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RESEARCH ON THE INFLUENCE OF CLEANING PRODUCTS ON THE QUALITY OF OPTICAL LENS SURFACES

Beatrice Daniela TUDOR, Iustina BĂBUȘANU
"Dunarea de Jos" University of Galati, Romania
e-mail: beatrice.tudor@ugal.ro

ABSTRACT

The paper presents research on the evaluation of the influence of maintenance products, such as cleaning solutions, on the quality of lenses. The research analysed the effects of these products on scratch resistance and image clarity. The eyeglass lenses were cleaned repeatedly with cleaning products, namely eyeglass wipes, liquid soap and dishwashing detergent. The results of this study are essential for knowing how to maintain these lenses, in order to preserve the properties and quality of the surfaces.

KEYWORDS: lenses, cleaning solutions, eyeglass

1. Introduction

The field of optical lens manufacturing is very vast and has great applicability in several engineering fields.

The development of modern technologies for manufacturing these optical lenses and the emergence of new materials with superior properties have led to the diversification of the fields in which these types of lenses find their application [1, 4].

Optical lenses are essential components of many optical devices, such as eyeglasses, cameras, telescopes, and microscopes. Lens manufacturing technology has developed significantly over the years, leading to improvements in precision, performance, and cost.

Lenses can be made from a variety of materials, including glass, plastic, and crystal. Each material has specific optical and mechanical properties that influence the performance and use of the lens.

A deeper understanding of how lens quality is affected by maintenance products can contribute to the development of more durable and efficient lenses that meet the needs of users in a more satisfactory way [2, 3].

2. Experimental research on the influence of maintenance products on the quality of optical lens surfaces

The research analysed the influence of cleaning products, namely eyeglass wipes, liquid soap and dishwashing detergent, on the quality of the lens surface.

The analysis was carried out on a set of lenses of different thicknesses and diopters, with and without protection, respectively:

- Lenses with medium protection with diopter -0.50 with 1.25 mm lens thickness.
- Lenses without protection with diopter -0.50 with a lens thickness of 1.20 mm.
- Lenses with medium protection with diopter -0.25 with 1.17 mm lens thickness.
- Lenses without protection with diopter -0.25 with a lens thickness of 1.15 mm.
- Sunglasses lens without diopters

To observe the influence of maintenance products on the quality of the lenses, a microscopic analysis of the lens surfaces was performed, and the PH of the solutions used for cleaning was determined, in order to analyse the degree of damage to the lens's protective layer and determine how they influence the quality of the surface [5].

To see the influence of the degree of acidity of the cleaning solutions on the quality of the lens surface, the PH of the solutions used for cleaning, namely liquid soap and dishwashing detergent, was determined. The analysis of the lens surfaces was done using an optical microscope, within the microscopy laboratory of the Faculty of Engineering.

The determination of the pH of liquid soap and dishwashing detergent is shown in Fig. 1.

The data obtained for the pH of cleaning solutions are presented in Table 1.

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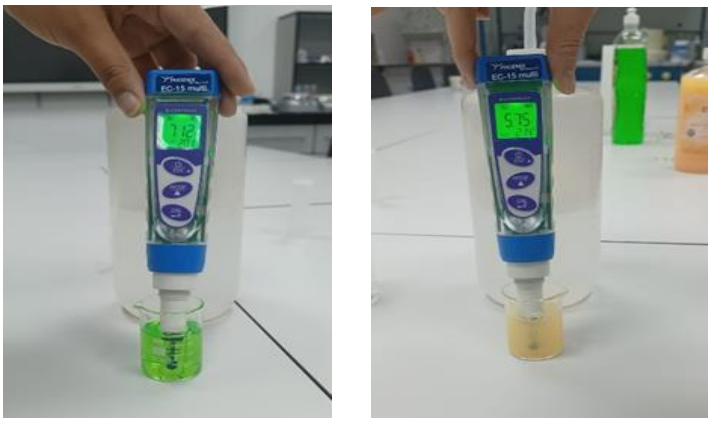


a b

Fig. 1. *Determination of the pH of cleaning solutions (a. dishwashing detergent, b. liquid hand soap)*

Table 1. *pH of cleaning solutions*

	Liquid dishwashing detergent		**Liquid hand soap**	
PH	7.12	20 °C	5.56	20 °C
Conductivity	-10.3 mW	63.3 mS	81.5 mW	56.2 mS
TSD (Total dissolved solids)	45.5 ppt		40.0 ppt	
Salinity	41.5 g/L		36.4 g/L	

The microscopic analysis of the lens surface was performed with the KERN optical microscope assembly, monitor and computer.

The powerful and adjustable 50W halogen unit ensures optimal illumination of the samples.

The technical data of the KERN optical microscope are:

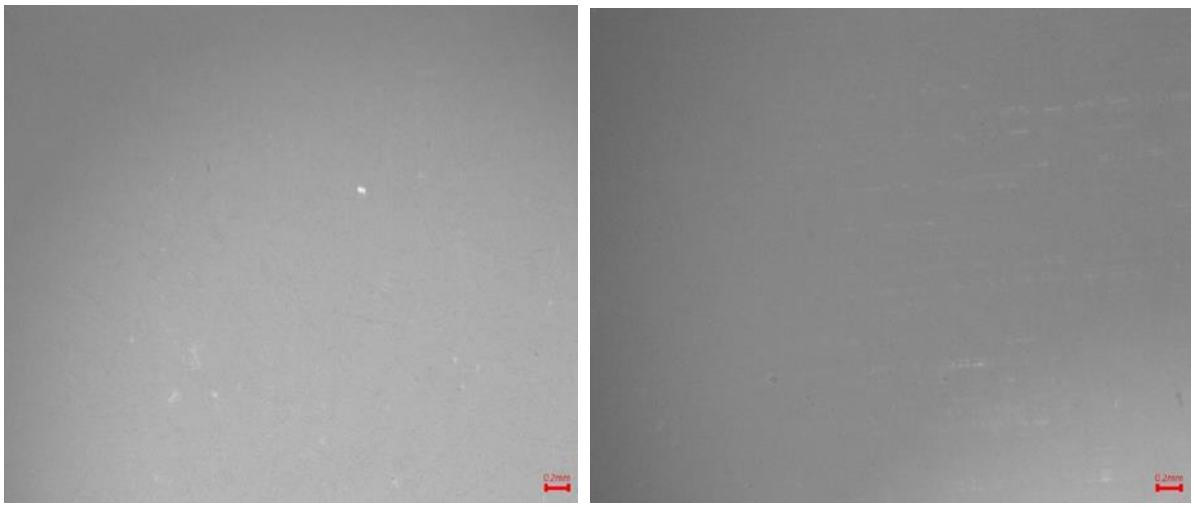
- infinite optical system;
- 30° inclined viewing position;
- diopter compensation on both eyepieces;
- dimensions: L×W×H 747×271×379 mm;
- net weight approx. 12.968 kg.

The images obtained from microscopic analysis are shown in Fig. 3.

Following microscopic analysis, it can be seen that the quality of the lens surface is influenced by the protective layer, regardless of the diopter value.

Both at the lenses with diopters of -0.50 and in those with diopters of -0.25, a small deterioration of the lens surface is observed. At the lenses without protection, cleaned with hand soap, we observe surface deterioration.

For the lenses with diopters of -0.50 and -0.25 with and without protection, cleaned with dishwashing detergent, we obtained the following images shown in Fig. 4.



a. Lenses with medium protection with diopter -0.50 b. Lenses without protection with diopter -0.50

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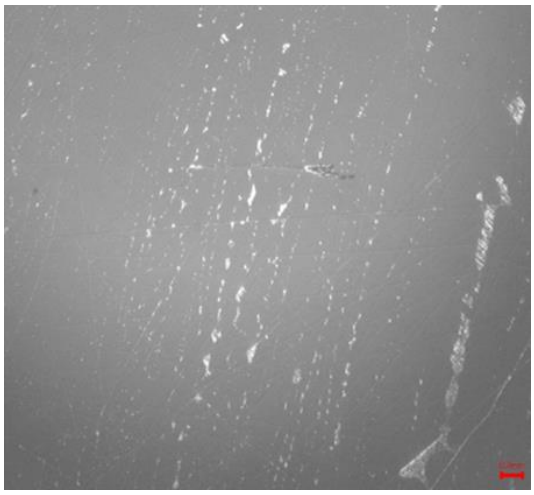
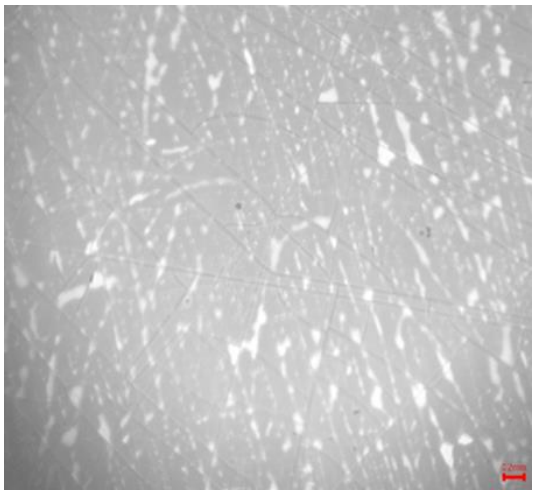
c. Lenses with medium protection with diopter -0.25

d. Lenses without protection with diopter -0.25

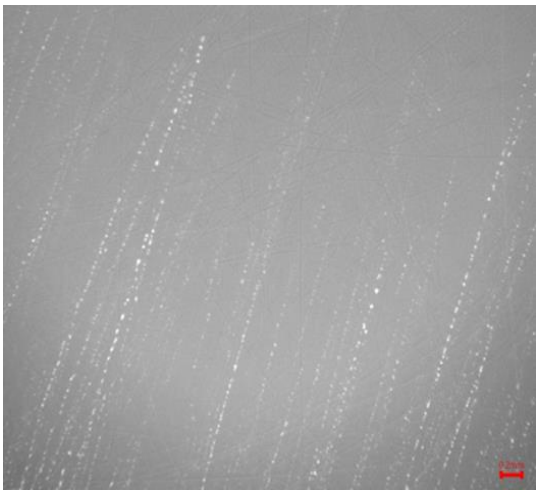
Fig. 3. *Lenses with diopters of -0.50 and -0.25 with and without protection cleaned with liquid hand soap*



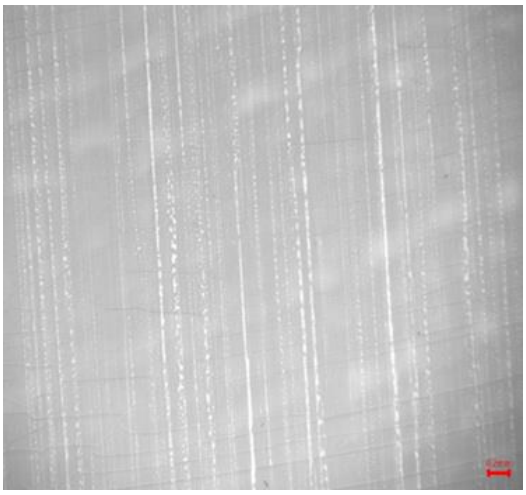
a. Lenses with medium protection with diopter -0.50



b. Lenses without protection with diopter -0.50



c. Lenses with medium protection with diopter -0.25



d. Lenses without protection with diopter -0.25

Fig. 4. *Lenses with diopters of -0.50 and -0.25 with and without protection cleaned with dishwashing detergent*

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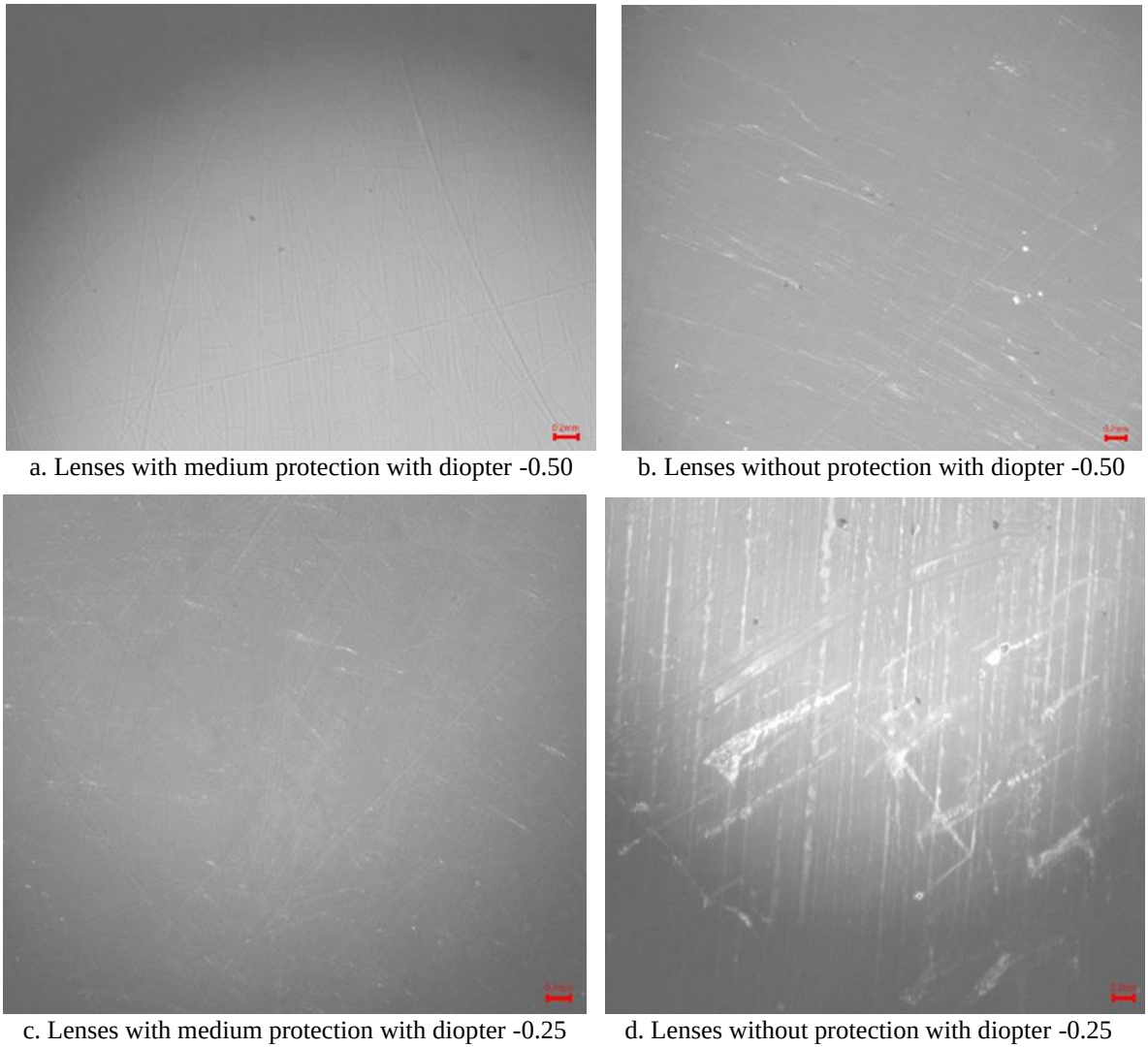
For lenses cleaned with dishwashing detergent, we observed, as in the case of those cleaned with liquid soap, a more advanced deterioration of the surface quality of the lenses without protection.

The surface damage was greater for lenses cleaned with dishwashing detergent than for those cleaned with liquid soap, because dishwashing detergent has a higher pH, 7.12 compared to 5.56 for liquid soap.

For lenses with diopters of -0.50 and -0.25 with and without protection, cleaned with eyeglass wipes, we obtained the following images shown in Fig. 5.



a. Lenses with medium protection with diopter -0.50
b. Lenses without protection with diopter -0.50
c. Lenses with medium protection with diopter -0.25
d. Lenses without protection with diopter -0.25

Fig. 5. *Lenses with diopters of -0.50 and -0.25 with and without protection, cleaned with eyeglass wipes*

The greatest degree of deterioration in surface quality was observed at unprotected lenses, cleaned with an eyeglass wipe. I recommend using wipes to clean your glasses as rarely as possible, only in situations where we cannot immediately use liquid soap.

In the group of lenses analysed under the optical microscope, we also included a pair of non-prescription sunglasses, from the lower quality category, cleaned with eyeglass wipes and dishwashing detergent, to highlight the fact that their surface quality is also influenced by cleaning products.

For both cleaning products, the surface was damaged. The images are presented in Fig. 6.

Following microscopic analysis of the surfaces of spectacle lenses for vision protection and correction, we concluded that long-term maintenance of lenses with inappropriate products damages vision by affecting the quality of the lens surface.

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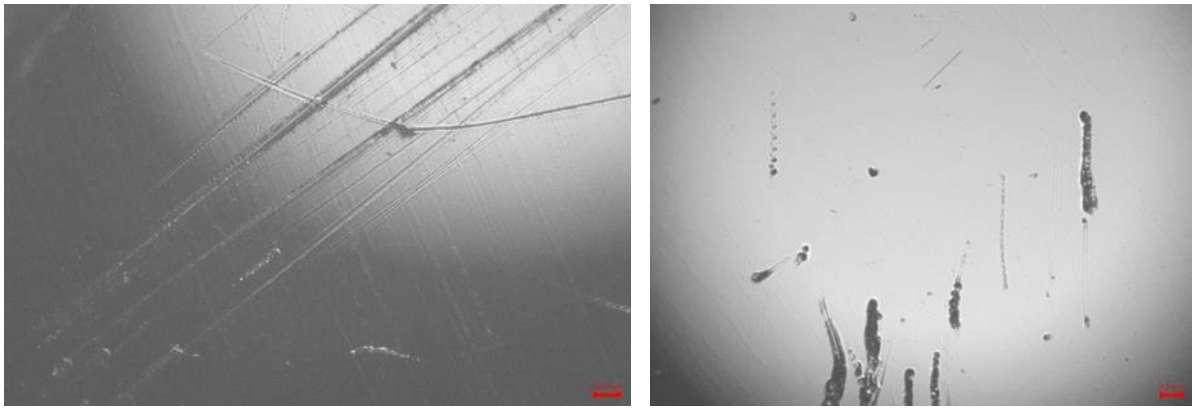

a. sunglasses lens, cleaned with glasses wipes b. sunglasses lens, cleaned with detergent

Fig. 6. *Sunglasses lenses without prescription, cleaned with eyeglass wipes and dishwashing detergent*

The materials used to clean lenses, used improperly and over a long period of time, accentuate vision difficulties, deepening them over time by deteriorating the quality of the lens surface. As a result of using these cleaning materials, scratches appeared on the lens surface and the protective layer was damaged.

The most damaged surfaces were on lenses that were cleaned with dishwashing detergent, which had the highest pH value.

The best surface quality was obtained at lenses cleaned with liquid soap.

Lenses cleaned with eyeglass wipes showed scratches after multiple uses.

Both uncoated and coated lenses showed deterioration in surface quality, with more advanced surface deterioration occurring in lenses without a protective coating.

4. Conclusions

The experimental research consisted of evaluating the influence of maintenance products, such as cleaning solutions, on the quality of lenses. We analysed the influence of these cleaning products on scratch resistance and image clarity. The results of this study are essential for improving the quality of lenses and associated maintenance products.

A deeper understanding of the optical and mechanical characteristics of lenses and how they are affected by maintenance products can contribute to the development of more durable and efficient lenses that best meet the needs of users. The results of this study are essential for knowing how to maintain these lenses to preserve the properties and quality of the surfaces.

References

[1]. ***, Differences_in_the_optical_properties_of_photochro%20MATERIALE%20PROTECȚIE%20LENTILE.pdf.
[2]. ***, Method_of_glass_selection_for_color_correction_in_%20MATERIALE%20PROTECȚIE%20LENTILE.pdf.
[3]. ***, Photochromic_Coatings%20MATERIALE%20PROTECȚIE%20LENTILE.pdf.
[4]. ***, https://www.everydayhealth.com/vision/new-directions-whats-coming-down-the-pike-in-eyewear/.
[5]. ***, https://www.icf.ro/Institut/lab04/XPS_ESCA_book2009.pdf.
[6]. ***, https://www.phys.uaic.ro/wp-content/uploads/2022/05/Lisnic-Petru-Rezumatul-tezei-de-doctorat.pdf.
[7]. ***, https://www.ucecom-spiruharet.ro/wp-content/uploads/2014/05/MIX_Tehnologia-lentilelor_teme.pdf.