Study the effect of blue light on the eyes for locally available models

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Abstract

For any vision light is an essential element but on the other hand exposing light might be the main reason of ocular tissue pathological changes by energy absorption.

The photo energy is at its highest level when the wavelength is nearly 400 nm that's how it reaches the retina. Because the blue blocking BB lenses. The most important advantage of BB lenses is to reduce the eyestrain while working digital devices blue-blocking (BB) spectacle lenses. To achieve the most comfort ability while using different kinds of digital devices blue cut lenses are marketed as well as they help improving the quality of sleep and protecting the eye from photo toxicity. The aim of this study is to state the transmission of the UV+420 nm lenses for blue light, ultraviolet and visible light, so three types of lenses are tested for making comparison between models in commercial markets. The results show the blocking of each lens to determine the best quality from the used three models.

Keywords: *blue light, blue cut lenses, UV, UV+420 nm.*

دراسة تأثير الضوء الازرق على العيون للموديلات المتوفرة محلياً

أ.م.د. منذر سمين شكر و رنا عيدان عبد

الخلاصة

على الرغم من أن الضوء ضروري للرؤية ، فإن التعرض للضوء يمكن أن يتسبب أيضًا في تغيرات مرضية في أنسجة العين من خلال امتصاص طاقة الفوتون. عدسات حجب الضوء الازرق يتم تسويقها للتخفيف من إجهاد العين وعدم الراحة عند استخدام الأجهزة الرقمية ، تحسين نوعية النوم ويحتمل أن تمنح الحماية من السمية الضوئية للشبكية, لذلك الهدف من هذه الدراسة هو تحديد نفاذية العدسات للضوء الأزرق والأشعة فوق البنفسجية والضوء المرئي ، لذلك يتم اختبار ثلاثة أنواع من العدسات لإجراء مقارنة بين الطرز في الأسواق التجارية. وضحت النتائج حجب كل عدسة وعلى أساس نسبة النفاذية يتم تحديد أفضل جودة من النماذج الثلاثة المستخدمة.

الكلمات المفتاحية : *الضوء الازرق ، العدسات الزرقاء ، الاشعة فوق البنفسجية + الاشعة الزرقاء .*

Introduction

The position of visible spectrum is exactly between ultraviolet (UV) and infrared (IR) radiation, basically from 360 up to 720 nm, which is stated as either short wavelength radiation - (blue) or medium- (green) or long- (red). The blue light begins at 415nm and finishes at 500 nm as shown in fig.1 [1].

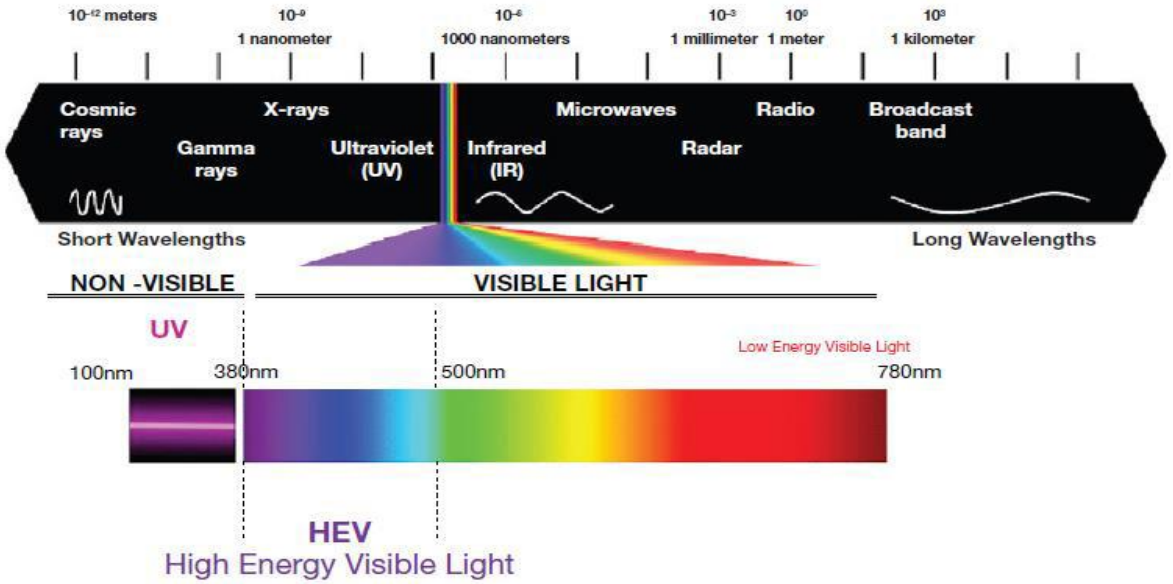

Figure (1): Spectrum of Light [1]

Blue light lies between 415nm to 495 nm, so it's considered as a part of the visible light spectrum, [2].

Photochemical damage might be caused by exposing to blue light for a long time, this can trigger the formation of toxic reactive oxygen species which may induce retinal pathologies like age-related macular degeneration (AMD) [3].

Blue light approaching the eye must enter the ocular media, the transparent tissues and l iquids between the front of the eye and the retina. The eye media cornea, aqueous humor, lens, and vitreous humor — retain or transmit light, depending on their wavelength UV radiation is divided into three bands: UVC with wavelength of (100 to 280 nm), UV B with wavelength of (280 to 315 nm) and UV A (315 to 400 nm) for the 100–400 nm wavelength range.

All UV C and about 90 % UVB are absorbed as shown in Fig.2 by ozone. It's important to state that UVA is less harmful of the ultraviolet light. Cataract and pterygium potential might be one of the results of cumulative UV exposition.

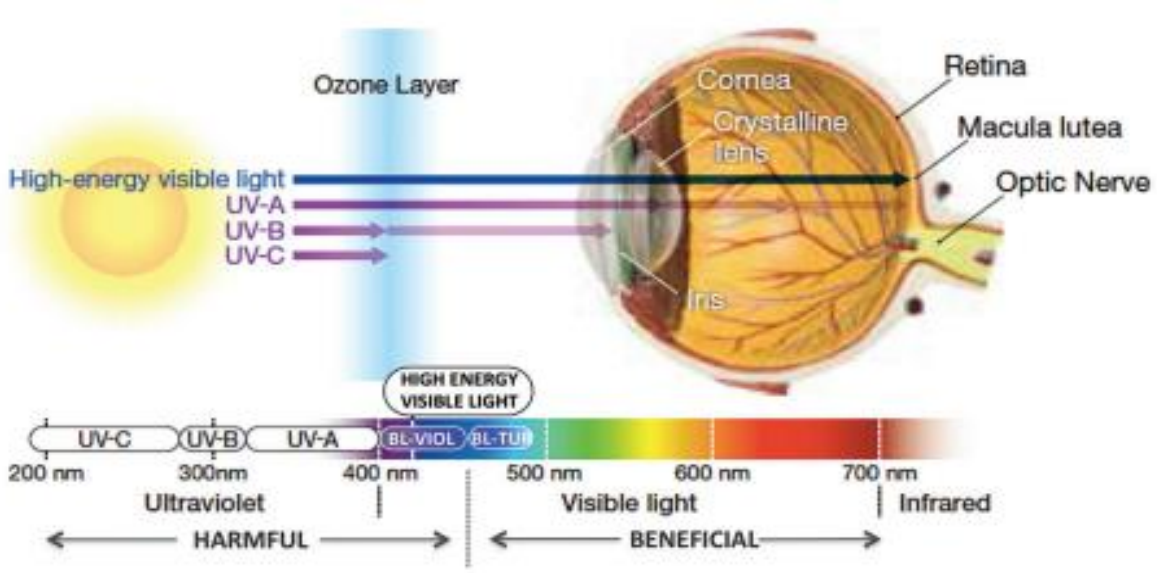

Figure (2): Non-visible radiation, and visible. UV and blue violet radiation are potentially harmful; AMD is associated with blue violet, cataract related UV. Blue turquoise is beneficial (sunlight) and produces melatonin in its absence, which prepares the body for sleep [4]

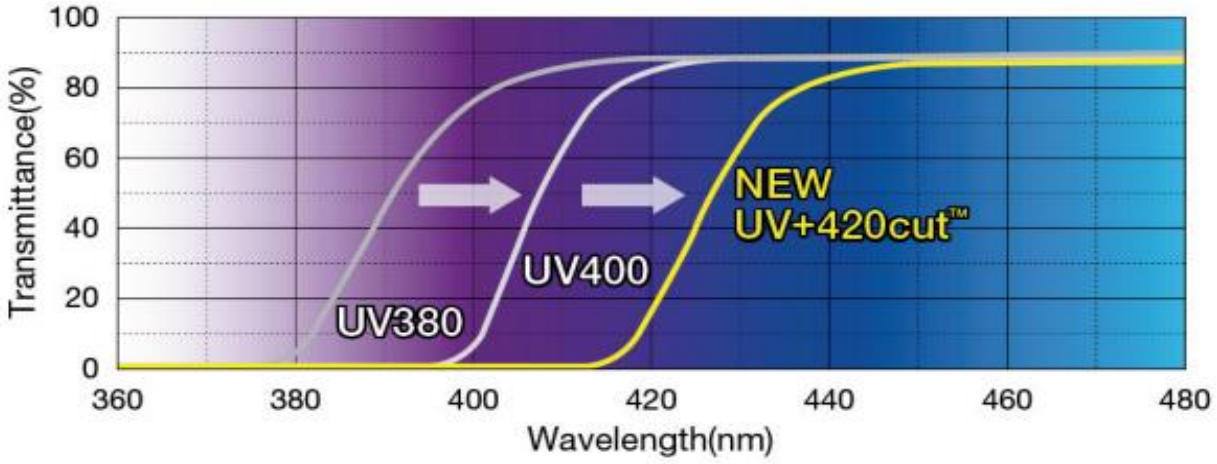

Figure (3): UV+420 nm cut lenses drive the absorption of harmful blue violet radiation further into the visible range [4]

The relationship between wavelength and permeability (%) in Figure 3 used in commercial matters and to study the properties of lenses such as UV380nm and UV400nmm after coating to prevent radiation from passing into the eye's harmful eye when using smart devices with lensesUV+420cut appeared, which passes a bundle light on the eye from 420 nm to the end of the curve.

Protection from UV and Blue-Violet Light

The wavelengths in the blue portion of the spectrum cause damage to the retina. The front of the lens deflects UV light and about 20% of the blue violet light to remove the har mful rays. The posterior side protects the patient by clearing the light coming from the back of the lens, primarily from UV light.

The blue cut glasses may give pretty sunsets, but that's not the goal, manipulation of color are not wanted; natural colors are wanted [5].

Figure (3): Blue cut eye glasses [5]

Blue light causes eye strain

Looking for a long time at any digital devices leads to eyestrain because of the fact that blue lights' , high energy and short wave, disperse more quickly in comparison with other visible light and it's really hard to concentrate that kind of light [6-8] .

Advantages of blue-cut glasses

The main advantage is to avoid harm the essential DHA fat in the retinal epithelium, which is responsible for converting sunlight into vital DC electric current [9،10]. Glasses that block more than that may be better for people who are particularly sensitive to light. If you have an abnormal sensitivity to light, you should report this to the optometrist during the examination. [11].

Figure (4): Sources of Blue Light [6]

Method

The permeability measurements was used to find out the effect of these rays on the patients eye. The tests were done at the University of Al-Nahrain. Three models of lenses are taken for testing as shown in Fig.5. These lenses are commercial and are used locally in the markets.

Figure (5): The three models of lenses

The device used for lens transmission measurement is the “Spectrum Analysis device” as stated in Fig.6.

Figure (6): Spectrum Analysis device

The practical work stars by fixing the lens in front of the source and a long a distance (30 cm) from a Screen to display the light which is coming from the lens. Then the detector (part of the spectrum analyzer) is fixed in front of the screen at a distance (8 cm) to pick up the light from the screen as shown in Fig.7**.**

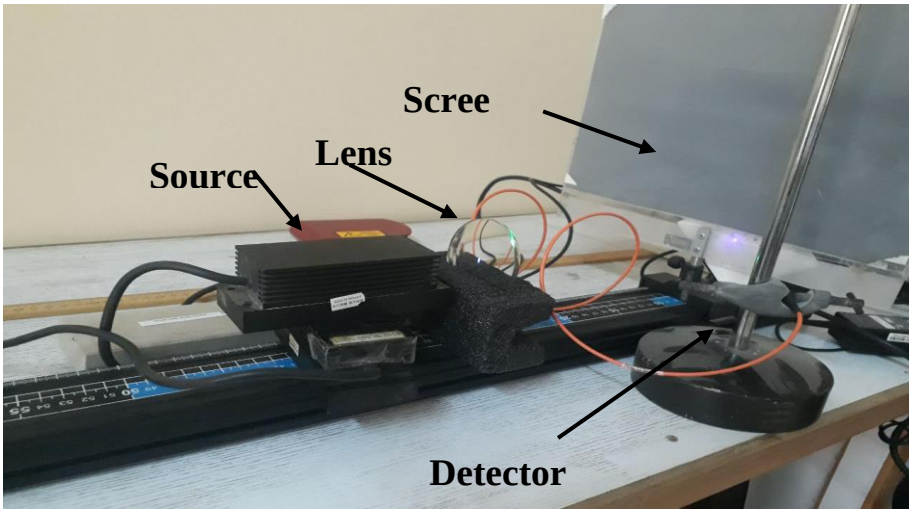

Figure (7): Experimental setup of the lens with the detector

Three sources are used blue visible source 650 nm, blue source (403-433 nm) and ultravioet source (400 nm) for testing the lesnses. The light emmited from the source and passes through the lens, is displayed on the screen, finally the detector is picked up the signal from the screen and translate it to digital form as curve in special software known as Thorlabs OSA.

Results

Visible light source intensity and the transmission of the visible light from the three lenses are shown in Fig.8 and the UV light source intensity and the transmission of the UV from the three lenses are shown in Fig.9 and so on for blue light in Fig.10.

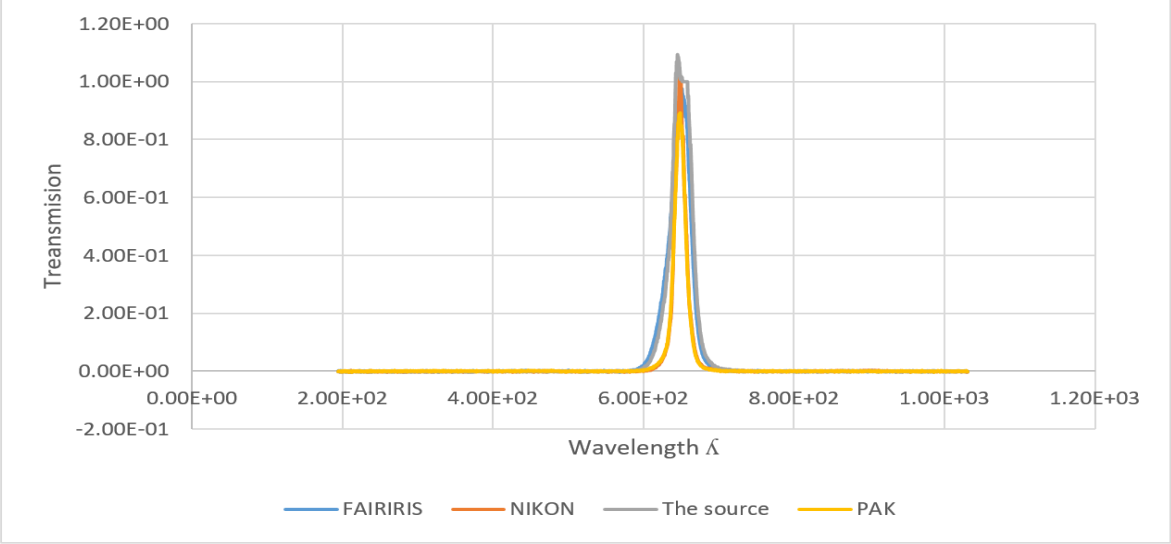

Figure (8): Transmission versus wavelength curve for visible light source without lenses and with the three models of lenses

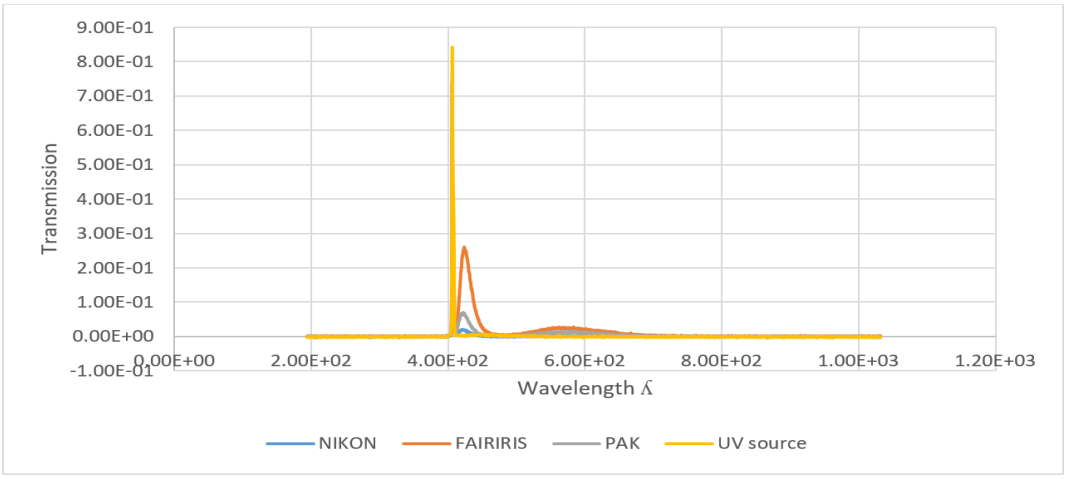

Figure (9): Transmission versus wavelength curve for UV source without lenses and with the three models of lenses

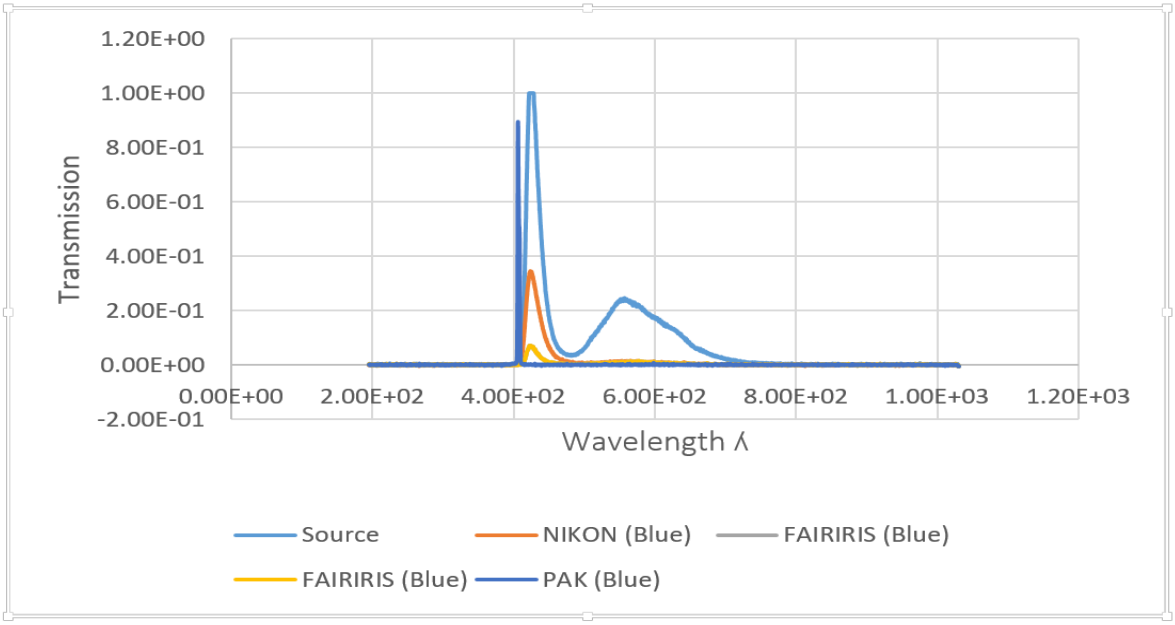

Figure (10): Transmission versus wavelength curve for Blue light source without lenses and with the three models of lenses

Testing of each lens model with the three sources and analysis their transmission as shown in Figures 11, 12 & 13.

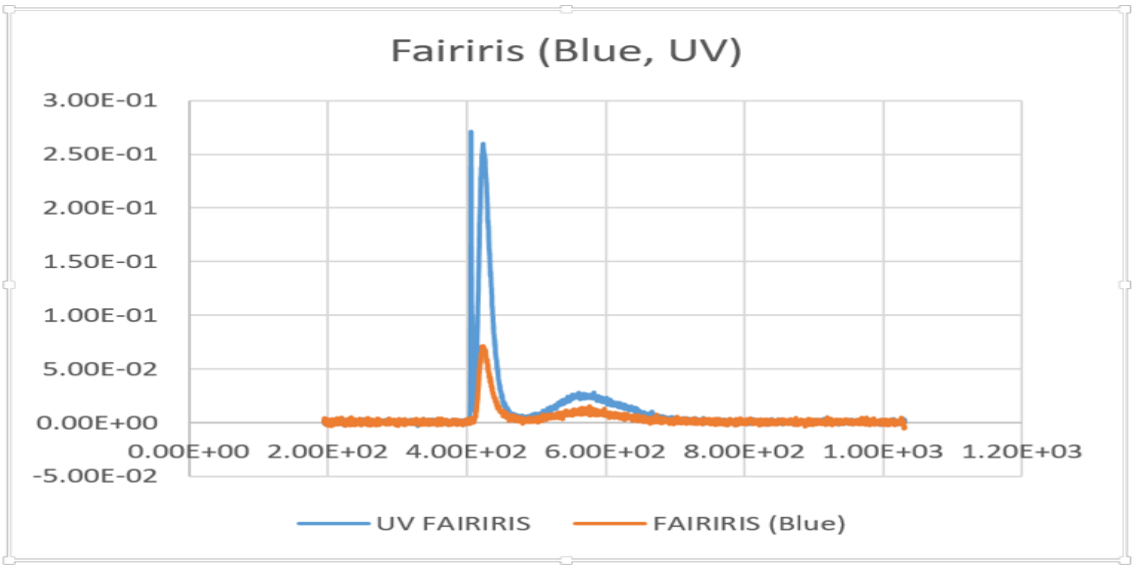

Figure (11): Transmission versus wavelength curve for Fairiris lens with blue and UV sources separately

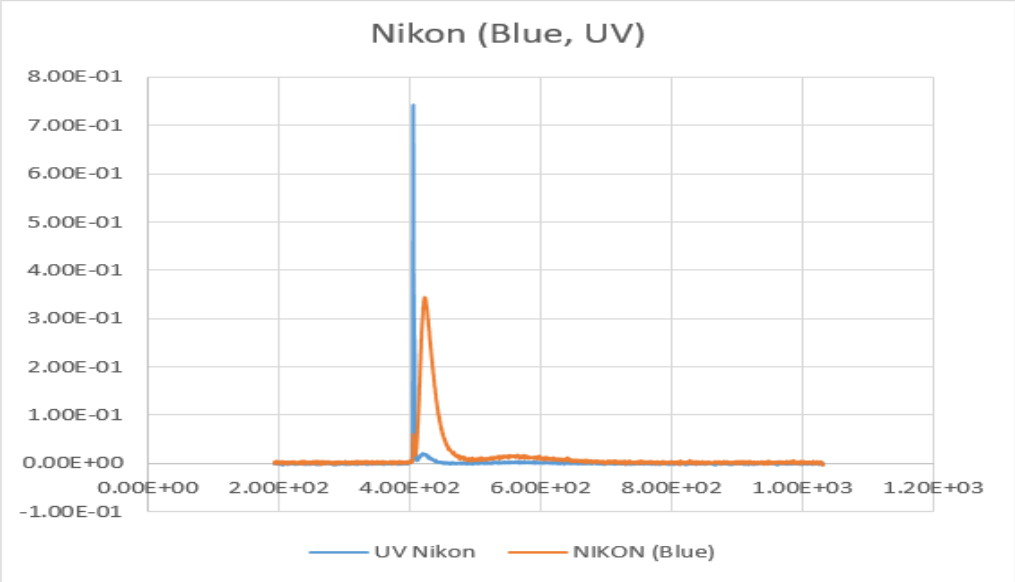

Figure (12): Transmission versus wavelength curve for Nikon lens with blue and UV sources separately

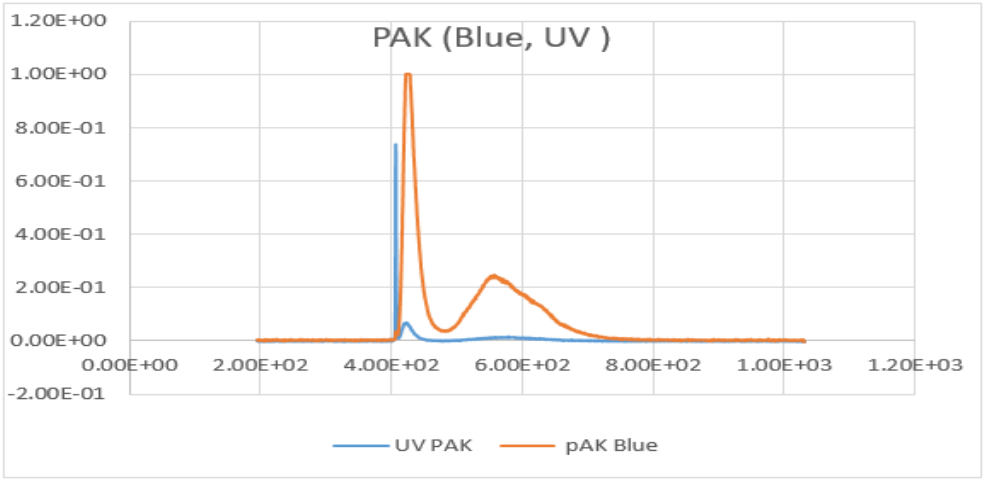

Figure (13): Transmission versus wavelength curve for PAK lens with blue and UV sources separately

Discussion

When the visible light source is used, the three lenses transmit nearly all the visible light through them. UV blocking varies from one lens to another. The fairiris is the highest transmitter of UV, the Nikon comes secondly and lastly the pack.

Concerning the blue light transmitting, the fairiris transmit most of the blue light in comparison with the other two lenses, the Nikon comes after it and at last comes the pack.

The figures 12, 13 & 14, state that each lens a side has its own transmission of UV and Blue light. The fairiris and Nikon are less transmission of blue light than UV unlike the pak which has less transmission of UV than blue.

Conclusion

- All three models of lenses transmit almost all of the visible light.
- For UV transmission, the Nikon lens is the best because of its biggest block of UV compared with the other lenses.
- For blue light transmission, the Fairiris is the best because of its biggest block of blue than other lenses.

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