



Gunpowder may smell nice, but it certainly harms the airways

With a nanofiber shield

Studies show that polluted air kills up to 5.5 million people a year – i.e. smog causes more deaths than alcohol, obesity, drugs and unprotected sex altogether. One of the possibilities to protect our lungs is the nanofiber filter which was incorporated into the R-Shield outdoor scarf made by the Czech company RESPILON

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Domestic fireplaces lit by inappropriate fuels, factory stacks and automobile transport belong among the largest air polluters. Areas afflicted with excessive smog are growing, same as related health problems. Short inhalation of fumes may result in a headache or eye and skin irritation, yet a long-term exposure is a cause of lung cancer, liver failure, anemia or asthma.

WHY JUST NANOFIBER?

People, mostly in Asia, have become accustomed to protecting their respiratory tract by wearing mouth covers filled with mechanical filters. You can imagine it as a sieve designed to trap pollutants and, on the other hand, let in oxygen molecules. However, the vast majority of masks are only based on a nonwoven layer whose pores are too large to stop dangerous par-

ticles which are usually so tiny (often less than one micron or a thousandth of a millimeter) that they can penetrate an ordinary non-woven textile fabric. In addition, it is necessary to bear in mind the inverse proportion, i.e. the smaller the particles, the worse the risk, as ultrafine particles settle permanently in the alveoli or penetrate through the vessel walls into the blood.

The change came no earlier than the beginning of the 21st century when the nanofiber was invented and originated at Czech universities. It is an extremely thin polymer fiber with a diameter of less than 500 nanometers (0.5 microns) - for comparison, human hair is about a thousand times thicker. Filters from this material “fight fire using fire” which means that nanoscale particles are captured in a dense and strong nanofiber net while oxygen still passes through. In practice, the membrane will stop allergens (pollen

grains, mold spores) and microorganisms (bacteria and a large part of the viruses) in addition to the products. Hence it is no coincidence that the nanofiber has become a popular material for the mentioned face masks, which, in addition to the inhabitants of polluted localities, are also worn by asthmatics, immunocompromised patients or travelers to places with infectious diseases.

FLEXIBLE AND INCONSPICUOUS

However, in the European environment, wearing a face mask is not a tradition, on the contrary, if you take it to public places, you will see confused faces of passers-by who might even be scared that you are a carrier of a disease (we have already tried it). Therefore the RESPILON Company, seated in Brno, came up with the idea to incorporate the filter

WASHING PRINCIPLES

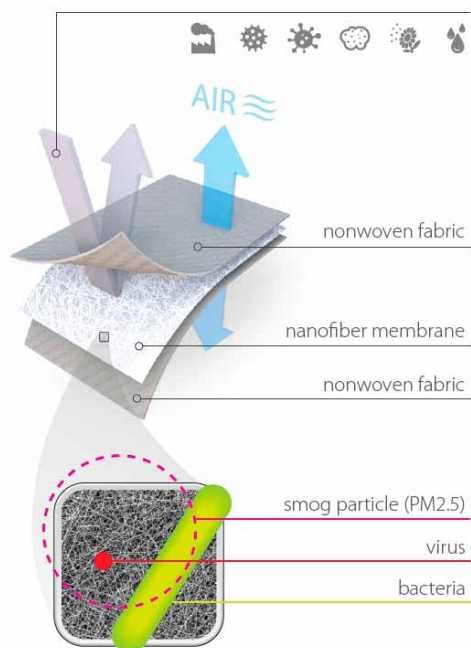
- Wash the scarf only by hand in water at temperatures up to 30 °C using washing powder or soap.
- Do not use bleach, bile soap, fabric conditioners or other water softeners.
- Avoid dry cleaning.

Recommended steps

- Gently wash the scarf by hand. Handle the filter membrane carefully - just soak the sewn filter part and rub it in your hands.
- After washing, wring the scarf by hand, as the spinning in the washing machine could damage the nanofibers. Hang the product on the clothes line and let it dry. Do not use dryers.
- Do not iron or steam! The filter can be damaged irreversibly.

into a tubular outdoor scarf used so far to protect the body against cold or mud.

Thus a protective item is created which does not look "medical", yet on the other hand ensures a high level of protection - the type of nanofibre used will capture the vast majority of particles and microorganisms (see Comparison of Filtering Qualities). The body of the R-shield consists of a durable lycra



The filter consists of three layers - the nanofiber itself is protected by nonwoven fabric from both sides



R-shield is sold in a simple box made of recycled paper

commonly used in sportswear. The rectangular filter is sewn from the inside to the front and covered with a protective layer against saliva and women's makeup. When pulling the scarf over the head, the filter must be aligned so as to cover the mouth and nose. The manufacturer has sewn a soft aluminum nose clip over the filter, which you can bend around the nose root to allow all air to pass through the nanofibers while the scarf is firmly set.

You can adjust the product to your proportions using a rubber string sewn around the perimeter of the top edge of the tube, the length of which is set by a double-hole spring stop. Lycra's elasticity and specially shaped cut prevent from feeling unpleasant pressure around the head and ears. Let's add that there is no need to choose a specific size, like for a hat or helmet, since the R-shield is made in a single all-round design that fits, thanks to these features, both children and adults.

The flexible scarf and neckerchief in one suits the city and terrain and goes with normal sports or outdoor clothing; moreover, you can choose from a variety of designs ranging from monochromatic to BDU camouflages. It can be used when walking or cycling to work, hiking in the mountains, hunting and fishing, or riding a motorcycle (nanofibers capture the wear from brake linings and tires which contain, inter alia, carcinogenic benzopyrene). If you do not need to use the filter, you do not have to remove immediately the scarf from the head - just roll it down on the neck in the "standby" position.

ON A FOOT-SCOOTER AND AT A SHOOTING RANGE

I decided to try this Czech product at one of the indoor shooting ranges in Prague, but I put it on at home, where the temperature is 25 °C. It turned out to be the limit value where the veiled face begins, willy-nilly, to sweat a little. After that in the afternoon I went on an electric scooter passing through the congested roads in Prague. Thanks to the R-shield I did not have to breathe in exhaust fumes, nor had I to smell other unpleasant "stenches", such as from the sewage at the decreasing pressure before the storm. At an outdoor temperature of 19–20 °C, the neckerchief pleasantly warmed up and I



When moving outdoors, the neckerchief protects the lungs from pollen and other allergens

soon ceased to feel it on my neck. Upon arrival at the finish I checked again the adjustment of the scarf. I probably did not use the back tightening string around the ears at all because my head size is 59, so the diameter of the tunnel design fits perfectly. I also appreciate the fact that the aluminum plate does not push or hinders unnecessarily, even when wearing protective goggles - I am just a bit worried about its durability.

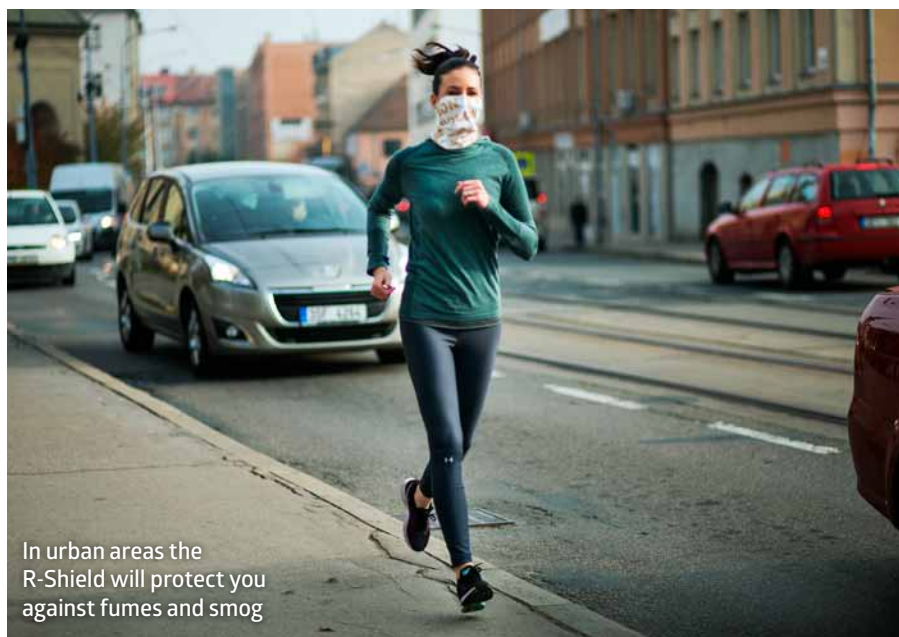
At the shooting range the R-Shield did not interfere, even though I had fired with long weapons, including the AR-15. Thanks to the air conditioning at firing posts the face under the scarf did not sweat, but I have to admit it would be quite different without the supply of cooled air. Above all, however, I did not smell the cordite after firing, which the gun lovers enjoy, but their lungs are not so happy. I spent about an hour at the shooting range, during which the scarf functioned perfectly and I enjoyed the shooting without having to cough after a long time.

A MATE IN TERRAIN

I took the second test with the R-shield in the open air, in moderately difficult



The tightening rubber string helps adapt the R-shield to the size of the head



terrain at a temperature of about 17 ° C and with a 30-liter backpack on my back. As a person allergic to pollen, this time I deliberately did not take antihistamines (although I had the pill in a pocket), yet I did not hesitate to go through several blooming meadows with the neckerchief on. There was no sneezing or tickling in the throat, and the scarf was cool enough when moving. However, as the air got warmer around noon, climbing up a steep hill with the R-shield on became more strenuous. Of course, it was a mechanical barrier to the mouth which, however, is same for all filters and we have to put up with it, and in terms of protection against harmful substances it is definitely recommended.

The bottom line is that the nanofiber tube proved to be successful in both situations. We just have to take into account that not everyone with the R-shield on can withstand more demanding aerobic activities. On the other hand, this multifunctional shield will protect you against all negative external influences

and will also serve as a stylish garment if an appropriate printing is chosen. Adding the fact that this non-traditional protective item can be washed and reused (see the Washing Principles), we can state that R-shield is an interesting alternative to face masks and respirators. Of course, if you use the scarf regularly and wash it frequently, the nanofiber will slightly degrade, but the trapping quality will only drop by a tiny percentage. And even if you buy a new piece after dozens of washing cycles, in contrast to disposable mouthpieces discarded just after one day, you will save not only the money in your pocket, but also the environment. ■

R-shield scarf with the nanofiber filter

+ excellent protection of the respiratory system

+ inconspicuous

+ universal design

+ nose sealing clip

- the filter degrades slightly over time

- strenuous breathing in demanding activities

Price: 35 €

Where to buy: shop.respilon.com

COMPARISON OF FILTERING QUALITIES OF DIFFERENT SCARVES*

Particle size	0,75 microns	1 microns	2 microns	3,5 microns	5 microns
Polyester scarf (grammage 130 g/m ²)	0,76 %	8,8 %	26,8 %	46,9 %	49,5 %
Polyester scarf (grammage 150 g/m ²)	0 %	9,6 %	41,3 %	88,1 %	99 %
Cotton scarf (grammage 150 g/m ²)	3,4 %	11,2 %	43,5 %	88 %	98,5 %
RESPILON scarf (lycra + nanofiber filter)	99,97 %	99,99 %	100 %	100 %	100 %

*The result of an independent test done at the Engineering Testing Institute