SPECIALTY MEDICAL LENSES

Photocromic Filtering Lenses for Ocular Protection

For more information, contact:
Luzerne Optical Laboratories, LTD at 800-233-9637 or on the web at
www.LuzerneOptical.com

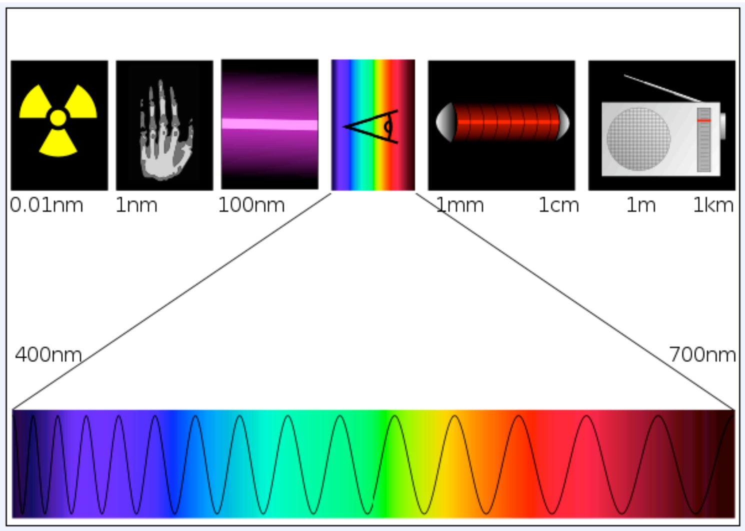
INTRODUCTION

Currently in the ophthalmic community, ocular protection is one of the most concerned subjects. Considering the fact that optic radiation can cause various ocular problems, photo chromic medical filter lenses are becoming widely accepted among the solutions for overall prevention and protection.

Facts with latest scientific testing have proven that that UVB radiation can cause permanent and cumulative damage to all tissues, especially the eyes, which are more exposed to risks because they don't have defensive structures as melanin and keratin.

Because of this, it is of essential importance to understand that eyes must be properly protected with filters able to avoid the damaging action of UVA and UVB damaging rays.

The filtering lenses from the Dinamica collection, **LM med,** are a particular type of selective lenses which, filtering specific radiations, protect the fragile ocular tissues. In cases of particular diseases or ocular challenges, these photochromic medical lenses guarantee an improvement of ocular performances. The main function of these lenses is the filtering of specific radiations from UV light with a high energetic power. The value of the Dinamica **LM Med** lenses is both in the strict filter protection, and the comfort of the hi tech photochromic technologies.



As you can see in the figure above, visible light is just a part of the wide spectrum of electromagnetic radiations. Most part of the spectrum is invisible. The UV rays are made of invisible electromagnetic radiations with wavelength between 400 and 100 nanometres..

MORE ABOUT UV RAYS

Conventionally, the UV range is subdivided in three parts:

- **UVA (long waves) between 400 and 315nm;**
- **UVB (medium waves) between 315 and 280nm;**
- **UVC (short waves) between 280 and 100nm.**

UV rays coming from the sun are mostly stopped by the ozone of the Earths atmosphere, which allows the penetration of most UVA rays, and a limited percentage of the UVB rays. UV rays are damaging for all ocular structures in concomitance with other factors, such as wavelength and exposition time to radiant energy. Most likely, the first risk factor is the total absence of consciousness about the health concerns existent from the relevant exposure. In fact, if this scientific information is now available, but awareness is not shared about ocular damages caused by UV rays, it is not likely that a general consensus will adopt the necessary measures to campaign for protection.

Moving from inferior wavelength (280nm) to the superior wavelength (above 700nm), radiation waves loose their energetic power. The shorter wavelength of the visible radiation is the one which penetrates into the eye, while the higher wavelength causes the diffusion that is known for causing a veiling, which not only reduces the visual performance, but it also contributes to a substantial loss of contrast, and most often, a disabling visual acuity, which we call "dazzling".

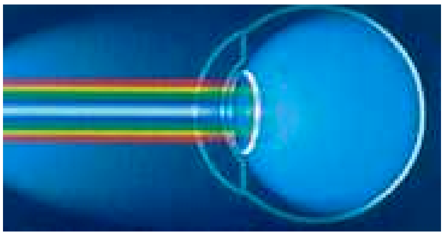
"*It's possible to define dazzling as a light which doesn't contribute to the image of the retina, but on the contrary, it creates an action of disability to the visual comfort and to the resolution of details. We are talking about a condition of the vision characterized by a loss of comfort or a reduction in the capacity of seeing details and objects, because of an unfavourable division of luminescence or an excessive contrast* " (S.Abati – A.Farini).

At the corneal level, potential ocular damages from UV radiation affects all of the cellular strata, which is further compounded by the thinning of the cornea as with age, which further reduces filtering ability. The crystalline lens is the main UV filter, and that's why it loses its transparency, as a consequence of the exposition to the UV radiation, so that, because of the further ozone reduction in the next 20 years, we can expect an increase of cataract cases.

The retina, even if submitted to a modest exposition to UV radiations, is also subjected to risk, especially in the subjects affected by aphakia, who can contract solar retinitis and senile macular degeneration. It's important to underline that the UV damage is cumulative. But where the UV stops, the visible spectrum starts, and the first part of the visible spectrum is at high energy (High Energy Visible – HEV). The blue light, full of energy, can damage the retina and the pigmented retinic epitelio irrevocably. In this case, the damage is not direct, but is mediated by the oxidative stress.

We remind again that the eye is an organ full of oxygen, and all its structures generate substances susceptible of oxidative stress. In fact, these substances, hit by the light, produce many free radicals, which cause a progressive damage as years go by. Scientific testing has demonstrated that exposition to blue light (HEV) causes a potential damage and a destruction of retinic cells. For instance, the violet-blue light in high concentration can cause photochemical damage to the retina, a precocious ageing of the visual organ and a potential of Age Macular Degeneration, or AMD, causing serious damages in the long run. [SOLUTION: OPTICAL LENSES WITH SELECTIVE TRANSMISIVITY FUNCTIONS; Optical Filtration].

Therefore, at the ocular tissues level, blue and ultraviolet radiations provoke biologic effects, which can produce phototoxic damages, often irreversible, especially on the retina and on the crystal lens. The blue light, both outside (first light of the visibile spectrum) and inside, as in a TV and PC screen, perturbs the vision because of an effect called Blu Blur.



This effect is caused by the incidence of the blue short waves which, spreading in front of the retina, make a circle of confusion causing a decrease of the contrast with a strong blue dominance (blue fog), with consequent higher visual effort.

Another effect to consider s the *Veling Glare*, that is a vision similar to a veiling, which is present when the blue light disperses on the atmospheric dust or on the particles of humidity. These are the reasons why, using the filtering lenses, the eye is protected and you can have a comfortable vision with less reflexes and higher contrast.

PHOTOCROMIC FILTERING LENSES FOR OCULAR PROTECTION

Optical properties of filtering lenses

The term "filtering lens" is used to identify a device which modifies radiation iter and also has a filtering ability.

The term "selective filter" identifies an optical device which, unlike the lens, doesn't modify the radiation iter, but changes the energetic composition of a ray, avoiding the penetration of some wavelengths or limiting their energy.

Filtering lenses and/or selective filters distinguish themselves by:

- The percentage of light which is absorbed or inversely the percentage of light transmitted
- The range of radiations they work in
- Every time a beam of light goes on the surface of a generic lens, a part of it will be transmitted, a part absorbed and a part reflected
- As the filtering lenses have specific colourations which make them unique in their action field, the transmittance is the main parameter which characterizes them
- The Transmittance "T" shows the quantity of light that the filter allows to pass through and its value depends on the specific absorption of the filter (if this is coloured) and on the reflections which come on its surfaces

Basically, the value of T is obtained from the ratio (in percentage) of the quantity of emergent light to the quantity of incident light: In the expression of transmittance we can see the dependence from the wavelength λ, which is the parameter that permits to distinguish radiations.

$$T(\lambda) = I_1(\lambda) / I_0(\lambda)$$

The fact that T depends from λ means that the behaviour of a lens can vary and sometimes even in a effective way, it depends on the type of radiation which goes on it.

In a similar way we can define the absorbance and the reflectance.

The reflectance R is obtained from the ratio of the reflected radiant flux to the incident radiant flux.

$$R(\lambda) = I_r(\lambda) / I_0(\lambda)$$

The absorbance A is defined as the decimal logarithm of the inverse of the transmittance:

$$A(\lambda) = \log_{10} (I_o(\lambda) / I_1(\lambda)).$$

Advantages of using photocromic filtering lenses LMmed

Photochromic filtering lenses LMmed have been conceived to improve visual performances in bright environments.

These lenses are recommended to people who take care of their own health and they can be considered a medical instrument for ocular protection and a disease prevention device.

In fact, they are recommended not only to the ones who have particular ocular diseases, but also to people who would like to have a better visual comfort, preventing in this way eventual retinal pathologies which might come up with an uncontrolled exposition to UV radiations.

Advantages of photochromic filtering lenses LMmed can be synthesized in this way:

- UV rays selective filtration;
- Reduction of blue light risks;
- Reduction of dazzling;
- Increase of contrast limit: the photoreceptors, which are sensitive to the noxious wavelengths for the eye, are intentionally underexposed. In this way, it's possible to increase the contrast between photoreceptors less exposed and the ones more exposed and the result is a better vision.
- Additional protection of the retina
- Improvement of the vision performanPerformances of photocromatic filtering lenses: LMmed

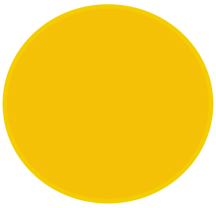
LMmed are organic light and resistant lenses, suitable to children, to sportsmen and to all people who have a dynamic life. In LMmed lenses, coloured filtering pigments are solubilized inside the mass of the lens, assuring stability and duration of the UV protection. This is an important difference in comparison to other filtering lenses, which are made by immersion in colouring solution. This is not the only property of these lenses; the quality which make unique the LMmed is that they are photochromic.

In comparison to the classic selective lenses, the photochromic technology of LMmed permits to obtain a better protection not only in indoor environment, but also in outdoor situations, where, in the activated status, the LMmed take on a pleasant colouring. Therefore, LMmed are the only lenses which guarantee the functional advantages of filtering lenses and a better protection from external radiations.

It's important to underline that anybody can use these advantages wearing just a pair of glasses, without the necessity of having a pair of glasses for indoor use and another one for outdoor environments.

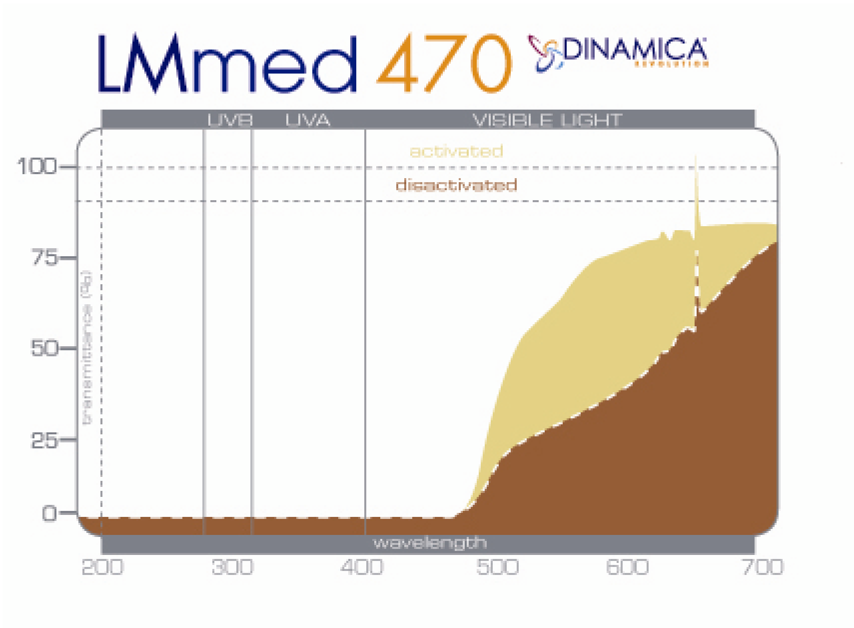
Transmittance spectra of filtering lenses LMmed: LM470

LM 470



DEACTIVATED STATUS (EN 1836)
Filter category: 1
Traffic lights: YES
Daylight driving: YES
Night driving: NO

ACTIVATED STATUS (EN 1836)
Filter category: 2
Traffic lights: YES
Daylight driving: YES
Night driving: NO



This lens permits:

- The block of beyond the 99% of all solar rays with λ < 470 nm;
- The transmission of at least the 90% of the visible solar light with wavelength λ > 470 nm.

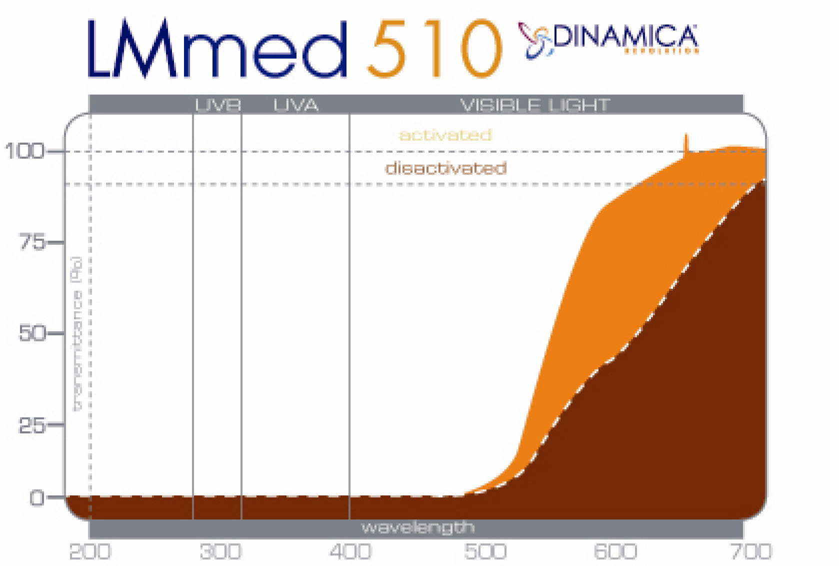
The LMmed 470 is in amber yellow colour and is suggested in case of cataract, retinopathy, corneal dystrophy, albinism and photophobia.

Transmittance spectra of filtering lenses LMmed: LM510

LM 510

DEACTIVATED STATUS (EN 1836)
Filter category: 1
Traffic lights: NO
Daylight driving: NO
Night driving: NO

ACTIVATED STATUS (EN 1836)
Filter category: 2
Traffic lights: NO
Daylight driving: NO
Night driving: NO



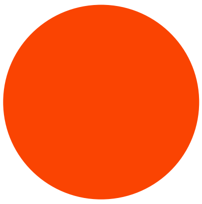
This lens permits:

- The block of beyond the 99% of all solar rays λ < 510 nm;
- The transmission of at least the 90% of the visible solar light with wavelength λ > 510 nm.

The LMmed 510 is in orange-amber colour and is suggested in case of developmental cataract, aphakia, intraocular implant, light sensitivy, glaucoma.

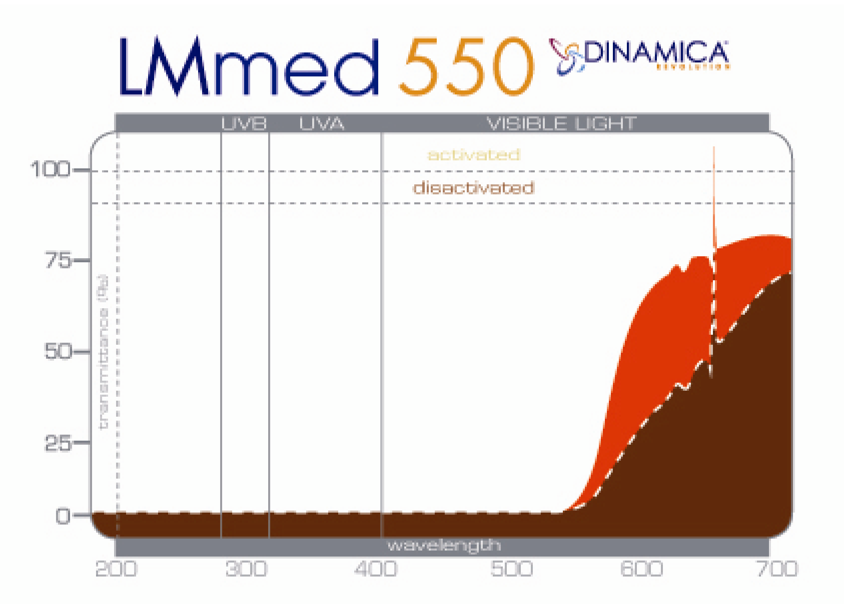
Transmittance spectra of filtering lenses LMmed: LM550

LM 550



DEACTIVATED STATUS (EN 1836)
Filter category: 2
Traffic lights: NO
Daylight driving: NO
Night driving: NO

ACTIVATED STATUS (EN 1836)
Filter category: 3
Traffic lights: NO
Daylight driving: NO
Night driving: NO



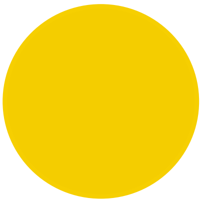
This lens permits:

- The block of beyond the 99% of all solar rays λ < 550 nm;
- The transmission of at least the 90% of the visible solar light with wavelength λ > 550 nm.

The LMmed 550 is in red colour and is suggested in case of macular degeneration, retinis pigmentosa, aniridia, albinism, glaucoma and marked photophobia.

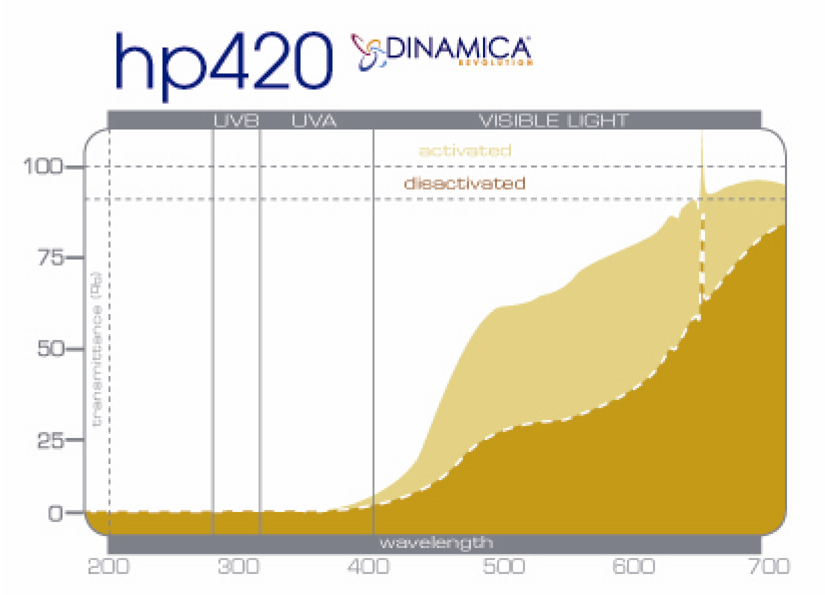
Transmittance spectra of filtering lenses LMmed: HP 420

HP 420



DEACTIVATED STATUS (EN 1836)
Filter category: 1
Traffic lights: YES
Daylight driving: YES
Night driving: NO

ACTIVATED STATUS (EN 1836)
Filter category: 2
Traffic lights: YES
Daylight driving: YES
Night driving: NO



The photocromic filtering lens HP 420 protects from UVA and UVB rays (noxious light) and from the first blue light of the visible up to 420 nanometers.

Suggested Uses:

- To protect after refractive surgery in order to minimize the photophobia effects;
- To protect after cataract surgery and for retinopathy problems;
- To prevent senile maculopathy;
- To protect photosensitive subjects;
- To protect users of display screen

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