right choice for a factory

Respirators serve as a protection of the users' airways but not against viruses – respirators intercept solid particles which are produced at a workplace during grinding, cutting, polishing etc. Respirators must comply with various standards, the most common ones are American standard NIOSH (respirators N95, N99 and N100) or the EU standard EN 149 (respiratory protective devices of classes FFP1 to FFP3). These categories cannot be directly compared to one another because the tests that are carried out on these respirators differ – anyhow, the relevant authorities do not test the respirators' ability to intercept viruses. To put it simply, we can say that the filtration efficiency is at the lowest level for FFP1 respirators, a little bit more efficient are N95 and FFP2 respirators, even one level up are N99 or FFP3 products and the absolute top level of filtration efficiency is provided by N100 equipment. But there is one problem – the particles which are intercepted by respirators are again significantly bigger than viruses. While the protective equipment for professional use is tested for their filtration efficiency of particles which are on average 0,3 µm in size, the coronavirus is three times smaller.

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The use of respirators also brings a second problem with it. Zima explains: "*Aside from mechanical interception the respirator uses also the electrostatic principle. The smallest particles carry positive charge and are drawn to the fibres which carry negative charge. A filtration like this works well in dry conditions, but viruses travel through the air in droplets and human breath also has a level of humidity. As soon as the material becomes moist, there is no charge and only mechanical filtration is left. If I really had to choose a respirator against viruses, I would choose respirators with the highest numbers: FFP3, N99 or N100. But the user must take into account that there may be some discomfort – the better the filtration, the lower the breathability.*

The modern solution: Nanofiber

So far, the best solution in the protection against viruses is represented by nanofibers – a Czech invention from the beginning of the 21st century. A nanofiber filter consists of fibres which are 500-1000 times thinner than a single hair and which form a dense structure. The pores in a nanofiber membrane are so small that they intercept the tiniest viruses, but a molecule of oxygen can still penetrate the membrane. That solves the problem with breathability, and also, particularly thanks to mechanical filtration, the nanofiber filter maintains a high level of efficiency in humid conditions.

The Czech company RESPILON uses the unique characteristics of nanofibers and produces, beside other products, ReSpimask face masks from them, which customers around the world use e.g. during influenza outbreaks. Unlike respirators, the nanofiber filters must undergo special testing of their ability to protect from bacteria and viruses. These tests are carried out in Nelson Labs, which is an American institute specialized in microbiological tests. RESPILON achieved a 99.9% filtration efficiency for both types of microorganisms and the users can therefore be undeniably protected also from the coronavirus.

Another advantage lies in the material which is used to make the nanofiber filters. Mostly the PVDF polymer is used (polyvinylidene fluoride) – a solid matter resistant to chemicals and UV light which absorbs almost no moisture. Thanks to the flexibility of PVDF and its placement between two layers of non-woven fabric there is no chance that the nanofibers would break and disengage from the filter.

Shape matters

The top level of filtration efficiency is not the only factor which influences the level of protection against viruses. The best filter in the world would be useless if air could seep in around the mask near the nose and the ears. That is the issue with most medical face masks whose universal shape does not fit the face properly. Respirators have a more sophisticated design and there is no "seeping in," although that goes at the expense of size, comfort and weight. The density and efficiency of nanofibers, on the other hand, allows the use a thin filter which adheres also to the problematic areas on a person's face. RESPILON especially focuses on their products' ergonomics, so all air flows through the membrane without the protective equipment limiting the user. At the same time, it is more intuitive and quicker to put on the face mask.

The complicatedness of the market with respiratory protective equipment will fully show itself especially in critical situations. People are searching for information in one place, but they find only shreds and pieces on various producers' or organizations' websites. Roma Zima says: "*Since the start of our company we have been trying to educate the public – for example at conferences or lectures in schools. Our goal is to contribute to raising the awareness of how to protect ourselves against pathogens and what things to avoid. I feel excited about the fact that more and more people are*

learning about nanofibers and that there is an effective tool for them. The development and production of RESPILON filters is done in the Czech Republic, which also earns the confidence of our customers. Our final products are then completed in China from where we supply our customers on all continents."

Products from our company's portfolio which offer the best protection against the coronavirus are primarily the ReSpimask and RespiPro face masks, the latter of which is also available in a version enriched by carbon which can absorb undesirable odours. Another option of protection is the R-shield neck gaiter which is washable.

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