

Photoprotectors profile in Brazilian sunscreens

Perfil dos filtros solares utilizados nos fotoprotetores no Brasil

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ABSTRACT

Introduction: Photoprotectors are the active ingredients of sunscreens with the capability of protecting the skin against UV radiation. An increasing number of such photoprotection ingredients have been launched in the marketplace, causing sunscreens' formulas to become increasingly varied.

Objective: To list the main active photoprotection ingredients contained in formulations commercially available in Brazil, as well as to document the presence of other ingredients contained in sunscreens.

Methods: The authors inspected four drugstores in the city of Rio de Janeiro, Brazil, and analyzed the formulas of the SPF 30 sunscreens available. The active photoprotector substances found in all formulations were listed and the percentage of each of them was compared to those contained in all sunscreens evaluated. The presence of plant extracts and antioxidants was also documented.

Results: Thirty commercially available SPF 30 sunscreens were found in different drugstores, having their formulas analyzed. Within this sample, there were 17 different active photoprotection principles, of which titanium dioxide was the most frequently found, followed by bis-ethylhexyloxyphenol methoxyphenyl triazine.

Conclusion: The present study lists the profiles of photoprotection active principles found in the main sunscreens on sale in Brazil and provides data for further evaluation of changes in these profiles over time, as new sunscreens are launched in the marketplace.

Keywords: photoprotectors; sunscreens; photoprotection; ultraviolet rays

RESUMO

Introdução: Filtros solares são os ingredientes ativos dos protetores solares capazes de promover proteção contra as radiações ultravioleta. O mercado tem oferecido um número crescente desses ingredientes, tornando a fórmula dos fotoprotetores cada vez mais variada.

Objetivo: Listar os principais filtros solares que fazem parte das formulações à venda no Brasil, assim como registrar a presença de outros ingredientes dos protetores solares.

Métodos: Os Autores visitaram quatro farmácias da cidade do Rio de Janeiro, (RJ), Brasil, e analisaram as fórmulas dos protetores solares com fator de proteção solar 30 encontrados. Os filtros solares encontrados nas formulações foram listados, e o percentual de cada um deles foi avaliado em relação ao total de todos os filtros presentes. A presença de extratos vegetais e antioxidantes também foi anotada.

Resultados: Foram encontrados 30 fotoprotetores à venda com FPS 30 nos diferentes estabelecimentos, e todos foram analisados em sua composição. Neles havia 17 filtros solares, sendo o mais frequente nas formulações o dióxido de titânio, seguido pelo bis-ethylhexyloxyphenol methoxyphenol triazine.

Conclusão: Este estudo apresenta o perfil dos filtros solares utilizados nos principais fotoprotetores à venda no Brasil e fornece dados para posterior avaliação de mudanças desse perfil ao longo dos anos, à medida que novos filtros solares sejam introduzidos no mercado.

Palavras-chave: filtros solares; fotoprotetores; fotoproteção; raios ultravioleta

Original Articles

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INTRODUCTION

Sunscreens are molecules or molecular complexes that promote photoprotection against types A and B ultraviolet radiation, and visible light, according to their spectrums of action.

Sunscreens are products whose formulas are based on the combination of photoprotecting agents – deemed as the active photoprotecting ingredients – with vehicles such as hydroalcoholic lotions, oils, aerosols, creams, emulsions and gels. This combination yields several compounds, with different action spectra against solar radiation, texture and photo-stability, among other aspects.^{1,2}

The habit of using sunscreens has been increasing in the last few decades. A seven-fold increase in the sales of these products between 1992 and 2002 corroborates this fact.¹ People are increasingly becoming aware of the importance of photoprotection in the prevention of photoaging and pre-malignant and malignant photoinduced lesions.²

As a result, manufacturers have been investing in the development of new formulations, offering a growing number of new sunscreens.¹

The constant emergence of new photoprotecting agents implies that the sunscreens' formulations have been changing over the years. While stronger and more photo-stable photoprotecting agents are introduced in the formulations, others used in the past are suppressed, for instance, for being less effective, for containing allergenic potential or providing poor aesthetic effect regarding the formulation. In addition, ingredients deemed as antioxidants have often been included in current formulations of sunscreens.

In light of these facts and the necessity to gain knowledge about the profiles of the photoprotecting agents used in the formulations of some of the main sunscreens on sale in the Brazilian market, the present study is aimed at listing the active photoprotecting ingredients present in the major formulations that are commercially available. This knowledge can provide data for later analysis and changes in those profiles.

METHODS

The authors surveyed four drugstores – two large and two small – in the city of Rio de Janeiro, Brazil.

All products identified as SPF 30 (Sun Protection Factor 30) sunscreens had their formulations evaluated based on the information contained in the labels provided by the manufacturers.

Based on data related to the ingredients contained in the package, the photoprotecting agents listed in the formulations were segregated from the remaining substances contained in each of the analyzed sunscreens. Finally, the percentage of each photoprotective agent was calculated for all products.

Also, the presence of antioxidants and vegetable extracts in the formulations was evaluated.

Lips sunscreens or moisturizers containing SPF were not included in the assessments.

RESULTS

A total of 30 different SPF 30 sunscreens were found, which contained 17 different types of photoprotecting agents in their formulations.

The photoprotecting agents found in the formulations, as well as their percentage, are depicted in Figure 1.

The most commonly found photoprotecting agent in the sunscreens' formulations was the titanium dioxide (present in 70% of the products analyzed), followed by the bis-ethylhexyloxyphenol methoxyphenyl triazine (anizotriazine), which was present in 66.6% of the products.

Disodium phenyl dibenzimidazole tetrasulfonate and isoamyl p-methoxycinnamate were the less frequently found active photoprotecting ingredients (3.3%).

The number of the active photoprotecting ingredients in the researched sunscreens ranged from 2 to 9, with an average of 6.

The concentration of the photoprotecting agents could not be evaluated, given that this data is not provided on the products' labels.

DISCUSSION

The choice for analyzing products with SPF 30 was based on the recommendations of the American Academy of Dermatology, which compiled studies showing that the use of sunscreens with SPF below 30 are ineffective, since the amount of the product applied to the skin by the population in general is smaller than that recommended in tests measuring the sunscreens' FPS.³ In addition, the assessment of products that have the same FPS makes the comparisons and the study more homogeneous and reliable.

Of the 17 sunscreens found, 16 were approved for use by ANVISA⁴ and 10 by the FDA³ (Table 1).^{3,4,5,6,7,8,9} The disodium phenyl dibenzimidazole tetrasulfonate, present in 3.3% of the analyzed sunscreens, was the only photoprotecting agent without ANVISA approval.

The authors did not find similar research reports in Brazil, which precludes static and time series comparisons of the sunscreens' profiles. However, it was possible to compare the data found with the data related to the formulation of sunscreens marketed in the European Union (EU), where some differences could be observed.

In European study performed by Kerr,¹⁰ in 2011, 19 photoprotecting agents were found in the sunscreens' formulations. Of these, 18 are approved by AVISA and 9 were approved by the FDA. The sample of sunscreens analyzed in this study was larger and not limited to products with SPF 30. The average SPF of all sunscreens analyzed in this study was 30. The average number photoprotecting agents found in the formulations was 5 (min = 1, max = 8).

The photoprotecting agent found most frequently in the EU sunscreens was the butyl methoxydibenzoylmethane (96.4%). This finding corroborates the necessity and effort of the European pharmaceutical companies to provide adequate protection against UVA, as well as adequate efficacy against UVB.¹⁰ According to the findings of the present study, (Figure 1) it is the fourth most frequently used photoprotecting agent in SPF 30 sunscreens in Brazil, along with ethylhexyl methoxycinnamate

TABLE 1: INCI, USAN and trademark nomenclature, action spectra, marketing approval according to ANVISA and FDA and maximum percentage concentration for use of the photoprotecting agents found^{3,9}

Nomenclature Inci	Nomenclature Usan	Trade mark®	Manufacturer	UVA action	UVB action	ANVISA	FDA	Maximum allowed concentration (%)
Titanium dioxide		Neo Heliopan E 1000	Symrise	+	+	+	+	25
Bis-Ethylhexyloxyphenyl methoxyphenyl triazine	Anisotriazine	Tinosorb S	BASF	+	+	+	-	10
Octocrylene		Eusolex OCR	Merk	+	+	+	+	10
		Neo Heliopan 303	Symrise					
		Uvinul MC 80	BASF					
Ethylhexyl (ou Octyl) methoxycinnamate	Octinoxate	Parsol MCX	DSM	-	+	+	+	10
		Eusolex 232	Merk					
		Uvinul MC 80	BASF					
Butyl methoxydibenzoylmethane	Avobenzene	Eusolex 9020	Merk	+	-	+	+	5
		Neo Heliopan 357	Symrise					
		Parsol 1789	DSM					
		Uvinul A Plus	BASF					
Ethylhexyl triazone	Octyl triazone	Uvinul T150	BASF	-	+	+	-	5
Methylene bis-benzotriazolyl tetramethylbutylphenol	Bisocetrizola	Tinosorb M	BASF	+	+	+	-	10
Ethylhexyl salicylate	Octisalate	Eusolex OS	Merk	-	+	+	+	5
		Neo Heliopan OS	Symrise					
Homosalate		Eusolex 232	Merk	-	+	+	+	15
		Neo Heliopan 357	Symrise					
Benzoaphenone-3	Oxybenzone	Eusolex 4360	Merk	+	+	+	+	10
		Neo Heliopan BB	Symrise					
Phenylbenzimidazole sulfonic acid	Ensilizole	Eusolex 232	Merk	-	+	+	+	8
		Neo Heliopan Hydro	Symrise					
Terephthalylidene dicamphor sulfonic acid	Ecamsule	Meroxyl SX	L'Óreal	+	+	+	+	3
Diethylamino hydroxybenzoyl hexyl benzoate		Uvinul A Plus	BASF	+	-	+	-	10
Drometrizole trisiloxane		Meroxyl XL	L'Óreal	+	+	+	-	15
Zinc oxide		Zinc Oxide Neutral	Symrise	+	+	+	+	25
Disodium phenyl dibenzimidazole tetrasulfonate	Bisdisulizole disodium	Neo Heliopan AP	Symrise	+	-	-	-	10
Isoamyl p-methoxycinnamate	Amiloxate	Neo Helipan E 1000	Symrise	-	+	+	-	10

(53.3%). Nevertheless, based on the analysis performed in the present study, it was possible to conclude that the Brazilian pharmaceutical companies also demonstrate an interest in providing effective protection against UVA and UVB radiations. Bis-ethylhexyloxyphenyl methoxyphenyl triazine, and octocrylene, two combined photoprotecting agents (with action against both radiations spectra), constitute the first and second organic photoprotecting agents most frequently found in the formulations (66.6% and 56.6%, respectively).

There has been an increase in the percentage in the use of these two photoprotecting active ingredients in sunscreens in the EU.¹⁰

Titanium dioxide, the most frequently used photoprotecting agent in the analyzed formulations in Brazil (70%), was present in only 49% of Europeans sunscreens. Its low allergenic potential in addition to the action spectrum against UVA, UVB and visible light can justify the high percentage of use of this photoprotecting agent in sunscreens.² While zinc oxide, another example of inorganic photoprotecting agent, was present in 6.6% of the Brazilian formulations, it was absent in the European formulas, since its use is not allowed in the EU.¹⁰

Allergic reactions, contact and photocontact dermatitis triggered by the use of photoprotecting agents are rare. Contact photoallergies are more related to benzophenone-3 (oxybenzone).² Despite this possible adverse effect, this active photoprotecting ingredient was found in 23.3% of the sunscreen for-

mulations marketed in Brazil. This percentage is smaller in the European Union (15.1%).¹⁰

Current reports of octocrylene as an emerging photoallergenic ingredient suggest a possible increase of photoallergy cases related to this photoprotecting agent.¹⁰ While in 2005 it was the fourth most used photoprotecting active principle in European sunscreens, its presence increased by 23% in 2010, meaning it is currently the second most frequently used active photoprotecting agent in European formulations.¹⁰ This increase may be responsible for an increase in the number of cases of photoallergy in the EU. In Brazil, it is the third most commonly used photoprotecting agent in the sunscreens analyzed (present in 56.6% of them), nevertheless it was not possible to evaluate the progression of its presence in the formulations due to a lack of comparative data. Notwithstanding, it is important to warn dermatologists that this photoprotecting agent is emerging as a potential cause of photoallergic reactions related to sunscreens and, in case this correlation becomes evident, its concentration in subsequent formulations will tend to decrease. A similar situation occurred with the photoprotecting agent PABA. It was the most frequently used photoprotecting active principle in the 70s' sunscreens formulations. Nonetheless, PABA, amyl dimethyl PABA and benzophenone-10 were proven to be allergenic, with sales being interrupted.²

Another interesting finding of the present study was the presence of plant extracts in a significant number of sunscreens.

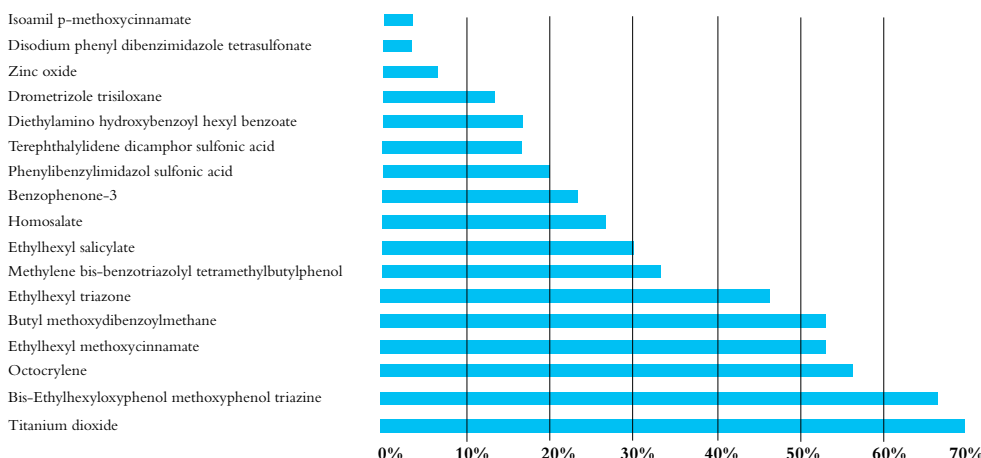


FIGURE 1: Profile of photoprotecting molecules found in the commercial solar formulations analyzed

Among them, *Camellia sinensis* (green tea extract) was the most frequently present in the formulations. It has a powerful antioxidant and photoprotecting effect against photoaging and photo-immunosuppression.^{11,12,13} *Polipodium leucotomos* was found in only one of the studied sunscreens. Scientific evidence suggests its topical or systemic use has a photoprotective effect.¹³

Others plant extracts found in the studied sunscreens were *Aloe barbadensis* (aloe vera), daucos carota oil (carrot oil), chamomile, *Glyciriizia inflata*, *Calendula officinales* (calendula), *Zinger oficinalles*, *Citrus vulgaris*, *Cucurbita pepo* seed oil (pumpkin seed oil), *Prunus Cerasus* (cherry), *Malphiguia pruncifolia* fruit extract and *Cassia alata* leaf extract. These plant extracts act as protectors against free radicals generated by UV radiation, which

participate in the photoaging process and carcinogenesis. Another component with antioxidant effect found in 66% of the studied products was tocopherol (vitamin E).¹⁴

As with titanium dioxide and zinc oxide, talc is considered an inorganic photoprotecting agent,¹⁵ being found in only one of the 30 analyzed sunscreens.

CONCLUSION

The present study allows to draw a profile of the photoprotecting active principles found in the composition of the main SPF 30 sunscreens marketed in Brazil, providing a foundation for further analysis of the progression of the formulations as new active photoprotecting ingredients are introduced and new sunscreen formulations are created and marketed. ●

DECLARATION OF PARTICIPATION:

Mariana Marteleto Godinho:

Data collection at pharmacies, data analysis and drafting of the manuscript

Bryan Hudson Hossy:

Data analysis, preparation of the table and figure, drafting of the manuscript

João Paulo Niemeyer-Corbellini:

Data analysis, drafting and final review of the manuscript

Márcia Ramos-e-Silva:

Drafting and final review of the manuscript

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