A STUDY OF UV SPECTRAL TRANSMISSION THROUGH DIFFERENT TRANSPARENT MEDIA WITH SPECTROPHOTOMETER

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Summary

This experiment was carried out with the help of spectrophotometer using an artificial UV light source to find out the percentage transmission of UVA and UVB regions of the UV spectrum. The aim of the experiment was to select the transparent medium which would block maximum UVB at the same time allowing maximum UVA to pass through thus reducing the unwanted side-effects of UVB light and reducing the efficacy of PUVASOL.

It was observed that an ordinary plain 3.5 mm colourless glass was the best transparent medium and with its use a simple solarium could be constructed to treat pat ents on PUVASOL with sunlight as the source of UV light.

Introduction

Photochemotherapy[1] is a recent advance in the treatment of psoriasis, wherein a photosensitizing drug is combined successfully with longwave UV (UVA) light exposures. Longwave UV light can be obtained from artificial or natural sources (sun). The use of sunlight as a source of UV light, in controlling psoriasis, was demonstrated by El Mofty[2] from Egypt, and also at the Dead Sea, Israel, by Professor Avarach[3]. The solar spectrum emits wavelengths of 200-700 nm covering both UVA and UVB rays. The artificial UV lamps used, emit UVA and a negligible amount of UVB. In order to make PUVASOL feasible for psoriatic patients, this study was undertaken with different kinds of transparent media to eliminate UVB which is erythemogenic and more harmful.

Material and Method

This experiment was undertaken with the help of Karl Zeiss spectrophotometer, which is fixed with a hydrogen discharge lamp emitting a continuous band-spectrum in the region of 200–400 nm covering the entire UV region.

The following transparent media were used to study transmission at different wavelengths:

a. Plain glass of thickness varying from 1 to 5 mm;

b. Coloured glasses including brown, green, violet, blue, pale green, smokey grey, etc;

c. Acrylic 1 mm;

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TABLE 1

Percentage Transmission of Ultraviolet Light for Various Glasses

Wave Length	Description of Glass										
	Violet	Green (T=3.52 mm)	Pale Blue (T=3.30 mm)	Pale Green (T=3.02 mm)	Pl. Glass (T=4.02 mm)	Pale Green (T=5.3 mm)	Opaque Pl. (T= 2.51 mm)	Smokey Grey Pl. (T=3.86)	Green Pl. (T= 3.16 mm)	Brown Pl. (T= 3.52 mm)	Deep Blue Pl. (T= 3.02 mm)
290	Neglig	Neglig	Neglig	Neglig	Neglig	Neglig	2.5	0.5	Neglig	—	Neglig.
295	0.6	,,	,,	,,	,,	,,	—	0.5	,,	—	,,
300	0 6	,,	,,	,,	,,	,,	—	0.5	,,	—	,,
305	0.6	,,	,,	,,	,,	,,	—	0.5	,,	—	,,
310	0.9	,,	,,	,,	,,	,,	—	0.6	,,	—	,,
315	1.7	2.2	2.2	2.2	0.8	0.8	—	0.6	,,	—	0.7
320	5.0	8.1	0.5	1.3	4.4	2.2	1.5	0.8	,,	—	2.3
325	12.2	18.5	2.8	6	13.1	7.6	—	1.5	—	—	8.1
330	24	32.5	9.3	16.2	24.7	17.5	6.4	3.8	—	—	19
335	37.7	47	21.5	29.2	40	30.8	—	10	—	—	33
340	51.2	59.5	35	43 8	54	45.2	13.8	21.3	—	—	46.8
345	61.7	69	48.2	56.7	66.3	56.8	—	35	—	—	58.8
350	70.3	76.3	59	66.5	74.2	66.2	19.2	48	—	—	68
355	75.8	81.0	67.5	73.6	80.5	72 5	—	58.6	—	—	74.3
360	79.4	83.8	72.8	78	84.3	76.8	—	66.2	—	—	78.7
365	81.7	85.8	76.8	81	86.5	79.8	—	71.2	26.4	—	81.5
370	82.4	86	77.8	81.8	87.3	80.4	—	73.2	30 3	—	82.4
375	81.5	85.5	76.3	80.5	85.8	79	—	70.6	28.8	—	81.6
380	81.3	85.5	75.3	80	85.6	78.3	23	68.7	27.7	—	80.6
385	83	86.8	77.3	82.7	87.6	80.8	23.4	70.3	30.8	2.8	82.4

TABLE 2

Percentage transmission of various transparent materials in ultraviolet light (290 to 385 m/u)

Wavelength in m/u	UV Range	Glass 1 mm %	Glass 4 mm %	Acrylic 1 mm %	MICA %	PVC 6 Gauge %	PVC 8 Gauge %	PVC 10 Gauge %	Polythene 100 Gauge %	Polythene 200 Gauge %	Cello-phane %
290	B	5	0.5	67	0	1.0	3	0	64	67	76
295	B	10.5	1.0	70	0	25.0	22.5	10	65	69	75
300	B	20	1.0	75	0	55	42	39	66	71	74
305	B	30	1.5	78	2	65	49	53	66	72	74
310	B	45	1.5	80	5	70	55	59	67	73	75
315	B	55	4.5	80	8	72	60	62	67	73	78
320	B	65	10.5	81	12	74	63	65	68	74	80
325	A	73	21.5	81	16	75	65	67	68	74	82
330	A	80	35	82	18	76	67	69	69	75	83
335	A	83	50	83	20	78	69	70	69	75	83
340	A	86	60	84	23	79	71	73	70	76	83
345	A	88	70	84	27	80	73	74	70	76	84
350	A	89	76	85	29	81	74	75	70	76	84
355	A	90	80	85	30	81	75	76	71	76	85
360	A	90	84	85.5	32	82	76	77	71	76	85
365	A	90	85	86	37	83	77	77	72	76	86
370	A	90	86	87	42	83	78	78	72	77	87
375	A	90	86	90	42	84	79	80	73	77	87
380	A	90	86	90	42	84	80	80	73	77	87
385	A	90	86	90	42	84	80	80	73	77	87

REMARKS : From the above data, it is evident that glass sheet of 4 mm. thickness absorbs almost 95% of the UV light in the 'B'region, and transmits about 75%-80% of PUVA.

d. Mica ;

e. P.V.C. - 6 gauge, 8 gauge, 10 gauge ;

f. Polythene - 100 and 200 gauge ;

g. Cellophane.

Observations are tabulated in Table 1 & 2

Discussion

The use of sunlight in photosynthesis is well-known. In humans there are certain problems directly related to sunlight exposures. People all over the world have different capacities to react to sunlight. The skin of the dark race has more melanin, which acts as a barrier to the damaging effects of sunlight, whereas that of the white race has light-sensitivity problems because of melanin pigment deficiency.

To resort to artificial light sources is not possible in most places because of the high cost and availability involved. Sunlight could be used as a source of UVA provided the UVB spectrum, which is probably harmful, is filtered out. For this a solarium is constructed covered on the top with 3.5 mm thick glass to enable patients to take advantage of longwave UV light.

Conclusion

From the above experiment we have concluded that plain ordinary glass of 3.5 mm thickness, which is easily available, is the best filter for UVB and at the same time allows UVA to pass through.

References

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