Letter

Can Currently Available Safety Eyewear Protect Welder's Eyes from Harmful Rays?

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Dear Editor,
All types of welding produce ultraviolet (UV), visible, and infrared (IR) radiation at damaging levels.[1] Photokeratoconjunctivitis (welder's flash), pingueculum, pterygium, corneal opacity, and pigmentary macular deposits are common eye disorders among welders.[2-4]

Use of protective eyewear while welding helps reduce harmful effects of ultraviolet, visible, and infrared radiation.[5] There are several valid standards such as ANSI Z87.1[6] (American National Standard Institute) that specify allowable transmission values of the harmful rays through welding protectors.

Twelve (three samples for each of the four types) available welding safety protectors were evaluated including three glasses and one pair of goggles of the following types: Type 1- Uvex futura (Shade No. 4; Germany), Type 2- Parsoptic (Shade No. 5; Iran), Type 3 (Shade No. 7; no identified company and country), and Type 4- unnamed (Shade No. 8; China). Shade number is the degree of the darkness of the filters. All of the types were made from plastic. They were collected randomly from the Iranian central market for industrial safety clothes and glasses.

This study was conducted in the laboratory-Ophthalmic Lenses Verification Center (O.L.V.C.R)-of Shahid Beheshti University of Medical Sciences, a collaborating laboratory of Iranian National Standard Organization (INSO).

Using SPSS software, one-sample *T* test was performed to establish whether a statistically significant difference existed between the standard criteria and UV (far and near), blue light, and IR spectra means for each type of welding protectors (α=0.05). After providing absolute transmittance values of each type, we checked the average transmittance values with relative parts of the standard.

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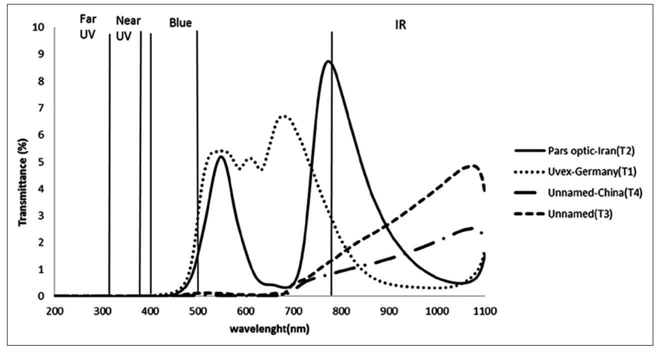

Figure 1. Spectral transmittance curves of the tested welding protectors in this study.

We have provided a single transmission graph for all of the types evaluated in this study [Figure 1].

Unnamed (T3) welding glasses showed the least transmittance of far UV (0.001%) and Parsoptic (T2) had the highest transmittance (0.003%). Uvex (T1) and Chinese goggles (T4) had the same value of transmittance (0.002%). All of the tested protectors transmitted lower than the maximum allowable value mentioned in the standard ($P < 0.001$). In the near UV region, T4 welding goggles showed the least transmittance of near UV (0.002%) while T2 had the highest transmission (0.004%). T1 and T3 were at the same level transmission (0.003%). All of the tested protectors transmitted lower than the maximum allowable value of the standard ($P < 0.001$).

T1 had the highest transmission value (0.499%) of blue light. After that, T2, T3, and T4 had transmission values of (0.273%), (0.029%), and (0.008%), respectively. According to the standard,[6] all of the tested protectors transmitted lower than the maximum allowable value of the standard ($P < 0.001$).

In the IR waveband region, T3 had the highest value (3.220%) while T1 had the least value (0.765%). T2 and T4 showed transmittance of (2.605%) and (1.683%), respectively. T1 transmitted lower than the maximum allowable value of the standard ($P < 0.001$). T3 and T4 transmitted higher than the maximum allowable value of the standard ($P < 0.001$) while T2 transmitted 0.1% higher than the maximum allowable value of the standard ($P = 0.27$). According to the standard, the cut-off values were different for the various protectors. So, although T2 transmitted higher than T4, the transmission difference was not statistically significant. All of the welding protectors showed an overall reduction in transmittance of all the wavebands evaluated in this study. It seems that the difference between materials used for manufacturing the filters of the protectors is the main reason for different transmission of the spectra. In addition, other factors such as thickness of the filters may have a role. Spectral transmittance requirements of ANSI Z87.16state maximum far UV average transmittance for welding filters with shade numbers of 4, 5, 7, and 8 are 0.04%, 0.02 %, 0.007%, and 0.004%, respectively. In addition, the near UV average transmittance shall be less than one tenth of the minimum allowable luminous transmittance except for welding protectors with clear lenses. The blue light transmittance shall be less than the luminous transmittance except for welding protectors with clear lenses. In IR region, the maximum far average transmittance for welding filters with shade numbers of 4, 5, 7, and 8 are 5.0%, 2.5%, 1.3%, and 1.0%, respectively.

Considering the above results, all protectors tested in this study had good blocking properties for far and near UV and blue light spectra, and could pass the standard criteria, but in IR region, only type 1 (Uvex) met the specified value. Because of the limited range of our instruments, we were unable to test wavelengths longer than 1100nm by the protectors. We showed that type 1(Uvex) welding glasses could definitely meet the ANSI Z87.1 transmission criteria.

We recommend further studies on other unexamined welding eye protectors used in industrial activities. It can be helpful for users to find which product can provide better protection against the hazards.

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Conflicts of Interest

There are no conflicts of interest.

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