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(54) **PAPER CAPABLE OF PARTIALLY ABSORBING BLUE LIGHT, PROCESS FOR MAKING SUCH PAPER AND PAPER PRODUCTS MADE FROM SUCH PAPER**

(57) Paper made from cellulose fibres, which contains a carotenoid dye, the dye being the xanthophyll dye

of *Tagetes Erecta*, which absorbs light of a wavelength of 430 to 470 nm.

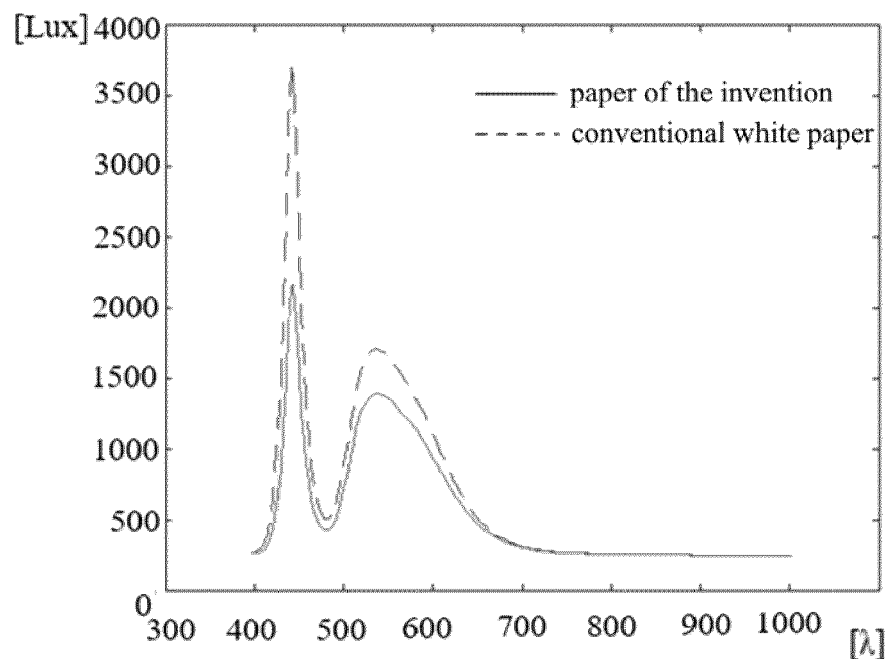


Fig. 1

## Description

### Subject of invention

**[0001]** The subject of the invention is paper capable of partially absorbing blue light, products made from such paper, such as notebooks, memo pads, books, and a process for making such paper.

### Prior art

**[0002]** Visible light is electromagnetic radiation with wavelengths between about 380 and 750 nm. The wavelength of a light beam defines its colour and energy. A short-wavelength light beam has higher energy than a long-wavelength light beam, which is why short-wavelength light beams are more strongly refracted in the human eye. In addition, when they reach the retina, they can cause higher oxidative stress than longer wavelengths. The visible light spectrum includes blue, green, yellow, orange, and red light. Blue light has a very short wavelength, i.e. 420 nm to 495 nm, and therefore high energy. Blue light through the eyes is known to have an inhibitory effect on the production of the hormone melatonin, which is produced in the human body mainly at night and affects hormonal balance, cognitive abilities, the circadian rhythm of many biological functions and thus the overall health of the body.

**[0003]** The natural source of blue light is sunlight, to which the human is exposed during the day when the production of the hormone melatonin is reduced, and therefore has no significant effect on humans, or an effect that is consistent with the human biorhythm. The way people work has changed with the development of technology, especially various electronic devices with screens. People are spending longer and longer periods of time, both in the light and dark parts of the day, in front of various electronic devices that emit a high amount of blue light, work surfaces and paper reading material that are illuminated by artificial light. Due to their positive technical characteristics, light-emitting diodes are increasingly used as a source of artificial light, emitting significantly more blue light than incandescent bulbs. In LEDs, the excitation of the light is such that the primary source is a diode with a very narrow short-wavelength band, and the entire spectrum is corrected to a quasi-white light by additional fluorescent elements. Blue light is therefore over-represented in LED lights and can adversely affect living beings if exposed to it for long periods of time. Excessive blue light through the human visual system affects hormonal balances, disrupts circadian rhythms, particularly in the form of sleep disturbances, and further affects cognitive abilities as well as pupil function. It has even been shown to cause degenerative changes in the retina of the eye.

**[0004]** When working with electronic devices, special glasses with lenses having blue light filters that only transmit light of certain wavelengths can be used for

protection. A disadvantage of such filters is that they are integrated in glasses which many users use primarily for their dioptré, and so have the filter in front of their eyes even when it is not useful, which can also be disturbing. Some electronic devices have built-in blue light filters that modify the light spectrum at the source, thereby reducing blue light radiation. However, as the light source is typically a LED with a blue light wavelength, reduced blue light radiation also reduces luminous intensity.

**[0005]** When working on a particular work surface, especially when looking at and reading paper material, the light does not reach the user's eye directly from the lamp or electronic device, but the material is intensely illuminated by an artificial light source, which, in the case of LED lamps, has a high amount of blue light. The light that illuminates the surface is reflected from this surface. The reflected light has a similar spectrum as its source, so the reflected light also has a high amount of short-wavelength, high-energy blue light. When writing and reading, the user is exposed to blue light which has a negative impact on their hormonal balance and disrupts circadian rhythms. The use of special glasses having blue light filter lenses, while reducing the access of blue light to the wearer's eyes, causes the entire light spectrum to change due to the built-in filter, which may be unfavourable for accurate colour assessment. In addition, such glasses with filter lenses are an additional accessory that must be available to the wearer at all times.

**[0006]** Solutions aimed at reducing the reflection of blue light from the surface of paper are known, where the paper contains or is coated with fluorescent compounds and dyes which, when irradiated with light based on fluorescence and/or phosphorescence, emit light of a longer wavelength, thereby reducing the reflection of light of a shorter wavelength. The problem with these compounds and dyes is that they are artificial substances, the production and use of which is environmentally harmful. The changing wavelength of the reflected light also leads to the problem of paper colouring, which limits the use of multi-coloured inks. The use of fluorescent and/or phosphorescent compounds is also user-unfriendly.

**[0007]** Plants contain a variety of dyes. Yellow and orange dyes form a group of carotenoids which are contained in all green plants and are known for their ability to absorb light energy. The carotenoid group also includes the xanthophyll dye which has been associated with many positive effects on the human body. The *Tagetes erecta* plant, which is pharmaceutically used as a food supplement for its many beneficial effects, including age-related macular degeneration, contains xanthophyll which gives the plant its characteristic yellow colour. Xanthophyll has the ability to partially absorb light of a wavelength of 430-500 nm, with the highest absorption of light of a wavelength of 470 nm, which is the wavelength of blue light.

## Technical problem

[0008] The technical problem is to configure a paper, in particular for educational applications such as school notebooks, memo pads, books, etc., which will overcome these disadvantages and which, when illuminated, in particular by artificial light in the visible light spectrum, will at least partially absorb light in the blue light range, i.e. the light having a wavelength of 420-495 nm, thereby reducing the reflection of blue light, while the reflection of light of other wavelengths will not be significantly altered. The newly configured paper must be ecologically friendly and not pose a risk to health, recyclable without restrictions and allow the use of any type of pen, regardless of its colour.

## Solution to the technical problem

[0009] The technical problem is solved by the paper, the main characteristics of which are defined in the first independent claim.

[0010] Paper made from cellulose fibres contains a dye from the carotenoid group, i.e. the xanthophyll dye of the *Tagetes Erecta* plant, which partly absorbs light of a wavelength in the range of 430 to 470 nm.

[0011] The paper contains an extract of the xanthophyll dye of *Tagetes Erecta* in such quantity that the paper exhibits at least 20% absorption of light of a wavelength of 430-470 nm in the 430-470 nm wavelength range of the light spectrum as determined by a conventional spectrographic analysis. 1 kg of paper of the invention contains 1-6 g, preferably 2-4 g, of the xanthophyll extract of *Tagetes Erecta* in a mixture of ethanol  $C_2H_6O$  and water. The amount of ethanol  $C_2H_6O$  is 50-100% by weight, preferably 60-80% by weight, even more preferably 70% by weight, the rest being water. Said extract quantity is obtained from 2-10 g of dry matter in the form of dried and milled petals of *Tagetes Erecta*.

[0012] The paper making process of the invention comprises a step of adding the xanthophyll dye extract of *Tagetes Erecta* in a solution to paper pulp, the quantity of the added dye extract being 1-6 g/1 kg of produced paper, preferably 2-4 g/1 kg of produced paper. The xanthophyll dye extract of *Tagetes Erecta* is obtained by extracting dry milled petals of *Tagetes Erecta* in a solvent which is a mixture of ethanol and water, the amount of ethanol being 50-100% by weight, preferably 60-80% by weight, even more preferably 70% by weight, the rest being water, at a temperature higher than ambient temperature and lower than boiling temperature, preferably 40-90°C, more preferably 60-70°C.

[0013] The paper making process of the invention may comprise a step in which a mixture of milled petals of *Tagetes Erecta* and water is added to the paper pulp instead of adding the xanthophyll dye extract of *Tagetes Erecta* in a solution, the mixture comprising 6-15 g of milled petals of *Tagetes Erecta* per 100 ml of water depending on the intensity of the colour of petals. The

size of the milled particles of the petals of *Tagetes Erecta* is below 250  $\mu m$ .

[0014] The paper of the invention may also be produced by a paper coating process, wherein the paper is produced by a conventional process. The paper is produced by a coating containing the xanthophyll dye extract of *Tagetes Erecta* in a solution, the solvent being a mixture of alcohol, preferably ethanol, and water, the amount of ethanol being 50-100% by weight, preferably 60-80% by weight, even more preferably 70% by weight, the rest being water. The coating contains the xanthophyll extract of *Tagetes Erecta* in a solution in an amount of 0.5-3% by weight, preferably 0.8-2% by weight, more preferably 0.8-1.2% by weight of the xanthophyll extract of *Tagetes Erecta*.

[0015] The paper of the invention, which contains the xanthophyll of *Tagetes Erecta*, absorbs, when the surface is illuminated, at least a portion of blue light of a wavelength of 430-470 nm, which reduces the reflection of blue light from the illuminated surface. The blue light absorption level depends on the amount of the xanthophyll dye in the paper and/or on the paper surface. The higher the amount of the xanthophyll dye of *Tagetes Erecta*, the higher the blue light absorption when the paper surface is illuminated. However, high amounts of the xanthophyll dye of *Tagetes Erecta* in the paper pulp and thus in the paper or on the paper surface as a coating cause an increased yellow colouring of the paper and a decreased whiteness, which is not desirable.

[0016] The paper which absorbs a portion of blue light is thus suitable for paper products intended for writing and printing, such as notebooks, books, memo pads, notepads, printing paper and similar. Its importance lies in the normalization of the light spectrum originating from artificial lamps, in which the short-wave (blue) light is disproportionately represented. The person using such paper under artificial light receives a portion of the reflected spectrum which has a significantly reduced portion of blue light, which has a beneficial effect on hormonal balance and other bodily functions and can benefit eye health in the long term. A yellowish shade of such paper also has influence on memory. Psychological studies have shown that content written on yellow paper is better remembered.

[0017] Many positive effects of *Tagetes Erecta* are known in the field of pharmacy and food supplements. The xanthophyll dye of *Tagetes Erecta* is obtained by an extraction process by adding alcohols, preferably alcohols having no negative impact on the user's health. The paper of the invention can therefore be used in food industry if there is a need for a yellow coloured paper.

[0018] The paper of the invention will be described herein below in more detail by way of an embodiment and drawings representing in

Fig. 1 represents the intensity of light reflected from a surface of both conventional white paper and the paper of the invention containing the xanthophyll dye

of *Tagetes Erecta*;

Fig. 2 represents the reflection %R of paper of the invention containing the xanthophyll dye of *Tagetes Erecta* and of white paper.

**[0019]** The paper of the invention is capable of partially absorbing blue light and is intended for writing, such as notebooks and other educational accessories, memo pads, notepads, and printing paper, and normally has a basis weight between 60 and 120 g/m<sup>2</sup>.

**[0020]** The paper of the invention is basically produced from cellulose fibres, conventional additives, such as fillers, binders, sizing agents, and the xanthophyll dye contained also in *Tagetes Erecta*, the dye of this plant in particular absorbing blue light and the absorption rate being the highest in the light of a wavelength of 470 nm, which is also the wavelength of blue light.

**[0021]** The xanthophyll from *Tagetes Erecta* is obtainable by extraction from dry milled petals of *Tagetes Erecta*, where alcohols, preferably ethanol, or acetones with an addition of water are used as solvents. The amount of alcohol is 50-100% by weight, preferably 60-80% by weight, even more preferably 70% by weight, the rest being water. The amount of dry matter in the form of milled petals of *Tagetes Erecta* is 6-15 g in 100 ml of a solvent depending on the intensity of the colour of petals. For better extraction, the mixture is heated at a temperature higher than ambient temperature and lower than boiling temperature, preferably 40-90°C, more preferably 60-70°C. This yields 2-8 g of xanthophyll extract in 100 ml of a solvent, which is a mixture of 70% by weight of ethanol and 30% by weight of water. In the embodiment, 5 g of the dye extract was obtained by extraction from 10 g of dry matter in the form of milled petals of *Tagetes Erecta* in a solvent consisting of 70% by weight of ethanol and 30% by weight of water. Said process yielded 50% of extract.

**[0022]** The natural xanthophyll coloured yellow paper is obtainable also by adding a mixture of milled petals of *Tagetes Erecta* and water to paper pulp, wherein the size of the milled particles is smaller than 250 µm. Before adding to water, the petals of *Tagetes Erecta* are milled using a dry milling principle. The petals may also be milled in a known way using a wet milling principle, for instance with a colloid mill. If wet milling is applied, the dry petals of *Tagetes Erecta* are admixed to water and the liquid mixture is then milled in a colloid mill, for instance. The amount of the milled petals of *Tagetes Erecta* is 6-15 g in 100 ml of water depending on the intensity of the colour of petals.

**[0023]** The paper of the invention is produced by the process of making paper from cellulose fibres by adding conventional additives, such as fillers, starches, sizing agents, wherein the xanthophyll extract of *Tagetes Erecta* in a solution is added to the paper pulp, said solution being obtained by extraction in a solvent which is a mixture of ethanol and water, by the previously described

process, of a mixture of milled petals of *Tagetes Erecta* and water is added to the paper pulp by the previously described process. As a result, such paper absorbs a portion of blue light of a wavelength of 430-470 nm. In the paper making process, the xanthophyll extract of *Tagetes Erecta* in a solution is added to paper pulp, which increases the paper's absorption of the light spectrum of a wavelength of 470 nm by at least 20%, the increase in absorption being determined by spectrometry. Said paper characteristics are achieved by adding 1-6 g, preferably 2-4 g of the xanthophyll extract of *Tagetes Erecta* to 100 ml of solvent, depending on the intensity of the colour of petals, per 1 kg of paper produced in a conventional basis weight of 80 g/m<sup>2</sup> or 0.2-0.4%. To obtain said amount of extract, 2-16 g, preferably 4-8 g of dry matter in the form of milled petals of *Tagetes Erecta* is used depending on the intensity of the colour of petals.

**[0024]** Fig. 1 represents the intensity of light reflected from a surface of both conventional sheet of white paper and the paper of the invention containing the xanthophyll of *Tagetes Erecta*, namely 2 g of the dye extract in 100 ml of solvent per 1 kg of produced paper. A respective sheet of paper was illuminated by a wide-spectrum light, the light source being a LED lamp having a colour temperature of 6000°K. As shown in the diagram, the intensity of the light reflected from the paper of the invention in the light spectrum range of 440-460 nm is reduced by a half compared to the intensity of the light reflected from white paper, while it is comparable to the intensity of the light reflected from a white sheet in the range of other wavelengths. Since the reflected light is not reduced in the rest of the light spectrum, the illuminance of the paper is essentially unaffected and the quality of readability is not affected. On the contrary, as the reflection of light in the blue light spectrum is reduced, the negative impact is reduced, which has a beneficial effect on the user.

**[0025]** Figure 2 shows the reflection of paper of the invention and the reflection of conventional white paper. The paper of the invention has a significantly lower reflection, and hence a higher absorption, than white paper in the region illuminated by light of a wavelength of 400-500 nm. The reflection of the two types of paper is essentially equal in the illumination range with the rest of the visible light spectrum. This means that the paper of the invention, to which the xanthophyll dye extract of *Tagetes Erecta* in a solvent is added, reduces the reflection of the light spectrum of a wavelength of 400-500 nm, but does not reduce the reflection of the rest of the light spectrum, which does not considerably reduce the paper illumination that could lead to reduced readability. The reflection of the harmful blue light is considerably reduced.

**[0026]** The added xanthophyll extract of *Tagetes Erecta* may cause a light yellow coloration of the paper, which, however, does not cause reduced readability, which has been determined by measurements of reflection.

**[0027]** Reduced reflection of blue light from the surface of a sheet of paper may also be achieved by applying a

solution containing the xanthophyll extract of *Tagetes Erecta* on the paper surface by way of known printing techniques, such as offset printing or the like. Also in this case is the xanthophyll extract of *Tagetes Erecta* obtained by the previously described process of extraction from dry milled petals of *Tagetes Erecta* in a solvent which is a mixture of 70% by weight of ethanol and 30% by weight of water. The solution containing the xanthophyll extract of *Tagetes Erecta* is admixed to a coating mixture, such as natural starch based coating, which is then applied onto the paper by way of a conventional process of paper coating. When the coating mixture contains 0.5-3% by weight, preferably 0.8-2% by weight, more preferably 0.8-1.2% by weight of the xanthophyll extract of *Tagetes Erecta* and the coating is applied in an amount of 2-3 g/m<sup>2</sup>, the reflection of light in the blue spectrum range is reduced. Moreover, the paper does not exhibit yellow colouring in an extent that would be disturbing for use in writing, drawing, reading and the like.

[0028] Adding the xanthophyll extract of *Tagetes Erecta* in a solvent or as a mixture of milled petals and water to paper pulp to produce paper and also to a coating mixture does not pose any problem. The dye is evenly and without coagulation distributed in the base mixture.

#### Claims

1. Paper produced from cellulose fibres, **characterized by** containing a carotenoid dye.
2. Paper of claim 1, **characterized in that** the dye is the xanthophyll dye of the *Tagetes Erecta* plant, which absorbs light of a wavelength of 430-470 nm.
3. Paper of the preceding claim, **characterized by** containing the xanthophyll extract of *Tagetes Erecta* in a solution in such quantity that the paper exhibits at least 20% absorption in the 430-470 nm wavelength range of the light spectrum as determined by a conventional spectrographic analysis.
4. Paper of any of the preceding claims, **characterized in that** 1 kg of produced paper comprises 1-6 g, preferably 2-4 g of the xanthophyll dye extract of *Tagetes Erecta* in 100 ml of solvent or 0.2-0.4%.
5. Process for making paper as defined in the preceding claims, **characterized by** comprising a step of
  - adding the xanthophyll extract of *Tagetes Erecta* in a solution to paper pulp, the quantity of the added dye extract being 1-6 g/1 kg of produced paper.
6. Process for making paper of the preceding claim, **characterized by** comprising a step of

- adding the xanthophyll dye extract of *Tagetes Erecta* in a solution to paper pulp, the quantity of the added dye extract being 1-6 g/1 kg of produced paper, preferably 2-4 g/1 kg of produced paper.

7. Process for making paper of any of claims 5 to 6, **characterized in that** the xanthophyll of *Tagetes Erecta* is obtained by extracting dry milled petals of *Tagetes Erecta* in a solvent which is a mixture of ethanol C<sub>2</sub>H<sub>6</sub>O and water, the amount of ethanol being 50-100% by weight, preferably 60-80% by weight, even more preferably 70% by weight, the rest being water, at a temperature higher than ambient temperature and lower than boiling temperature, preferably 40-90°C, more preferably 60-70°C.
8. Process for making paper as defined in the claims 1 to 4, **characterized by** comprising a step of
  - adding a mixture of milled petals of *Tagetes Erecta* and water to paper pulp, the mixture comprising 6-15 g of milled petals of *Tagetes Erecta* per 100 ml of water depending on the intensity of the colour of petals.
9. Process for making paper of the preceding claim, **characterized in that** the size of the milled particles of the petals of *Tagetes Erecta* is below 250 µm.
10. Process for making paper as defined in the claims 1 to 4, **characterized by** comprising a step of
  - coating the paper with a coating containing the xanthophyll dye extract of *Tagetes Erecta* in a solution, the solvent being a mixture of alcohol, preferably ethanol C<sub>2</sub>H<sub>6</sub>O, and water, the amount of ethanol being 50-100% by weight, preferably 60-80% by weight, even more preferably 70% by weight, the rest being water.
11. Process of claim 9 or 10, the coating containing the xanthophyll extract of *Tagetes Erecta* in an amount of 0.5-3% by weight, preferably 0.8-2% by weight, more preferably 0.8-1.2% by weight.
12. Process for making paper as defined in the claims 1 to 4, **characterized by** comprising a step of
  - coating the paper with a coating containing a mixture of milled petals of *Tagetes Erecta* and water, the mixture comprising 6-15 g of milled petals of *Tagetes Erecta* per 100 ml of water depending on the intensity of the colour of petals.
13. Paper product made of paper of the preceding claims.

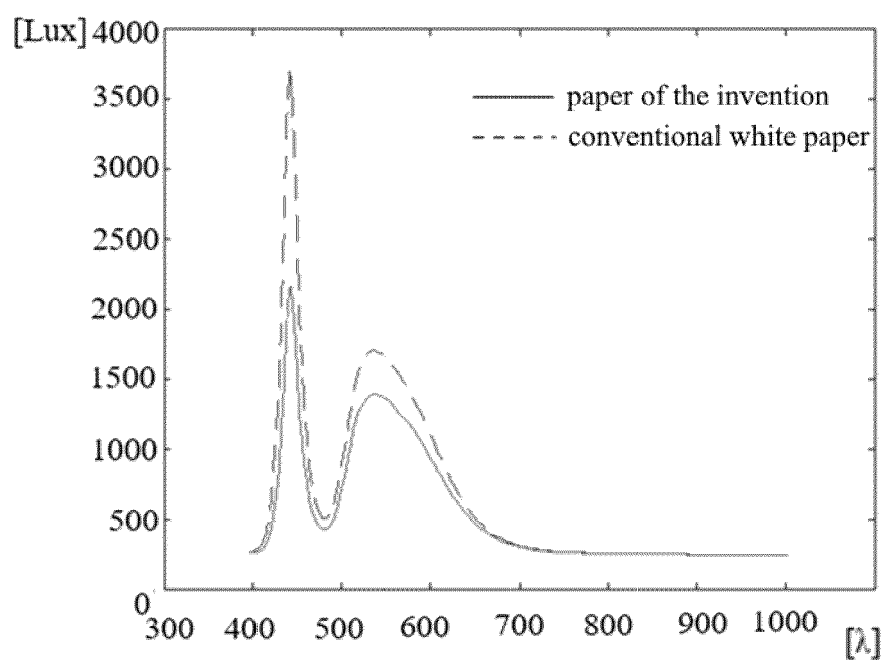


Fig. 1

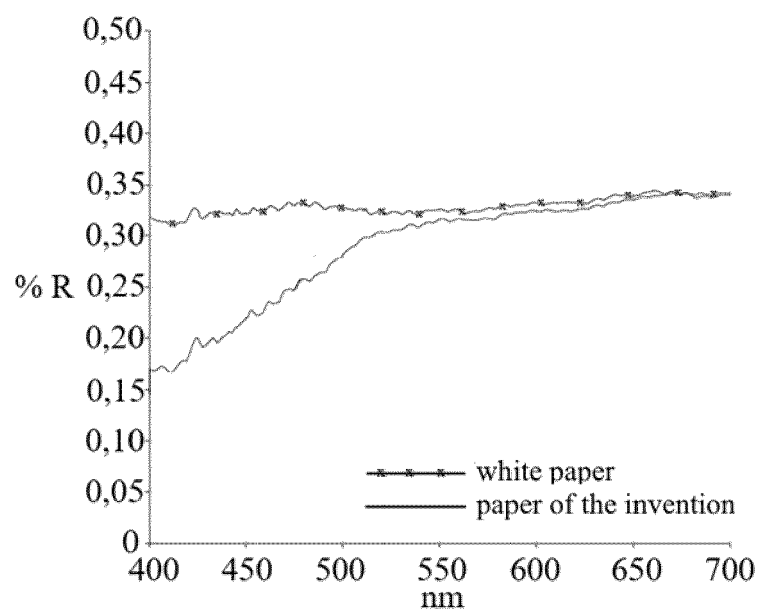


Fig. 2



## EUROPEAN SEARCH REPORT

Application Number

EP 24 18 7002

## DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2013/280320 A1 (MOMPON BERNARD [FR]) 24 October 2013 (2013-10-24)	1-9,13	INV. D21H19/42
Y	* paragraph [0022] * * paragraph [0056] * * paragraph [0071] *	10-12	D21H19/66 D21H21/28 D21H17/02 D21H21/52
X	Luo Yanbing ET AL: "Effects of yellow natural dyes on handmade Daqian paper   Heritage Science", Heritage Science, 19 July 2021 (2021-07-19), pages 25-54, XP093224183, Retrieved from the Internet: URL:https://link.springer.com/article/10.1186/s40494-021-00560-x [retrieved on 2024-11-14]	1,3,13	
Y	* page 7 - page 11 *	10-12	
A		2,4-9	
X	NALYANYA KALLEN MULILO ET AL: "Recent use of selected phytochemistry to mitigate environmental challenges facing leather tanning industry: a review", PHYTOCHEMISTRY REVIEWS, KLUWER, NL, vol. 18, no. 5, 26 September 2019 (2019-09-26), pages 1361-1373, XP036936956, ISSN: 1568-7767, DOI: 10.1007/s11101-019-09651-x [retrieved on 2019-09-26]	1,3,13	TECHNICAL FIELDS SEARCHED (IPC) D21H
A	* page 1369 *	2,4-12	
The present search report has been drawn up for all claims			
Place of search <b>Munich</b>		Date of completion of the search <b>18 November 2024</b>	Examiner <b>Lindner, Claudia</b>
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	



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Application Number

EP 24 18 7002

## DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	COLÍN-CHÁVEZ CITLALI ET AL: "Fabrication and Properties of Antioxidant Polyethylene-based Films Containing Marigold (Tagetes erecta) Extract and Application on Soybean Oil Stability - Colín-Chávez - 2013 - Packaging Technology and Science - Wiley Online Library", PACKAGING TECHNOLOGY AND SCIENCE, vol. 26, no. 5, 20 June 2012 (2012-06-20), pages 267-280, XP093224119, UK ISSN: 0894-3214, DOI: 10.1002/pts.1982 Retrieved from the Internet: URL:https://onlinelibrary.wiley.com/doi/full/10.1002/pts.1982> [retrieved on 2024-11-14] * the whole document *	1-13	
A	Ashritha Dhube ET AL: "Post harvesting and value addition in marigold", The Pharma Innovation Journal 2022; SP-11(5), 6 March 2022 (2022-03-06), pages 1295-1299, XP093224154, Retrieved from the Internet: URL:https://www.thepharmajournal.com/archives/2022/vol11issue5S/PartR/S-11-5-179-880.pdf [retrieved on 2024-11-14] * the whole document *	1-13	TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		18 November 2024	Lindner, Claudia
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	





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Application Number

EP 24 18 7002

## DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	Karmakar Arnab ET AL: "Carotenoids as Coloring Agents" In: "Carotenoids: Structure and Function in the Human Body", 18 February 2021 (2021-02-18), Springer Nature Link, XP093224170, ISBN: 978-3-030-46458-5 pages 189-207, Retrieved from the Internet: URL:https://link.springer.com/chapter/10.1007/978-3-030-46459-2_6> * the whole document *	1-13	
A	Anonymous: "Tagetes erecta", Wikipedia, 25 April 2023 (2023-04-25), pages 1-8, XP093223820, Retrieved from the Internet: URL:https://en.wikipedia.org/w/index.php?title=Tagetes_erecta&oldid=1149934511 [retrieved on 2024-11-14] * the whole document *	1-13	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		18 November 2024	Lindner, Claudia
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document			

# ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 24 18 7002

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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18-11-2024

10

15

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25

30

35

40

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50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2013280320 A1	24-10-2013	AU 2011322393 A1	23-05-2013
		BR 112013010513 A2	13-06-2017
		CA 2814816 A1	03-05-2012
		CN 103314093 A	18-09-2013
		CO 6710949 A2	15-07-2013
		EP 2633017 A2	04-09-2013
		ES 2616854 T3	14-06-2017
		FR 2966700 A1	04-05-2012
		IL 225993 A	30-11-2017
		JP 6325253 B2	16-05-2018
		JP 6509171 B2	08-05-2019
		JP 2013542216 A	21-11-2013
		JP 2017031187 A	09-02-2017
		KR 20140058396 A	14-05-2014
		MA 34680 B1	02-11-2013
		MX 349768 B	11-08-2017
		MY 161964 A	15-05-2017
		NZ 610003 A	25-09-2015
		RU 2013124366 A	10-12-2014
		UA 112637 C2	10-10-2016
		US 2013280320 A1	24-10-2013
		US 2019142762 A1	16-05-2019
		WO 2012056141 A2	03-05-2012
		ZA 201303122 B	27-08-2014
-----			

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82