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**A STUDY OF THE
FUNCTIONAL STABILITY OF SUNSCREEN COMPOUNDS**

BY

JESSE H. STARKMAN

**A THESIS
SUBMITTED TO THE FACULTY OF
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ABSTRACT

Previous work reported in literature, indicates that commercial sunscreen compounds were subject to breakdown on exposure to ultraviolet radiation with consequent change in their functional efficiencies.

These findings were retested under conditions more closely approximating actual usage.

A new method of evaluation which closely correlates to actual experience in large scale usage, was applied. This method provides, from simple spectral data, a reliable index of physiological efficiency of the sunscreen compound. As a result, twelve commercial sunscreen compounds were exposed to ultraviolet radiation for varying periods. Analysis indicated that, contrary to the previous reports, no significant changes in physiological efficiency occurred.

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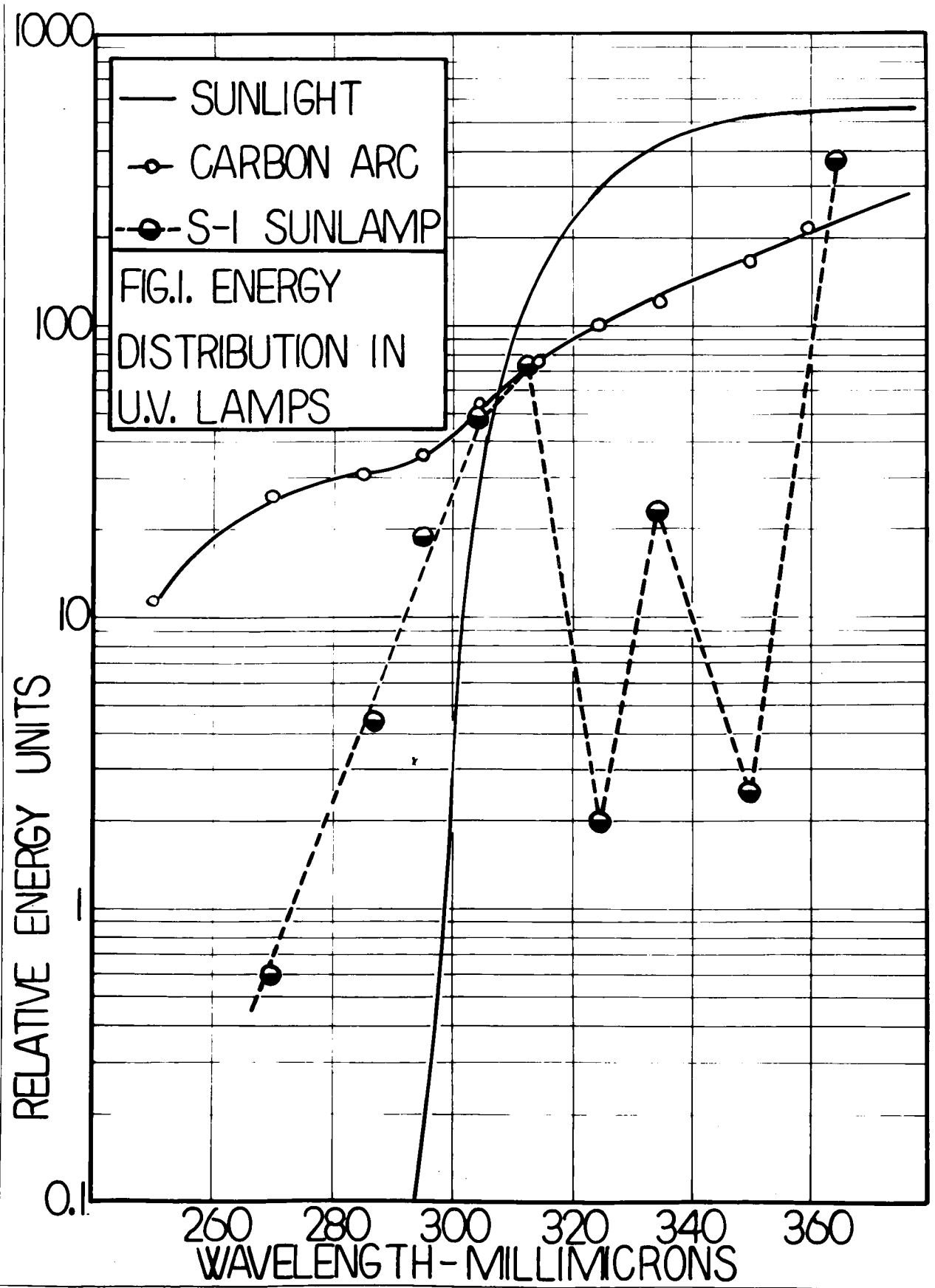
FUNCTIONAL STABILITY OF SUNSCREENS

INTRODUCTION

Cosmetically acceptable sun tan preparations have two major functions to perform. The most important is to protect the user against the burning, blistering, injurious effects of prolonged exposure to sunlight. The second function is to permit the most rapid possible development of skin pigmentation, or tan.

The essential ingredients in sun tan preparations comprise either single chemical compounds or mixtures which have the property of absorbing the ultraviolet radiation which is responsible for the syndrome of sunburn. Such materials, the sunscreens, have been offered to cosmetic manufacturers for many years, and there are screens available which have, through years of successful commercial use, proven their value. It has been difficult, however, to evaluate screening materials with any degree of certainty without resort to skin tests either under an ultraviolet lamp or in actual field use.

Skin tests themselves are not under perfect control, nor are they accurate, unless factors inherent to any in vivo testing are taken into account. Lamp tests indeed give a false picture of the efficacy of a sun tan preparation. The distribution of energy through the near ultraviolet varies drastically from lamp to lamp, and none of them duplicate or even closely approximate the energy and wavelength distribution of natural sun and skylight (Fig. 1). The evaluation afforded by a lamp test is only a rough approximation of the results to be expected in actual use.



— SUNLIGHT
—○— CARBON ARC
-●- S-1 SUNLAMP
FIG. I. ENERGY DISTRIBUTION IN U.V. LAMPS

RELATIVE ENERGY UNITS

WAVELENGTH - MILLIMICRONS

Possible variations introduced into tests employing human subjects render these tests difficult to evaluate. Individual response to irradiation varies widely with type of complexion, age, physical condition and previous history of the individual, and with the locus of the test area on the body. To draw valid conclusions under such circumstances requires the tester to employ large numbers of test subjects, and to treat the data resulting to rigid statistical analysis.

Use tests under the sun are still further complicated by daily variation in sunlight and atmospheric conditions, by lack of control over the subjects' method of application of the test preparation and of the subjects' subsequent activities during the test period.

In general, fairly good data can be obtained through field tests only by the use of large numbers of subjects. This is an expensive and time-consuming procedure at best if the results are to have any validity at all. Furthermore, field testing can be carried on only during a relatively short period of the year unless it is done in semi-tropical location: Florida, Arizona, or similar locales.

Within these limitations, not always realized or taken into account, field testing under the sun remains the primary and best method for sun tan evaluation. However, the need for a reliable instrumental test, independent of climatic or individual physiological differences is readily appreciated. Such a test is provided by spectrophotometric determination of the screening powers of the sun tan preparations. Spectrophotometric measurements have been used to supply data on the effective screening

powers of various sunscreens. The usual form of such data is the transmission curve showing per cent of transmission of ultraviolet radiation as a function of wavelength.

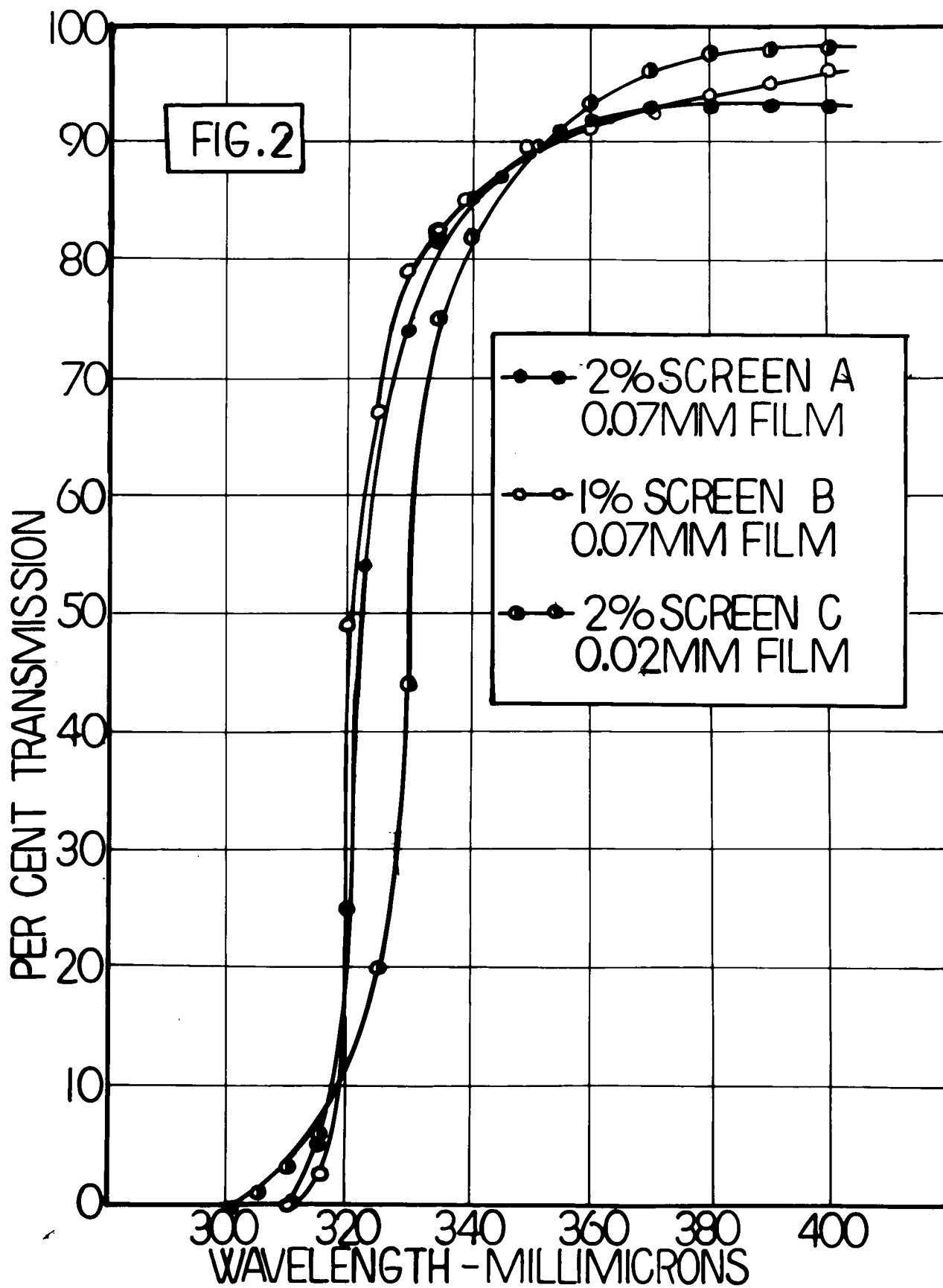
Three typical examples of such data are shown in Figure 2. Special short-path sample holders were used to approximate the film thickness of each sun tan preparation which would be found on the skin. The preparations differ in concentration, but the fact that any volatile solvent would soon disappear from the skin is completely neglected. This will, of course, result in changes in both film thickness and concentration on the skin. To determine the most efficient screen of the three presented is not a simple matter.

Preparation C shows greater transmission of ultraviolet than do either A or B in the 3000-3150 A.U. range*. However, it shows considerably less transmission from about 3150 to 3500 A.U. The latter band has an appreciable erythemalogenic effect. The data presented does not aid in evaluating whether the lower transmission of C between 3150 and 3400 A.U. will offset the greater transmission between 3000 and 3150 A.U.

Preparations B and C show on the curve zero percent transmission between 3000 and 3100 A.U. This is not actually zero, for should a further dilution be made of the test solution, it would be found that the transmission is measurable. On the curve in Figure 2, it is below 0.1 per cent transmission and cannot be plotted. How far below the plotting these values fall is not shown.

But beyond these difficulties of representation and interpretation resides the question: is a measurement on a 0.01 mm film of a

*10 A.U. (Angstrom Unit) = 1 Millimicron = 10^{-7} cm.



2 per cent solution of Preparation C comparable with either a 0.07 mm film of a 1 per cent concentration (Preparation B), or a similar film containing a 2 per cent Preparation A? What allowances should be made for differences in film thickness, or for changes in concentration? The entire analysis requires considerable intuitive estimation often incorrect.

This type of presentation has not been capable of satisfactory interpretation to the point where casual writers on the subject now regard such curves with complete suspicion. The claim is made that valid evaluations can be obtained only through use tests. This conclusion on the part of these experts stems, perhaps, from unfamiliarity with the principles of optical measurements, and with the nature of the radiation-absorption process involved.

Quantitative Spectrophotometry

The absorption of radiant energy is governed by laws capable of exact mathematical expression. One basic relationship is that of Lambert, which may be written:

$$I = I_0 e^{-Et} \quad (1)$$

where I_0 is intensity of radiation entering on an absorbing medium

I is intensity of the radiation transmitted through a thickness, t , of the medium, in centimeters

e is the natural logarithm base

E is the absorption coefficient per centimeter

The absorption coefficient, E is characteristic of the absorbing medium and represents the fraction of the entering radiation which is absorbed per unit distance traversed.

This relationship is basic; no exception has ever been found to Lambert's law in any case ever investigated⁽¹⁾. From Lambert's law it is apparent that the transmittance factor, I/I_0 , is independent of the absolute value of I_0 . The fraction of the entering light which is absorbed by a layer of the medium t cm thick is independent of the intensity of the incident light. Be the light source as powerful as the sun, or as weak as hydrogen discharge tube in a spectrophotometer, a unit layer of any one material will invariably absorb the same proportion of the incident light.

For example, the intensity of sunlight energy of 3500 to 4500 A.U. wavelength at mid-day in June is about 10.0 microwatts per square centimeter. In the same wavelength range, a hydrogen arc in quartz might provide about 0.12 microwatts per square centimeter. An absorbing medium with thickness t and transmittance factor equal to 0.9 would absorb 1.09 microwatts from sunlight, but only 0.012 microwatts of the energy from the hydrogen arc. For successive layers of thickness t of this same medium, the amount of energy transmitted is shown in Table 1.

Table 1

Transmitted Energy from Two Light Sources

Source		Sunlight		Hydrogen Arc	
I_0 microwatts/cm ²		10.9		0.12	
Thickness	Unit I/I_0	I	Overall I/I_0	I	Overall I/I_0
1st t	0.9	9.8100	.900	0.10800	.900
2nd t	0.9	8.8290	.810	0.09720	.810
3rd t	0.9	7.9461	.729	0.08748	.729
ETC.					

Each succeeding layer of thickness t transmits 90 per cent of the radiation reaching that layer, independent of the initial intensity of the radiation. The transmittance of a screen measured with a weak radiation source, as in a spectrophotometer, nevertheless is the same transmittance that would be obtained in field tests, with the sun as the energy source.

Lambert's law is applied to pure, homogeneous materials such as glass or quartz filters, solid crystals, melts, and so on. When, however, the absorbing material is a homogeneous solution of different kinds of molecules, only some of which are capable of absorbing the incident radiation, the mathematical expression for transmittance changes to

$$I = I_0 e^{-Etc} \quad (2)$$

where c is the concentration of the absorbing species in the solution. This may be written in a logarithmic form instead of as an exponential, and the equation becomes

$$\log (I/I_0) = -Etc \quad (3)$$

or

$$\log (I_0/I) = Etc \quad (4)$$

The term, $\log (I_0/I)$ is the optical density, and is related to per cent transmission, T , by the equation

$$\log (I_0/I) = \log (100/T) \quad (5)$$

If Eq. 4 is solved for the constant, E , we obtain the expression

$$E = \log (I_0/I)/tc = \log (100/T)/tc \quad (6)$$

The value of E is independent of the concentration, c , or of the thickness of the absorbing layer, t . It is a characteristic of the absorbing material, and varies only with the wavelength of the radiation being absorbed.

By use of Eq. 6, it becomes possible to equate measurements made at different concentrations, or at different thicknesses of the absorbing layers, and thus to obtain useful measurements of the absorbing characteristics of any materials.

Equation 2 is the well known Bouguer-Beer law, which is general in its applicability. This relationship is followed by many substances in solution, but it is not quite as universal as Lambert's law. Variations from constancy of E are observed in certain cases as t or c are varied. This is brought about by interactions of the absorbing solute with other molecular species present; and the changes are attributable to solvation, association, dissociation or ionization of the absorbing molecules. Most sunscreens are not subject to these variations, but follow closely the Bouguer-Beer relationship. Each case must be tested experimentally to prove the validity of the relationship.

Experimental Spectrophotometry

The measurement of the ratio I/I_0 is conveniently carried out with a modern spectrophotometer such as the Beckman Model DU quartz spectrophotometer. The screen, or the finished sun tan preparation containing it, is dissolved in an ultra-violet-transparent solvent such as methanol, isopropanol, cyclohexane or trimethylpentane. Quantitative procedure must be maintained throughout the determination in weighings, dilutions and transfers which are involved.

For most finished sun tan preparations it has been found convenient to dissolve from 1.0000 to 2.0000 grams of the sun tan preparation in 100 ml of the solvent. Dilutions of this stock solution in the pure solvent are accurately made at 1:10, 1:100 and 1:1000. The transmissions of these solutions are then measured over the desired wavelength range, usually 2900 to 4000 A.U. The data obtained from such a determination is shown in Table 2. The transmittance ratio, I/I_0 is calculated from the transmission readings obtained; the constant, E , is then calculated for each wavelength measured by use of equation 6. Once the values of E are established, equation 6 may again be used to calculate the per cent transmission for any solution of the sun tan preparation by substituting the desired values for concentration, c , and film thickness, t . Alternatively, the absorbance ratio, I_0/I , or its reciprocal, the transmittance ratio, can be calculated under conditions of equal concentration and equal film thickness for any number of materials. On this basis they may be compared with each other to determine their relative efficiencies in screening out the different wavelengths of ultra-violet light.

The determination of transmittance ratio values would be sufficient to measure relative efficiencies of sunscreens if we were dealing with monochromatic radiation. The picture is complicated, however, by the broad character of sunlight which extends in the ultraviolet from 2900 to 4000 A.U. at sea level in midsummer. The intensity of sunlight in this range varies greatly with wavelength. To complicate the process still further, the erythemalogenic effect as well as the tanning effect of the sun's radiation also varies with the wavelength. These variations must be taken into account if an accurate evaluation of sun tan prepara-

Table No. 2

Preparation: Sun Tan "D"

Solvent: Methanol, Spectro Grade

Wave Length	Trans- mission %T	Optical Density, $\text{Log}(\frac{100}{\%T})$	Conc., C Gm/1000 ml.	Cell Thick- ness, cm. t	$\frac{l}{t \times c}$	Absorption Coefficient, K	Transmittance Factor, I/I ₀
2925	69.7	0.1568	0.10253	0.998	9.7830	1.5324	0.0294
2975	69.3	0.1593	0.10253	0.998	9.7830	1.5568	0.0277
3025	71.2	0.1475	0.10253	0.998	9.7830	1.4415	0.0362
3075	76.0	0.1192	0.10253	0.998	9.7830	1.1649	0.0684
3125	13.1	0.8830	1.0253	0.998	0.9783	0.8830	0.1371
3175	31.8	0.4976	1.0253	0.998	0.9783	0.4863	0.3264
3225	55.5	0.2557	1.0253	0.998	0.9783	0.2499	0.5624
3275	3.2	1.4950	1.0253	0.998	0.9783	0.1461	0.7143
3325	23.2	0.6350	10.2530	0.998	0.09783	0.0621	0.8666
3375	43.2	0.3645	10.2530	0.998	0.09783	0.0358	0.9217
3425	62.4	0.2048	10.2530	0.998	0.09783	0.0200	0.9551
3475	77.3	0.1118	10.2530	0.998	0.09783	0.0109	0.9756
3525	87.5	0.0580	10.2530	0.998	0.09783	0.0057	0.9872
3575	93.3	0.0301	10.2530	0.998	0.09783	0.0029	0.9930
3625	96.1	0.1173	10.2530	0.998	0.09783	0.0017	0.9960
3675	97.3	0.0119	10.2530	0.998	0.09783	0.0012	0.9976
3725	97.7	0.0101	10.2530	0.998	0.09783	0.0010	0.9980

Table No. 3

Transmitted Energy through Sun Tan "D", 50 Angstrom Unit Band Width

Wave Length $m\mu$	Transmittance Factor, I/I_0	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	0.0294	1.1390	0.0334		
2975	0.0277	6.5100	0.1806		
3025	0.0362	10.0000	0.3617		
3075	0.0648	3.5770	0.2447		
3125	0.1371	0.9734	0.1334		
3175	0.3264	0.5670	0.1851		
3225	0.5624	0.4550	0.2559	1.9790	0.6069
3275	0.7143	0.2090	0.2064	1.0200	0.7286
3325	0.8666	0.1290	0.1118	0.9350	0.8111
3375	0.9217	<u>0.0456</u>	<u>0.0420</u>	0.7980	0.7355
3425	0.9551			0.6690	0.6390
3475	0.9756			0.5700	0.5561
3525	0.9872			0.4880	0.4817
3575	0.9930			0.4560	0.4528
3625	0.9960			0.3560	0.3545
3675	0.9970			0.3100	0.3090
3725	0.9980			<u>0.2600</u>	<u>0.2595</u>
	Total.....	23.6850	1.7550	6.9420	5.9338
			% Transmitted = 7.4%		% Transmitted = 25.5%

* E-rons/cm² x 10

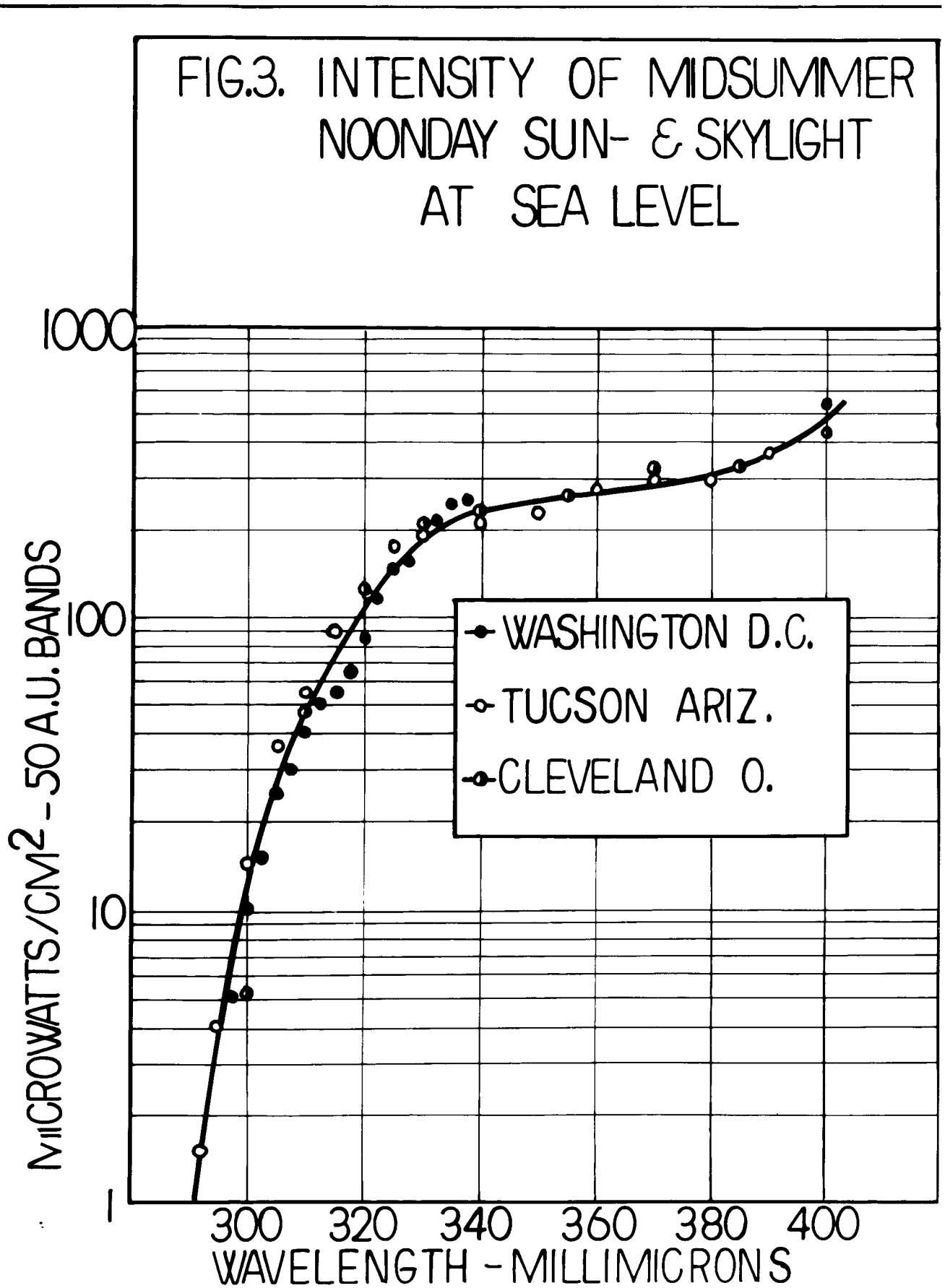
tions is to be made.

The Physiological Spectrum of Sunlight

The total solar radiation reaching sea level varies considerably with a number of factors which include the amount of water vapor in the atmosphere, the amount of ozone present, the altitude of the sun, the geographic latitude at which measurements are made, and the local climatic condition (Fig.3). The ultraviolet component of direct solar energy is strongly absorbed by the ozone layer in the upper atmosphere. It is also absorbed to a certain extent by other atmospheric gases, and by water vapor. Thus, the intensity of the ultraviolet radiation of the sun is reduced by cloudiness even more than is visible light.

Much of this reduction in intensity of direct radiation is due to scattering of the ultraviolet by water droplets, dust and so on. The solar energy scattered by the atmosphere is known as skylight, and comprises as much as 20 per cent of the total radiation received at sea level. It is the skylight which can account for sunburn suffered on cloudy days, or by a person shielded from direct exposure to the sun.

The shorter wavelength radiation is more strongly absorbed and scattered than the longer, visible radiation. At sea-level the energy of lowest wavelength is about 2900 A.U. As the wavelength of the radiation increases, atmospheric absorption is less, and more energy of longer wavelength is received at sea level. The variation in intensity of noontday summer sunlight and skylight received at sea level is shown in Figure 3 as a function of the wavelength, for 50 A.U. bands.

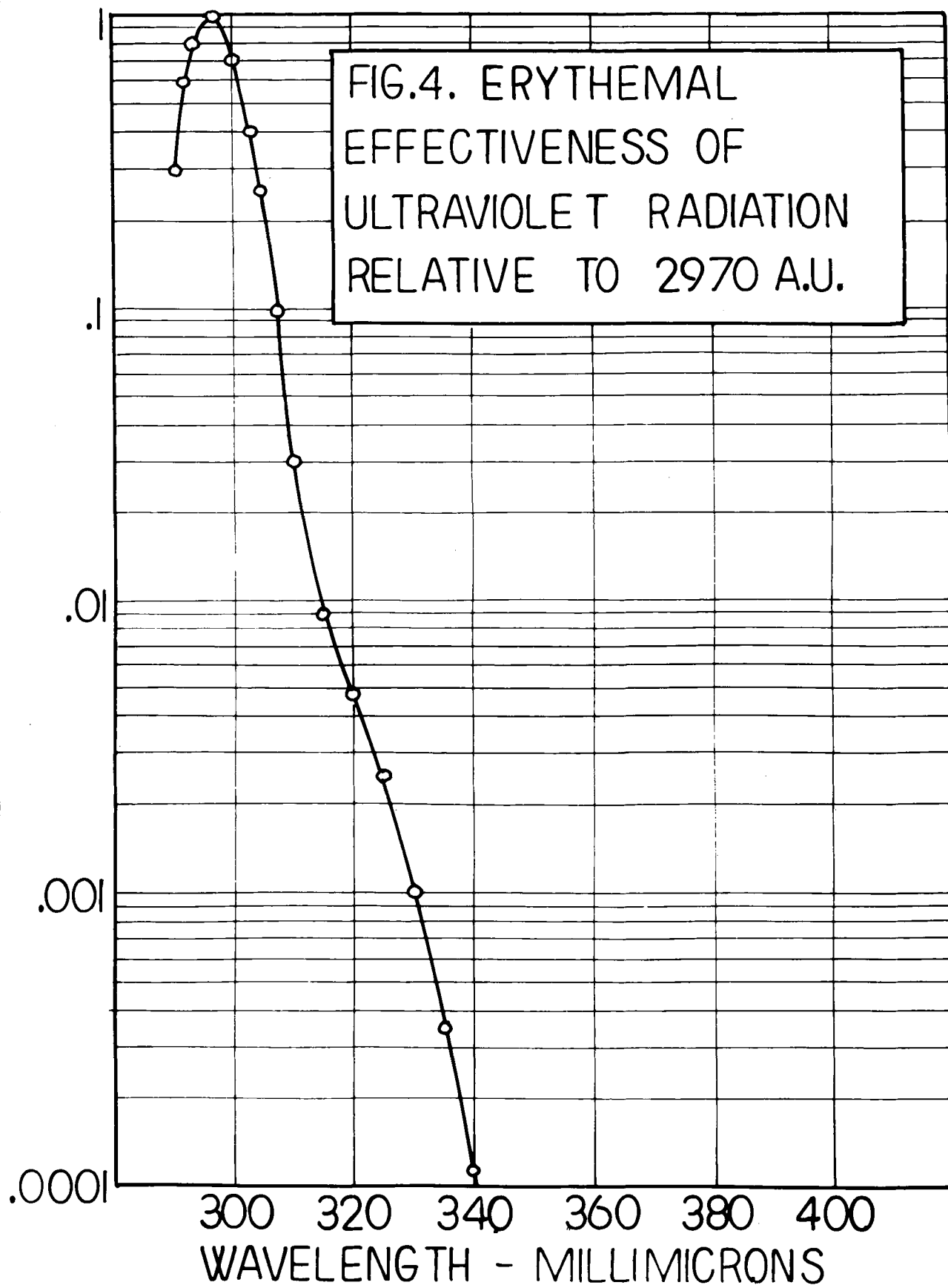


It is this radiant energy in sunlight and skylight which produces erythema and tanning of human skin. However, the response of human skin, aside from individual differences, is not the same for all wavelengths, (Fig.4). Many investigators have shown that the maximum erythema response is elicited by radiation of wavelength increases. Thus, equal amounts of energy at 3070 A.U. produces only 0.1 the erythema response of energy at 2967 A.U.; at 3140 A.U. about 0.01, at 3300 A.U. about 0.001, and at 3400 A.U. only 0.0001 the erythema response. Thus, 10,000 microwatts of radiation of 3400 A.U. is equivalent in erythema effect to 1 microwatt of 2967 A.U. radiation.

A unit of erythema flux has been devised. This unit, the E-viton, is equivalent to 10 microwatts per square centimeter of radiation of wavelength 2967 A.U. This is a unit of erythema effectiveness which is useable to weight the spectral energy of any source in accordance with its erythema effectiveness at different wavelengths.

The response of the skin to a unit of erythema flux is constant. Thus 10 E-vitons per square centimeter for one hour produces the same response as 5 E-vitons per square centimeter for two hours, or 2 E-vitons per square centimeter for 5 hours. On this basis also, the effects due to different wavelengths are additive.

The quantitative effects of the E-viton on normal untanned average skin have been determined. One E-viton per square centimeter for forty minutes produces an MPE (Minimum Perceptible

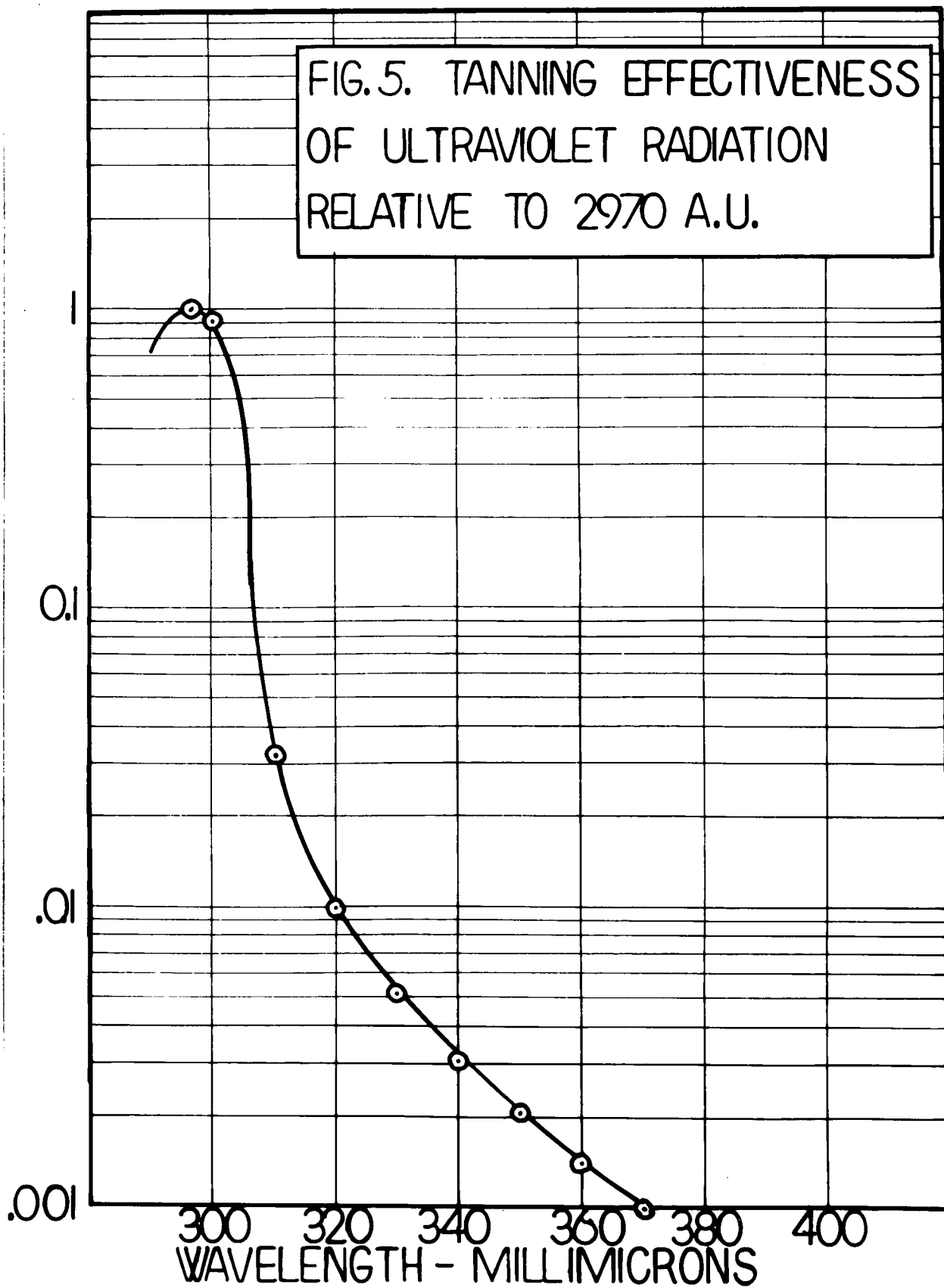


Erythema). Approximate evaluations have also been obtained for more severe exposures: in terms of E-viton seconds/cm² these are:

MPE	2400
Vivid erythema	6000
Painful burn	12000
Blistering burn	24000

An MPE is produced by exposure to midday summer sunlight on average untanned skin in about 20 minutes, the erythematous flux of the combined sun and skylight is thus a maximum of 2.0 E-vitons per square centimeter.

There is no similar quantitative relationship developed for amount of tanning produced by a given amount of radiation. The effectiveness of radiation of a given wavelength to produce pigmentation has been determined to be similar to the erythematous effectiveness (Fig.5). The most effective radiation is that at 2967 A.U. and the tanning effectiveness decreases with increasing wavelength in a manner similar, if not altogether identical, to that of the erythematous effectiveness. At wavelengths above 3400 A.U., tanning is produced without perceptible erythema, according to some investigators. The quantitative response of the human skin in terms of E-viton seconds per square centimeter required to produce a particular depth of pigmentation has not, unfortunately, yet been determined. But the time-energy equivalence still holds: a deeper pigmentation will be developed by any subject as the E-viton second exposure is increased. The principle of operation of the sunscreens is to permit an accumulation of E-vitons seconds exposure to radiation of those wavelengths that do not produce a significant erythematous response.



The difference in response to erythemalogenic and to pigmenting radiations is physiological: deep tan without erythema can be produced in a series of spaced exposures, equivalent in E-viton seconds to a single exposure that would invariably result in blistering sunburn.

Evaluation of Sun Tan Preparations

All the factors have now been developed for making a rigorous evaluation of any sun tan preparation. The transmittance factor, I/I_0 , determined by spectrophotometric measurement, can be combined with the known physiological spectrum of the sun. In this way, both the erythemal and tanning energy which will pass through a given screen of given film thickness can be calculated for the spectral band-widths involved. On an absolute basis, the film thickness is not essential information; if the film thickness is set at a constant value, equal quantities of different preparations can be assessed under comparable conditions of irradiation by sunlight.

The erythemal energy of the sun and skylight in a band of 50 A.U. width is obtained from Fig. 4. This value, multiplied by the average transmittance factor, I/I_0 , for the screen in this same band, determines the transmitted erythemal energy which will reach the skin and result in the physiological response. The sum of the transmitted erythemal energy values for all the bands in the burning range or the tanning range is directly proportional to the amount of erythema or tan which will be developed. A sample calculation of this type is shown in Table 3.

The erythemal and tanning ranges used here are different from those previously accepted. The erythemal range is taken from 2900 to 3400 A.U., rather than ending at 3150 A.U. The values for incident erythemal energy in Table 3 indicate appreciable erythemal activity for sunlight radiation of 3150 to 3400 A.U. This significant amount of erythemal flux should not be neglected in the evaluation. Beyond 3400 A.U., the erythemal flux of sunlight falls to less than one part per thousand of the maximum flux. This amount will have no significant effect on the total, and can be neglected.

The tanning range used includes radiation from 3200 to 3750 A.U. This includes some radiation with erythemal effect, but it represents the range in which a maximum of transmission is desired, in order to produce the most rapid pigmentation without painful erythema.

In comparing two or more sun tan preparations, the figures for transmitted energies can be used directly to determine which of the preparations will provide the better protection and which will permit more rapid pigmentation. The best protection is provided by that preparation characterized by the lowest transmitted erythemal energy, and protection is inversely proportional to the amount of transmitted energy. Conversely, the best pigmentation rate is provided by the preparation which transmits the greatest amount of the incident radiation in the tanning range. These values can be most conveniently expressed as per cent of the incident erythemal and tanning energy, as shown in Table 4.

Table 4

Comparison of Sun Tan Preparations

Basis: Incident Erythemat Energy: 23.6850 microwatts/cm²
 Incident Tanning Energy: 6.9420 microwatts/cm²

Preparation	Transmit. Erythemat Energy	% Trans- mitted	Transmit. Tanning Energy	% Trans- mitted
D	1.7550	7.41	5.9338	85.5
E	2.8190	11.8	5.7008	82.1
F	4.0445	17.1	5.5795	80.4
G	0.2143	0.9	3.4125	49.2
H	1.7923	7.6	4.3924	63.3
J	3.7109	15.7	4.8491	69.9

Identification:

- D - Commercial hydroalcoholic lotion, Screen 1
- E - Commercial aerosol, Screen 2
- F - Commercial oily lotion, Screen 3
- G - Commercial emulsified lotion, umbrella-type, Screen 4
- H - Commercial emulsified lotion, normal type, Screen 4
- J - Commercial hydroalcoholic lotion, normal type, Screen 5

From Table 4, the following analysis can be made:

Preparation G offers the best protection in both the erythemat and tanning ranges. It is a good umbrella-type preparation. However, when the screen concentration is reduced for a normal sun tan preparation in Preparation H, the protection against erythema is very good, but the tanning rate is very poor compared, for example, to Preparation D. Thus the screen used in G is not well balanced for normal use.

Optimum tanning rate and good protection are both afforded by Preparation D. The aerosol, E, also gives good protection and good tanning. Preparation F gives poor protection, less than half that afforded by an equal amount of D, but the tanning rate is adequate,

though less than that with either D or E. Preparation J affords poor protection and very poor tanning rate. The screen used here is entirely out of balance, giving too little absorption in the erythematous range, and by far too much in the tanning range.

This evaluation is relative and does not indicate the absolute value of any one preparation as far as the protective function is concerned. No assumption was made in the evaluation of the actual film thickness of the preparation used on the skin. Consequently, from the data presented, it is not possible to calculate the number of E-viton seconds of erythematous flux which would be accumulated with a given exposure. Past experience with one of the preparations permits a close estimate of the absolute values to be made.

Preparation D has been in use for many years, with several million packages sold each year. It is known through experience with this material that a single application on average untanned skin will provide protection from a painful burn over a continuous 220 minute exposure at mid-day, during midsummer. A vivid erythema usually results, but this is not painful, and fades within 12 to 24 hours into a tan. (8)

Since the response of the skin is constant to a given amount of erythematous flux accumulated in a single exposure, the maximum safe exposure times can be estimated for a number of preparations from the relative amounts of erythematous energy transmitted. This estimation may be made from the equation:

$$\text{Max. Safe Exposure} = 220 \times (7.41 / \% \text{ Ery. Energy Transmitted}) \quad (7)$$

In this way the preparations listed were evaluated as shown in results summarized in Table 5. On the basis of several years

Table 5.

Maximum Safe Exposure with Single Application of
Sun Tan Preparations

Preparation	Max. Safe Exposure
	Minutes
D	220
E	138
F	95
G	1811
H	218
J	105

of experience with sun tan preparations containing an amount of Screen 2 equal to that present in the aerosol. Preparation E, it has been found that the observed results agree within a few minutes with the calculated result presented.

LITERATURE REVIEW

Since about 1934, sun tan preparations have been introduced to the public for sunburn protection and tanning. Data has been compiled concerning the active ingredients in these preparations directly responsible for sun-tan, the sun screens. Kuller & Daniels (7) present the "Sunburn Curve", a region whose ranges are from 2900 to 3260 Angstroms. They describe the characteristics of an "ideal" sunscreen.

Giese et al (5) and Pernich (6) have studied the transmission and absorption spectra of many sunscreens used in suntan preparations. Pernich (6) illustrates the correlation of e/e Transmission with wavelength with dilutions of 0.01%, 0.1% and 0.5% sunscreen and lists nine "efficient" sunscreens based on this correlation. Giese et al (5) tabulate "Families of Sunscreens" and describe absorption spectra of representative screens of each family. Concentration of sunscreens varied from $1 \times 10^{-4}\%$ to $1 \times 10^{-1}\%$. Extinction coefficients based on the Lambert-Beer law were presented. The esters of p-aminobenzoic acid appear to have the highest extinction coefficients of the compounds studied. In this work, the absorption spectra are evaluated graphically by wavelength vs. Density, where density is related to the extinction coefficient, E, by the equation $E = D/ct$, C = concentration in mole/liter and t the thickness of the absorbing layer in centimeters.

In none of these studies, however, is there data on the stability of the sunscreen compounds upon irradiation.

deNavarre⁽³⁾ refers to a report by Ohlsson as to the loss of absorption of some compounds after five minutes exposure to solar ultra-violet radiations. The author also mentions the breakdown of menthyl salicylate, menthyl anthranilate and aesculin on irradiation.

Christensen & Giese⁽⁴⁾ determined the photosensitivity of some representative sunscreens and measured the changes in their absorption following irradiation. They graphically represent the Density vs. wavelength of eleven sunscreens after irradiation by a G. E. Sunlamp. There is listed fifteen compounds and the effect of 2 hour exposures, ranging from a great decrease in the case of benzalacetophenone to no or little change in Ethyl-p-dimethylamino-benzoate to a great increase in sal salicylate. All concentrations were at 0.001% in alcohol in water.

EXPERIMENTAL DATA AND PROCEDURES

Materials Used:

Ultra-violet source - Henovia Alpine Mercury Arc, Low Pressure, Type L794, equipped with a mercury burner (5" long x 3/4" diameter), and a Correx D Filter. Approximate output over range of 2800 to 4000 Angstrom Units is equal to 1225 - 1300 $m\mu/cm^2$.

Container for sunscreen - Pyrex weighing dish, 3" diameter, with ground glass cover, the top of which was removed and in its place, with de-Zhotinsky cement, was attached a quartz plate, 2 mm thick.

Measuring Apparatus - Beckman Model DU Quartz Spectrophotometer with Correx cuvettes, 0.997 and 0.998 cm cell thicknesses.

Sunscreen Compounds -

Glyceryl para aminobenzoate

Isobutyl para-aminobenzoate

Homomenthyl Salicylate

Ethyl para - Dimethylamino benzoate

Phenyl Salicylate

Materials Used:**Sunscreen Compounds - (Continued)**

Glyceryl Salicylate

"Giv-Tan" (probable coumarin derivative)

Hydroquinone

Tannic Acid

Ethyl p-(Glucosyl-imino) Benzoate

Sodium para-Aminobenzoate

Suntan "75-A" (Proprietary mixture of benzyl
cinnamate and benzyl salicylate)**Solvents -**

Distilled water and Methyl Alcohol, Spectro Grade

Glassware -Pyrex volumetric flasks, 100 ml. capacity; 5cc
and 10 cc volumetric pipettes.**PROCEDURE:**

All sunscreens were made up to 2.0% solution in Methyl Alcohol and/or distilled water. A 5cc aliquot was then placed in the special glass container and the top of the dish sealed on with silicone grease. The container was then placed on a sheet of black paper under the Mercury Arc Lamp at a distance of 12 inches below the Correx D Filter. (The intensity of this lamp is approximately 1/16 that of sunlight necessary to produce a Minimum Perceptible Erythema) The sample was then irradiated for three hours*. Since the temperature of the solution never rose above 30° C, thermal effects are neglected.

* A sample of glyceryl para-aminobenzoate was irradiated for 12 hours also.

A 1-gram sample was then weighed quantitatively into a 100 ml volumetric flask and diluted to mark with methyl alcohol (or distilled water). Dilutions are quantitatively made at 1:10, 1:100 and 1:1000. The transmission of these solutions are then measured over a wavelength range of 2250 to 4000 Angstrom Units. The Optical Density ($\log \left(\frac{100}{\%T} \right)$) is calculated and the Extinction Coefficient, E , is determined. A graph may then be drawn correlating $\log E$ with wavelength.

A 1-gram sample of the 3.0% stock solution is then measured in the same manner as a control.

The % Transmitted Erythematous Energy and % Transmitted Tanning Energy may then be calculated and evaluated.

SUMMARY OF RESULTS

<u>Sunscreen</u>	Time <u>Exposed, hrs.</u>	% Ultraviolet Transmitted	
		<u>2925-3375mμ</u>	<u>3225-3725mμ</u>
Glyceryl para-aminobenzoate	0	4.5	83.2
	3	4.2	83.1
	12	2.9	77.4
Isobutyl para-aminobenzoate	0	4.4	92.0
	3	4.4	92.1
Hydroquinone	0	37.1	99.8
	3	35.7	98.1
Glyceryl Salicylate	0	26.8	87.0
	3	23.9	83.7
Tannic Acid	0	30.6	96.6
	3	33.1	95.9
"Giv-Tan"	0	0.3	43.4
	3	1.0	46.6
Ethyl para-dimethylaminobenzoate	0	0.45	69.8
	3	0.47	73.0
Sunscreen "75-A"	0	31.0	92.4
	3	35.8	92.0
Ethyl p-(glucosylamine)benzoate	0	12.6	98.1
	3	10.5	97.7
Homomenthyl Salicylate	0	35.2	91.6
	3	38.7	88.9
Phenyl Salicylate	0	30.4	78.7
	3	29.3	86.7
Sodium para-aminobenzoate	0	55.4	99.7
	3	54.4	98.9

Discussion of Results

Any previous studies made concerning the stability of sunscreen compounds use a dilution of 0.5-0.001% sunscreen. The reason given for the use of low dilutions is that of avoiding any inaccurate spectral measurements resulting from molecular association at high concentrations. However, the use of 2.0% sunscreen as the stock solution more closely approaches actual in vivo testing. The volatile solvent of the screen vehicle evaporates rapidly when placed on the skin, leaving a residuum of the non-volatile screen. Thus, the material which actually accomplishes screening is present in the film at concentrations approaching pure sunscreen. Should the sunscreen be subject to molecular association at these higher concentrations, it is the screening action of the associated molecules which must then be evaluated. Thus, a 2.0% initial concentration will more closely approach the actual condition of sunscreen on the skin in practical usage.

The salicylates, hydroquinone, and tannic acid, are usually used in concentrations of 8.0% to 15.0% in "finished" cosmetic suntan preparations. Although these compounds were used at 2.0% concentrations in this study, the use of E, the Extinction Coefficient, precludes the need for any particular concentration used, the only variation occurring is a raising or lowering of the curve as drawn, depending on the concentration used. Thus, a valid comparison is possible among sunscreens, regardless of concentration.

All of the sunscreens tested appear to be basically stable to ultra-violet light with only minor variations appearing. Twelve hours exposure of glyceryl para-aminobenzoate produces relatively little change, 1.6%, in transmission through the "burning"

range as compared to the non-irradiated sample, and even this change is an increase in absorption. Since the radiant energy given off by the test lamp is equivalent to 16x the ultra-violet energy (energy measured at noon on a summer day) given by sunlight to the skin, the three-hour test exposure actually simulates 48 hours of sunlight. Since there is no apparent degradation of sunscreen in this period, the presence of any of the listed sunscreens on the skin for a period of eight hours at a suitable concentration, still allows for a large safety factor of protection.

It thus follows that any initial testing of the listed sunscreens will give a result essentially the same as any testing done during exposure.

FIG. 6

GLYCERYL PARA-AMINO BENZOATE

- NON-IRRADIATED
- △—△ IRRADIATED THREE HOURS
- ▽—▽ IRRADIATED TWELVE HOURS

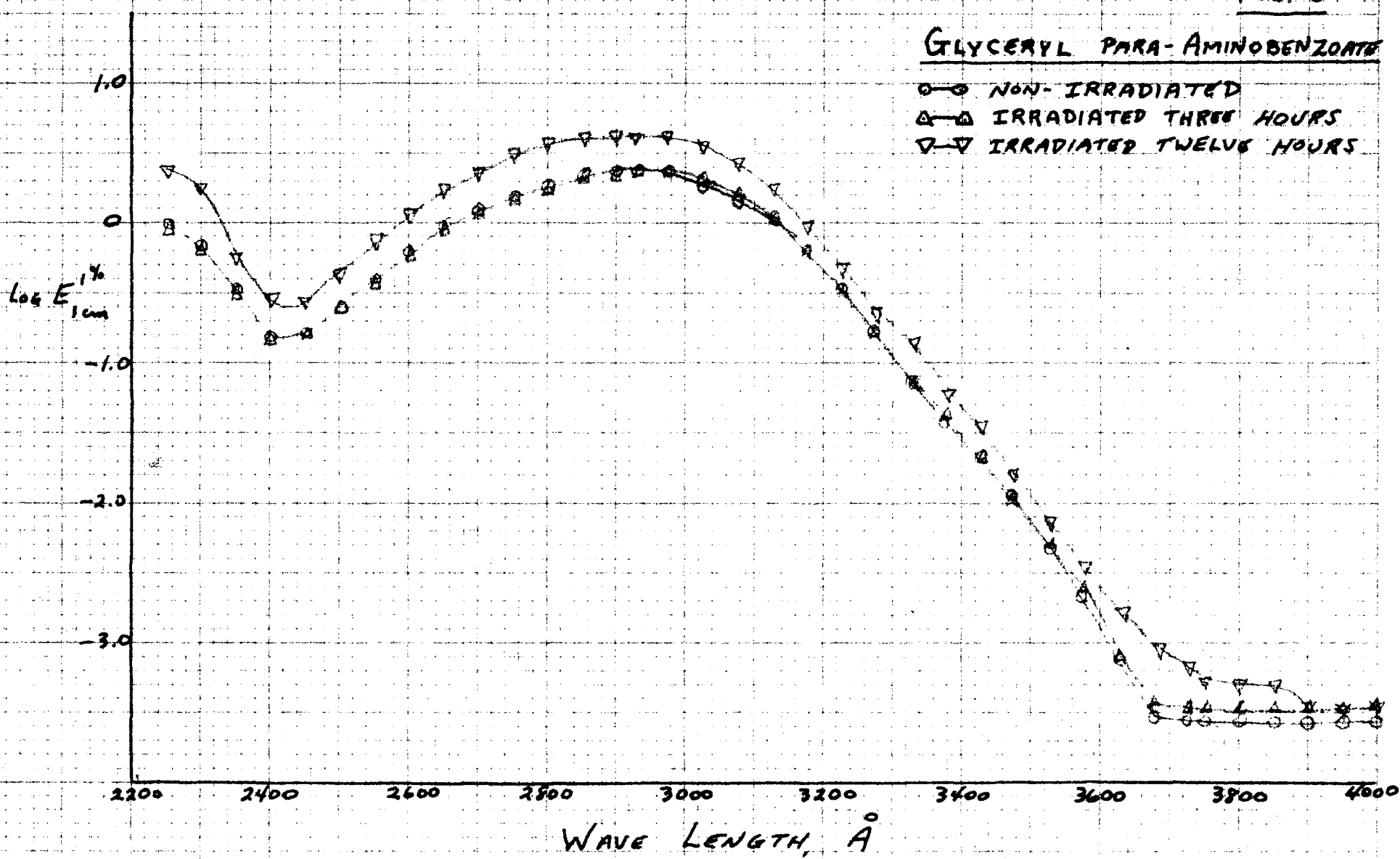


Table No. 6

Preparation: Glyceryl para-aminobenzoate

non-irradiated

Solvent: Methanol, Spectro Grade

Wave Length μ	Trans- mission, % T	Optical Density, $\text{Log}(\frac{100}{\%T})$	Conc., C gm/1000 ml	Cell Thick- ness, cm. t	$\frac{l}{t \times c}$	Absorption Coefficient, ϵ	$\text{Log } \epsilon_{1\%}^{1\text{cm}}$
2250	11.0	0.9590	1.1113	0.998	0.9016	0.8646	-0.0532
2300	19.8	0.7030	1.1113	0.998	0.9016	0.6338	-0.1981
2350	44.3	0.3536	1.1113	0.998	0.9016	0.3188	-0.4965
2400	68.9	0.1618	1.1113	0.998	0.9016	0.1459	-0.8360
2450	67.8	0.1688	1.1113	0.998	0.9016	0.1522	-0.8176
2500	54.3	0.2652	1.1113	0.998	0.9016	0.2391	-0.6214
2550	37.4	0.4271	1.1113	0.998	0.9016	0.3851	-0.4142
2600	21.3	0.6720	1.1113	0.998	0.9016	0.6059	-0.2176
2650	10.1	0.9960	1.1113	0.998	0.9016	0.8980	-0.0467
2700	76.1	0.1186	0.11113	0.998	9.016	1.0693	0.0290
2750	70.0	0.1549	0.11113	0.998	9.016	1.3966	0.1451
2800	64.8	0.1884	0.11113	0.998	9.016	1.6986	0.2302
2850	60.6	0.2175	0.11113	0.998	9.016	1.9610	0.2925
2900	57.8	0.2381	0.11113	0.998	9.016	2.1467	0.3318
2925	57.2	0.2426	0.11113	0.998	9.016	2.1873	0.3398
2975	56.8	0.2457	0.11113	0.998	9.016	2.2152	0.3454
3025	60.9	0.2154	0.11113	0.998	9.016	1.9420	0.2860
3075	68.0	0.1675	0.11113	0.998	9.016	1.5102	0.1790
3125	77.3	0.1118	0.11113	0.998	9.016	1.0080	0.0334
3175	80.1	0.0979	1.1113	0.998	0.9016	0.6284	-0.2018
3225	43.1	0.3655	1.1113	0.998	0.9016	0.3295	-0.4821
3275	66.0	0.1805	1.1113	0.998	0.9016	0.1627	-0.7986
3325	14.7	0.8330	11.113	0.997	0.09016	0.07519	-1.1238
3375	36.2	0.4413	11.113	0.997	0.09016	0.03983	-1.4098
3425	57.9	0.2326	11.113	0.997	0.09016	0.02009	-1.6970
3475	75.9	0.1198	11.113	0.997	0.09016	0.01081	-1.9662
3525	88.4	0.0536	11.113	0.997	0.09016	0.004838	-2.3153
3575	95.0	0.0223	11.113	0.997	0.09016	0.002013	-2.6962
3625	98.1	0.0083	11.113	0.997	0.09016	0.000749	-3.1255
3675	99.3	0.0030	11.113	0.997	0.09016	0.000271	-3.5670
3725	99.3	0.0030	11.113	0.997	0.09016	0.000271	-3.5670
3750	99.3	0.0030	11.113	0.997	0.09016	0.000271	-3.5670
3800	99.3	0.0030	11.113	0.997	0.09016	0.000271	-3.5670
3850	99.3	0.0030	11.113	0.997	0.09016	0.000271	-3.5670
3900	99.3	0.0030	11.113	0.997	0.09016	0.000271	-3.5670
3950	99.3	0.0030	11.113	0.997	0.09016	0.000271	-3.5670
4000	99.3	0.0030	11.113	0.997	0.09016	0.000271	-3.5670

Table No. 7

Preparation: Glyceryl para-aminobenzoate

non-irradiated

Wave Length μ	Extinction Coefficient, K	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	2.1873	1.1390	0.0074		
2975	2.2152	6.5100	0.0396		
3025	1.9420	10.0000	0.1143		
3075	1.5102	3.5770	0.1105		
3125	1.0080	0.9734	0.0955		
3175	0.6284	0.5670	0.1334		
3225	0.3295	0.4550	0.2131	1.0790	0.5054
3275	0.1627	0.2890	0.1986	1.0200	0.7015
3325	0.07519	0.1290	0.1084	0.9360	0.7866
3375	0.03983	<u>0.0456</u>	<u>0.0416</u>	0.7980	0.7281
3425	0.02009			0.6690	0.6390
3475	0.01081			0.5700	0.5556
3525	0.004838			0.4880	0.4827
3575	0.002013			0.4560	0.4537
3625	0.000749			0.3560	0.3550
3675	0.000271			0.3100	0.3100
3725	0.000271			<u>0.2600</u>	<u>0.2600</u>
		Total..23.6850	1.0624	6.9420	5.7782
		% Transmitted = 4.5%		% Transmitted = 83.3%	

* E-ritons/cm² x 10

Table No. 8

Preparation: Glyceryl Para-aminobenzoate Irradiated 3 hrs.

Solvent: Methyl Alcohol, Spectro Grade

Wave Length	Trans- mission	Optical Density,	Conc., C	Cell Thick- ness,		Absorption Coefficient,	Log $K \frac{l}{cm}$
$m\mu$	$\%$ T	$\text{Log}(\frac{100}{\%T})$	Gm/1000 ml	cm t	$\frac{1}{t \times C}$	E	
2250	10.0	1.2000	1.0894	.998	0.9198	0.0198	-0.03631
2300	19.8	.7030	1.0894	.998	0.9198	.6466	-0.18936
2350	45.2	.3449	1.0894	.998	0.9198	.3172	-0.49867
2400	68.8	.1624	1.0894	.998	0.9198	.1494	-0.82565
2450	67.8	.1688	1.0894	.998	0.9198	.1553	-0.80883
2500	53.7	.2700	1.0894	.998	0.9198	.2483	-0.60502
2550	36.4	.4389	1.0894	.998	0.9198	.4037	-0.39394
2600	20.9	.6806	1.0894	.998	0.9198	.6255	-0.20377
2650	10.0	1.0000	1.0894	.998	0.9198	.9198	-0.03631
2700	76.0	.1192	0.10894	.998	9.198	1.0964	0.03981
2750	69.8	.1561	0.10894	.998	9.198	1.4358	0.18715
2800	64.8	.1884	0.10894	.998	9.198	1.7329	0.23880
2850	60.5	.2182	0.10894	.998	9.198	2.0070	0.30255
2900	57.9	.2373	0.10894	.998	9.198	2.1827	0.33905
2925	56.8	.2457	0.10894	.998	9.198	2.2599	0.35410
2975	56.8	.2457	0.10894	.998	9.198	2.2599	0.35410
3025	60.2	.2304	0.10894	.998	9.198	2.0272	0.30685
3075	66.9	.1746	0.10894	.998	9.198	1.6060	0.20575
3125	77.0	.1135	0.10894	.998	9.198	1.0440	0.01870
3175	19.4	.7120	1.0894	.998	0.9198	0.6549	-0.18382
3225	44.0	.3565	1.0894	.998	0.9198	.3379	-0.43426
3275	65.9	.1811	1.0894	.998	0.9198	.1666	-0.77832
3325	15.3	.8150	10.894	.997	0.0921	.07506	-1.12459
3375	35.2	.4535	10.894	.997	0.0921	.04177	-1.37914
3425	37.2	.4286	10.894	.997	0.0921	.0223	-1.65169
3475	75.1	.1244	10.894	.997	0.0921	.01146	-1.94081
3525	88.2	.0545	10.894	.997	0.0921	.005019	-2.29938
3575	94.6	.0241	10.894	.997	0.0921	.00222	-2.65365
3625	98.0	.0088	10.894	.997	0.0921	.000810	-3.09151
3675	99.1	.0039	10.894	.997	0.0921	.000359	-3.44466
3725	99.1	.0039	10.894	.997	0.0921	.000359	-3.44466
3750	99.1	.0039	10.894	.997	0.0921	.000359	-3.44466
3800	99.1	.0039	10.894	.997	0.0921	.000359	-3.44466
3850	99.1	.0039	10.894	.997	0.0921	.000359	-3.44466
3900	99.1	.0039	10.894	.997	0.0921	.000359	-3.44466
3950	99.1	.0039	10.894	.997	0.0921	.000359	-3.44466
4000	99.1	.0039	10.894	.997	0.0921	.000359	-3.44466

Table No. 9

Preparation: Glyceryl para-aminobenzoate

Irradiated 3 hours

Solvent: Methyl Alcohol, Spectro Grade

Wave Length $m\mu$	Extinction Coefficient, E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	2.2599	1.1390	0.0063		
2975	2.2599	6.5100	0.0358		
3025	2.0272	10.0000	0.0918		
3075	1.6060	3.5770	0.0886		
3125	1.0404	0.9734	0.0879		
3175	0.6549	0.5670	0.1255		
3225	0.3279	0.4550	0.2139	1.0790	0.5073
3275	0.1666	0.2890	0.1970	1.0200	0.6953
3325	0.07506	0.1290	0.1084	0.9360	0.7866
3375	0.04177	<u>0.0456</u>	<u>0.0415</u>	0.7980	0.7255
3425	0.02330			0.6690	0.6353
3475	0.01146			0.5700	0.5551
3525	0.005019			0.4880	0.4822
3575	0.002220			0.4560	0.4537
3625	0.000810			0.3560	0.3556
3675	0.000359			0.3100	0.3100
3725	0.000359			<u>0.2600</u>	<u>0.2600</u>
	Total....	23.6850	0.9967	6.9420	5.7666
		% Transmitted = 4.2%		% Transmitted = 83.1%	

* E-vitons/cm² x 10

Table No. 10

Preparation: Glyceryl Para-aminobenzoate

Irradiated 12 hrs.

Solvent: Methyl Alcohol, Spectro Grade

Wave Length m	Trans- mission %	Optical Density, $\text{Log} \left(\frac{100}{\%T} \right)$	Conc., C Gm/1000 ml	Cell Thick- ness, cm t	$\frac{1}{t \times C}$	Absorption Coefficient, E	$\text{Log} E \frac{1\%}{\text{cm}}$
2250	58.3	.2343	0.10486	.998	9.556	2.2390	0.35005
2300	65.2	.1859	0.10486	.998	9.556	1.7755	0.24944
2350	27.8	.5560	1.0486	.998	0.9556	0.5313	-0.27466
2400	50.2	.2993	1.0486	.998	0.9556	0.2860	-0.54363
2450	50.2	.2993	1.0486	.390	0.9556	0.2860	-0.54362
2500	38.0	.4202	1.0486	.998	0.9556	0.4015	-0.39631
2550	84.2	.0747	0.10486	.998	9.556	0.7138	-0.15255
2600	76.8	.1146	0.10486	.998	9.556	1.0951	0.03941
2650	67.2	.1726	0.10486	.998	9.556	1.6494	0.21722
2700	57.6	.2396	0.10486	.998	9.556	2.2896	0.35984
2750	48.9	.3107	0.10486	.998	9.556	2.9690	0.47261
2800	43.8	.3585	0.10486	.998	9.556	3.4258	0.53479
2850	39.5	.4034	0.10486	.998	9.556	3.8549	0.58602
2900	37.9	.4214	0.10486	.998	9.556	4.0269	0.60498
2925	37.6	.4248	0.10486	.998	9.556	4.0594	0.60842
2975	38.2	.4179	0.10486	.998	9.556	3.9935	0.60140
3025	42.5	.3716	0.10486	.998	9.556	3.5510	0.55035
3075	52.1	.2832	0.10486	.998	9.556	2.7063	0.43233
3125	64.8	.1884	0.10486	.998	9.556	1.8004	0.25527
3175	10.9	.9620	1.0486	.998	0.9556	0.9202	-0.03612
3225	32.8	.4841	1.0486	.998	0.9556	0.4626	-0.33479
3275	56.0	.2518	1.0486	.998	0.9556	0.2406	-0.61870
3325	72.8	.1379	1.0486	.998	0.9556	0.1318	-0.88008
3375	25.0	.6020	10.486	.997	0.09565	0.0576	-1.23958
3425	42.5	.3716	10.486	.997	0.09565	0.0355	-1.44977
3475	68.5	.1643	10.486	.997	0.09565	0.0157	-1.80410
3525	84.0	.0757	10.486	.997	0.09565	0.00724	-2.14026
3575	92.2	.0352	10.486	.997	0.09565	0.00338	-2.47108
3625	96.2	.0168	10.486	.997	0.09565	0.00161	-2.79317
3675	97.9	.0092	10.486	.997	0.09565	0.000880	-3.05552
3725	98.5	.0066	10.486	.997	0.09565	0.000631	-3.19997
3750	98.8	.0052	10.486	.997	0.09565	0.000497	-3.30364
3800	98.8	.0052	10.486	.997	0.09565	0.000497	-3.30364
3850	98.8	.0052	10.486	.997	0.09565	0.000497	-3.30364
3900	99.2	.0035	10.486	.997	0.09565	0.000335	-3.47495
3950	99.2	.0035	10.486	.997	0.09565	0.000335	-3.47495
4000	99.2	.0035	10.486	.997	0.09565	0.000335	-3.47495

Table No. 11

Preparation: Glyceryl para-aminobenzoate

irradiated 12 hours

Solvent: Methyl Alcohol, Spectro Grade

Wave Length $m\mu$	Extinction Coefficient, E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	4.0594	1.1390	0.0001		
2975	3.9935	6.5100	0.0007		
3025	3.5510	10.0000	0.0028		
3075	2.7063	3.5770	0.0070		
3125	1.8004	0.9734	0.1540		
3175	0.9202	0.5670	0.0681		
3225	0.4626	0.4550	0.1567	1.0790	0.3717
3275	0.2406	0.2890	0.1660	1.0200	0.5859
3325	0.1318	0.1290	0.0952	0.9360	0.6908
3375	0.0576	<u>0.0456</u>	<u>0.0399</u>	0.7980	0.6988
3425	0.0355			0.6690	0.6166
3475	0.0157			0.5700	0.5497
3525	0.00724			0.4880	0.4803
3575	0.00338			0.4560	0.4528
3625	0.00161			0.3560	0.3549
3675	0.00088			0.3100	0.3097
3725	0.000631			<u>0.2600</u>	<u>0.2597</u>
	Total...	23.6850	0.6905	6.9420	5.3709
		% Transmitted = 2.9%		% Transmitted = 77.4%	

* E-vitons/cm² x 10

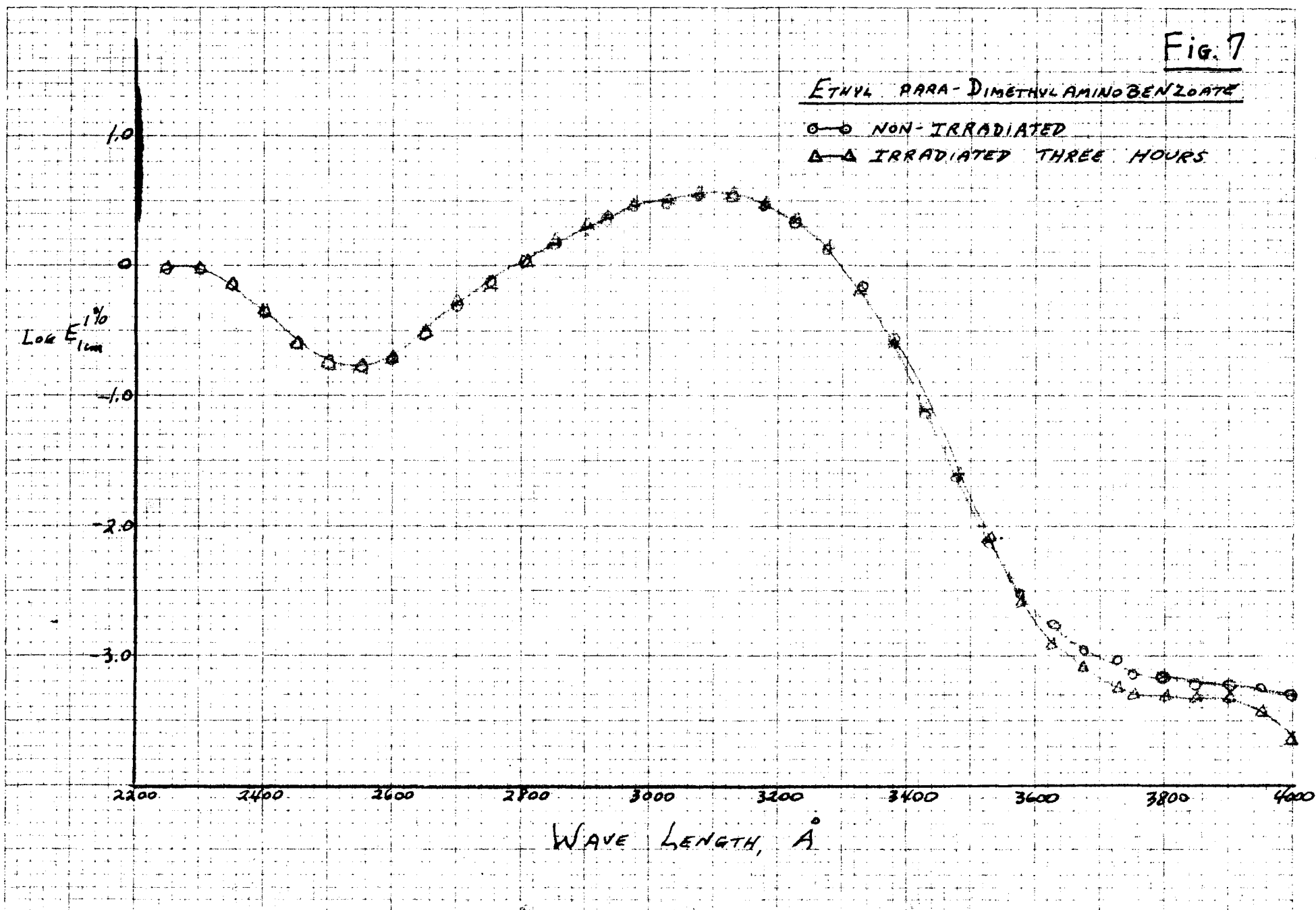


Table No. 12

Preparation: Ethyl Para-dimethyl aminobenzoate

Non-irradiated

Solvent: Methyl Alcohol, Spectro Grade

Wave Length μ	Trans- mission μ	Optical Density, $\log \left(\frac{100}{\%T} \right)$	Conc., G/ml	Cell Thick- ness, cm	$\frac{1}{t \times C}$	Absorption Coefficient, E	$\log K_{1cm}^{1\%}$
2250	12.5	.9030	1.030	.998	1.0279	0.8785	-0.05628
2300	11.8	.9280	1.030	.998	1.0279	.9029	-.04436
2350	17.9	.7470	1.030	.998	1.0279	.7269	-.13858
2400	35.0	.4559	1.030	.998	1.0279	.4435	-.25311
2450	55.8	.2534	1.030	.998	1.0279	.2465	-.60818
2500	63.7	.1959	1.030	.998	1.0279	.1906	-.71988
2550	67.8	.1688	1.030	.998	1.0279	.1642	-.78463
2600	62.6	.2034	1.030	.998	1.0279	.1979	-.70355
2650	49.5	.3054	1.030	.998	1.0279	.2971	-.52710
2700	31.2	.5058	1.030	.998	1.0279	.4921	-.30795
2750	16.2	.7909	1.030	.998	1.0279	.7686	-.11430
2800	78.8	.1035	0.1030	.998	0.1027	1.0070	0.00503
2850	70.1	.1543	0.1030	.998	0.1027	1.5012	0.17638
2900	63.8	.1952	0.1030	.998	0.1027	1.8991	0.27653
2925	60.2	.2304	0.1030	.998	0.1027	2.1443	0.35123
2975	54.0	.2676	0.1030	.998	0.1027	2.6035	0.41564
3025	48.0	.3188	0.1030	.998	0.1027	3.1016	0.49164
3075	45.8	.3391	0.1030	.998	0.1027	3.2991	0.51838
3125	45.5	.3420	0.1030	.998	0.1027	3.3273	0.52205
3175	50.0	.3010	0.1030	.998	0.1027	2.9284	0.46657
3225	59.9	.2226	0.1030	.998	0.1027	2.1657	0.33566
3275	73.2	.1355	0.1030	.998	0.1027	1.3183	0.11992
3325	22.1	.6560	1.030	.998	1.0279	0.6382	-0.19504
3375	54.0	.2676	1.030	.998	1.0279	0.2603	-0.58453
3425	18.3	.7400	10.30	.997	10.269	0.0721	-1.14206
3475	59.3	.2269	10.30	.997	10.269	0.0231	-1.65561
3525	85.2	.0696	10.30	.997	10.269	0.00678	-2.16877
3575	94.2	.0260	10.30	.997	10.269	0.00253	-2.59688
3625	96.3	.0164	10.30	.997	10.269	0.00160	-2.79588
3675	97.6	.0105	10.30	.997	10.269	0.00102	-2.99140
3725	98.0	.0088	10.30	.997	10.269	0.000857	-3.06702
3750	98.5	.0066	10.30	.997	10.269	0.000643	-3.19179
3800	98.5	.0066	10.30	.997	10.269	0.000643	-3.19179
3850	98.7	.0057	10.30	.997	10.269	0.000552	-3.25806
3900	98.7	.0057	10.30	.997	10.269	0.000552	-3.25806
3950	98.7	.0057	10.30	.997	10.269	0.000552	-3.25806
4000	99.1	.0039	10.30	.997	10.269	0.000360	-3.43922

Table No. 13

Preparation: Ethyl para-dimethylaminobenzoate

non-irradiated

Solvent: Methyl Alcohol, Spectro Grade

Wave Length $m\mu$	Extinction Coefficient, E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	2.1443	1.1390	0.0082		
2975	2.6035	6.5100	0.0162		
3025	3.1016	10.0000	0.0079		
3075	3.2991	3.5770	0.0018		
3125	3.3273	0.9734	0.0005		
3175	2.9284	0.5670	0.0007		
3225	2.1657	0.4550	0.0031	1.0790	0.7365
3275	1.3183	0.2890	0.0139	1.0200	0.4901
3325	0.6382	0.1290	0.0297	0.9360	0.2153
3375	0.2603	<u>0.0456</u>	<u>0.0250</u>	0.7980	0.4382
3425	0.0721			0.6690	0.5669
3475	0.0221			0.5700	0.5418
3525	0.00678			0.4880	0.4808
3575	0.00253			0.4560	0.4533
3625	0.00160			0.3560	0.3542
3675	0.00102			0.3100	0.3094
3725	0.000857			<u>0.2600</u>	<u>0.2597</u>
Total.....		23.6850	0.1070	6.9420	4.8462
		% Transmitted = 0.45%		% Transmitted = 69.6%	

* E-vitons/cm² x 10

Table No. 14

Preparation: Ethyl Para-Dimethylaminobenzoate

Irradiated 3 hrs.

Solvent: Methyl Alcohol, Spectro Grade

Wave Length	Trans- mission	Optical Density,	Conc., C	Cell Thick- ness,		Absorption Coefficient,	
$m\mu$	%T	$\text{Log} \left(\frac{100}{\%T} \right)$	$\text{gm}/1000$ ml	cm t	$\frac{1}{t \times C}$	K	$\text{Log} K \frac{1\%}{1\text{cm}}$
2250	8.50	1.0706	1.1687	.998	1.1664	0.9178	-0.04625
2300	8.83	1.0540	1.1687	.998	1.1664	0.9038	-0.04402
2350	14.2	.8480	1.1687	.998	1.1664	0.7270	-0.13847
2400	20.8	.5114	1.1687	.998	1.1664	0.4384	-0.35813
2450	51.5	.2882	1.1687	.998	1.1664	0.2471	-0.60713
2500	61.0	.2147	1.1687	.998	1.1664	0.1841	-0.73495
2550	65.0	.1871	1.1687	.998	1.1664	0.1604	-0.79480
2600	59.9	.2228	1.1687	.998	1.1664	0.1908	-0.72942
2650	48.8	.3487	1.1687	.998	1.1664	0.2989	-0.52447
2700	26.2	.5820	1.1687	.998	1.1664	0.4989	-0.30199
2750	84.5	.0731	0.11687	.998	0.11664	0.6541	-0.18346
2800	76.1	.1186	0.11687	.998	0.11664	1.0168	0.00732
2850	68.2	.1662	0.11687	.998	0.11664	1.4248	0.15382
2900	60.2	.2204	0.11687	.998	0.11664	1.8895	0.27646
2925	56.5	.2480	0.11687	.998	0.11664	2.1261	0.32756
2975	50.2	.2993	0.11687	.998	0.11664	2.5659	0.40926
3025	45.0	.3468	0.11687	.998	0.11664	2.9721	0.47320
3075	41.8	.3788	0.11687	.998	0.11664	3.2475	0.51151
3125	41.1	.3862	0.11687	.998	0.11664	3.3109	0.51996
3175	40.2	.3354	0.11687	.998	0.11664	2.8755	0.45871
3225	56.8	.2457	0.11687	.998	0.11664	2.1064	0.32346
3275	71.8	.1439	0.11687	.998	0.11664	1.2337	0.08132
3325	18.8	.7260	1.1687	.998	1.1664	0.6224	-0.20593
3375	49.8	.3028	1.1687	.998	1.1664	0.2596	-0.58569
3425	12.9	.8570	11.687	.997	11.652	0.0736	-1.13312
3475	53.0	.2757	11.687	.997	11.652	0.0237	-1.62525
3525	82.9	.0814	11.687	.997	11.652	0.00699	-2.15552
3575	93.9	.0273	11.687	.997	11.652	0.00234	-2.63078
3625	97.2	.0123	11.687	.997	11.652	0.00106	-2.97469
3675	98.0	.0088	11.687	.997	11.652	0.00073	-3.12805
3725	98.2	.0079	11.687	.997	11.652	0.000678	-3.16877
3750	98.8	.0062	11.687	.997	11.652	0.000446	-3.35066
3800	98.8	.0052	11.687	.997	11.652	0.000446	-3.35066
3850	98.8	.0052	11.687	.997	11.652	0.000446	-3.35066
3900	98.8	.0052	11.687	.997	11.652	0.000446	-3.35066
3950	99.1	.0039	11.687	.997	11.652	0.000335	-3.47495
4000	99.6	.0017	11.687	.997	11.652	0.000146	-3.83565

Table No. 15

Preparation: Ethyl para-dimethylaminobenzoate

irradiated 3 hours

Solvent: Methyl Alcohol, Spectro Grade

Wave Length m μ	Extinction Coefficient, E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	2.1261	1.1390	0.0085		
2975	2.5659	6.5100	0.0115		
3025	2.9731	10.0000	0.0106		
3075	3.2475	3.5770	0.0020		
3125	3.3109	0.9734	0.0005		
3175	2.8755	0.5670	0.0008		
3225	2.1064	0.4550	0.0036	1.0790	0.8449
3275	1.2337	0.2890	0.0169	1.0200	0.5954
3325	0.6224	0.1290	0.0307	0.9360	0.2225
3375	0.2596	<u>0.0456</u>	<u>0.0251</u>	0.7980	0.4387
3425	0.0736			0.6690	0.5646
3475	0.0237			0.5700	0.5403
3525	0.00699			0.4880	0.4803
3575	0.00234			0.4560	0.4533
3625	0.00106			0.3560	0.3553
3675	0.000755			0.3100	0.3097
3725	0.000678			<u>0.2600</u>	<u>0.2597</u>
	Total...	23.6850	0.1102	6.9420	5.0647
		% Transmitted = 0.47%		% Transmitted = 73.0%	

* E-vitons/cm² x 10

Fig. 8

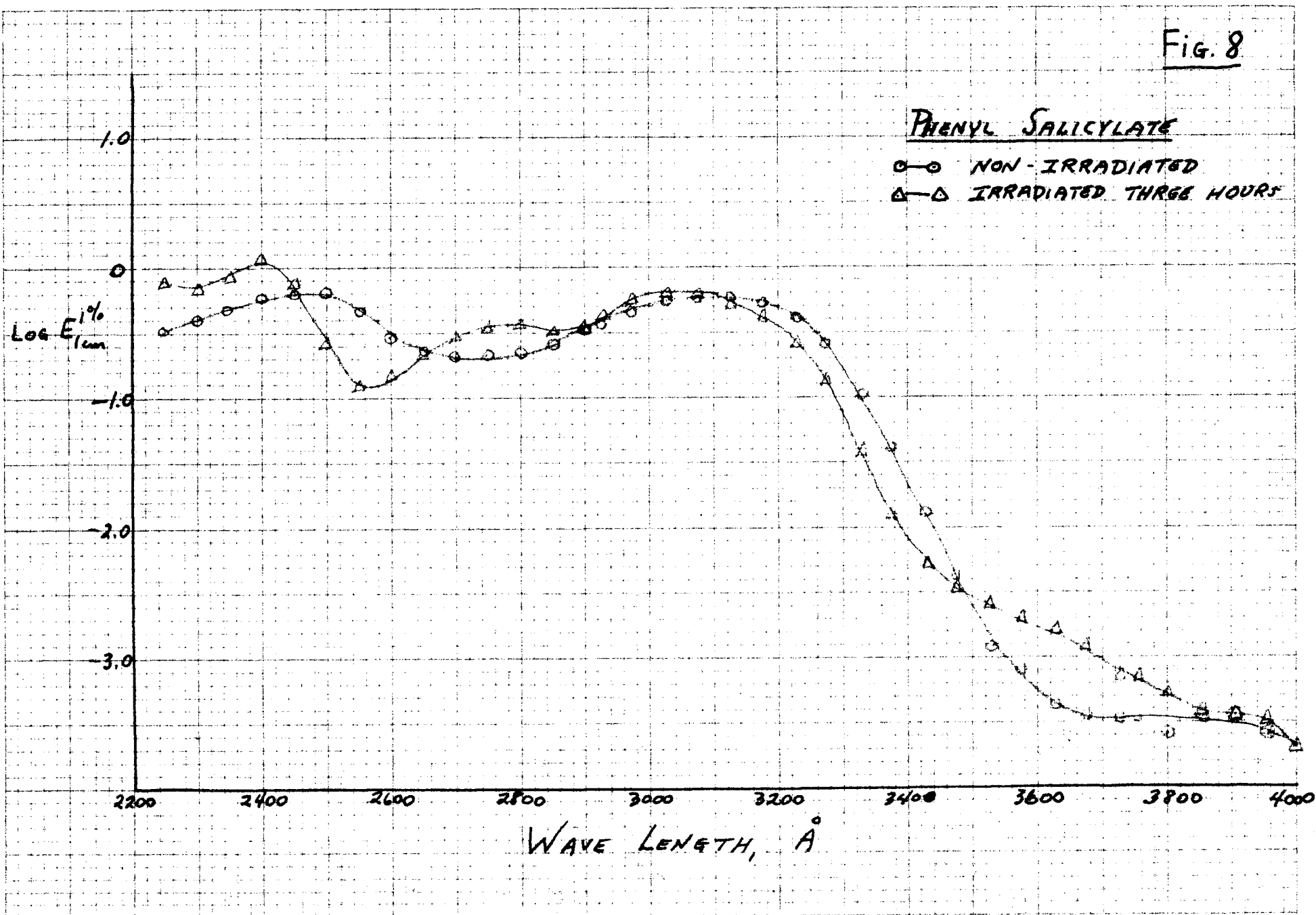


Table No. 16

Preparation: Phenyl Salicylate

non-irradiated

Solvent: Methyl Alcohol, Spectro Grade

Wave Length	Trans- mission	Optical Density,	Conc., C	Cell Thick- ness,	Absorption Coefficient,		
$m\mu$	%T	$\text{Log} \left(\frac{100}{\%T} \right)$	$\frac{\text{Gm}}{1000 \text{ ml}}$	$\frac{\text{cm}}{t}$	$\frac{1}{t \times C}$	E	$\text{Log } E_{1\%}^{1\text{cm}}$
2250	45.9	.3382	1.0218	.998	0.98058	.3316	-0.48928
2300	40.8	.3893	1.0218	.998	0.98058	.3817	-0.41828
2350	33.9	.4698	1.0218	.998	0.98058	.4607	-0.33658
2400	27.1	.5670	1.0218	.998	0.98058	.5560	-0.25492
2450	23.7	.6250	1.0218	.998	0.98058	.6129	-0.21261
2500	14.9	.8270	1.0218	.998	0.98058	.8109	-0.09108
2550	33.9	.4698	1.0218	.998	0.98058	.4607	-0.33658
2600	49.6	.3045	1.0218	.998	0.98058	.2986	-0.52491
2650	58.2	.2351	1.0218	.998	0.98058	.2305	-0.65733
2700	62.4	.2048	1.0218	.998	0.98058	.2008	-0.69724
2750	62.2	.2062	1.0218	.998	0.98058	.2022	-0.69722
2800	59.2	.2277	1.0218	.998	0.98058	.2223	-0.65111
2850	55.0	.2596	1.0218	.998	0.98058	.2546	-0.59414
2900	45.9	.3382	1.0218	.998	0.98058	.3316	-0.48928
2925	41.4	.3830	1.0218	.998	0.98058	.3756	-0.42527
2975	32.8	.4841	1.0218	.998	0.98058	.4747	-0.32358
3025	26.8	.5720	1.0218	.998	0.98058	.5609	-0.25111
3075	24.1	.6180	1.0218	.998	0.98058	.6060	-0.21753
3125	24.8	.6060	1.0218	.998	0.98058	.5942	-0.22607
3175	29.1	.5361	1.0218	.998	0.98058	.5257	-0.28926
3225	38.8	.4112	1.0218	.998	0.98058	.4032	-0.39448
3275	55.0	.2596	1.0218	.998	0.98058	.2546	-0.59414
3325	8.98	1.0467	10.2180	.997	0.09816	.1027	-0.99843
3375	38.2	.4179	10.2180	.997	0.09816	.0410	-1.38722
3425	72.9	.1373	10.2180	.997	0.09816	.0125	-1.86987
3475	90.8	.0419	10.2180	.997	0.09816	.00411	-2.38616
3525	97.1	.0137	10.2180	.997	0.09816	.00125	-2.90309
3575	98.0	.0088	10.2180	.997	0.09816	.000884	-3.06394
3625	99.0	.0044	10.2180	.997	0.09816	.000432	-3.36452
3675	99.1	.0039	10.2180	.997	0.09816	.000383	-3.41680
3725	99.2	.0035	10.2180	.997	0.09816	.000344	-3.46344
3750	99.2	.0035	10.2180	.997	0.09816	.000344	-3.46344
3800	99.4	.0026	10.2180	.997	0.09816	.000344	-3.59256
3850	99.2	.0035	10.2180	.997	0.09816	.000255	-3.46344
3900	99.1	.0039	10.2180	.997	0.09816	.000383	-3.41680
3950	99.4	.0026	10.2180	.997	0.09816	.000255	-3.59246
4000	100.0	.0000	10.2180	.997	0.09816	.000000	-----

Table No. 17

Preparation: Phenyl Salicylate

non-irradiated

Wave Length $m\mu$	Extinction Coefficient, K	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	0.5756	1.1390	0.4795		
2975	0.4747	6.5100	2.1825		
3025	0.5609	10.0000	2.7480		
3075	0.6060	3.5770	0.8863		
3125	0.5942	0.9743	0.2480		
3175	0.5257	0.5670	0.1690		
3225	0.4032	0.4550	0.1798	1.0790	0.4265
3275	0.2546	0.2890	0.1608	1.0200	0.3928
3325	0.1027	0.1290	0.1019	0.9360	0.7393
3375	0.0410	<u>0.0456</u>	<u>0.0415</u>	0.7980	0.7261
3425	0.0135			0.6690	0.6489
3475	0.00411			0.5700	0.5649
3525	0.00125			0.4880	0.4870
3575	0.000864			0.4560	0.4551
3625	0.000432			0.3560	0.3556
3675	0.000383			0.3100	0.3097
3725	0.000344			<u>0.2600</u>	<u>0.2597</u>
		Total....23.6850	7.1971	6.9420	5.3656

% Transmitted = 30.4%

% Transmitted = 78.7%

* E-rons/cm² x 10

Table No. 18

Preparation: Phenyl Salicylate

Irradiated three hours

Solvent: Methyl Alcohol, Spectro Grade

Wave Length μ	Trans- mission %T	Optical Density, Log $\left(\frac{100}{\%T}\right)$	Conc., G Gm/1000 ml	Cell Thick- ness, cm t	$\frac{1}{t \times C}$	Absorption Coefficient, K	Log $K \frac{1}{l}$
2250	83.2	.0799	0.10263	.998	9.7640	0.7801	-0.10785
2300	85.8	.0665	0.10263	.998	9.7640	0.6493	-0.18755
2350	82.5	.0825	0.10263	.998	9.7640	0.8153	-0.08868
2400	5.98	1.2233	1.0263	.998	0.97640	1.1944	0.07760
2450	16.5	.7830	1.0263	.998	0.97640	0.7645	-0.11662
2500	55.1	.2588	1.0263	.998	0.97640	0.2537	-0.59729
2550	74.5	.1278	1.0263	.998	0.97640	0.1248	-0.90378
2600	70.2	.1537	1.0263	.998	0.97640	0.1501	-0.82362
2650	59.6	.2248	1.0263	.998	0.97640	0.2195	-0.65856
2700	50.0	.3010	1.0263	.998	0.97640	0.2939	-0.53189
2750	44.6	.3507	1.0263	.998	0.97640	0.3424	-0.46547
2800	43.2	.3645	1.0263	.998	0.97640	0.3559	-0.44867
2850	48.9	.3107	1.0263	.998	0.97640	0.3034	-0.51798
2900	42.9	.3675	1.0263	.998	0.97640	0.3588	-0.44515
2925	38.1	.4191	1.0263	.998	0.97640	0.4092	-0.38836
2975	29.3	.5331	1.0263	.998	0.97640	0.5205	-0.28358
3025	24.8	.6060	1.0263	.998	0.97640	0.5917	-0.22790
3075	24.0	.6200	1.0263	.998	0.97640	0.6054	-0.21796
3125	27.0	.5690	1.0263	.998	0.97640	0.5558	-0.25508
3175	35.2	.4522	1.0263	.998	0.97640	0.4415	-0.35507
3225	51.5	.2882	1.0263	.998	0.97640	0.2814	-0.55062
3275	71.9	.1423	1.0263	.998	0.97640	0.13999	-0.85412
3325	39.4	.4045	10.2630	.997	0.09773	0.03937	-1.40422
3375	73.8	.1519	10.2630	.997	0.09773	0.01284	-1.89143
3425	87.8	.0565	10.2630	.997	0.09773	0.005499	-2.26972
3475	92.0	.0362	10.2630	.997	0.09773	0.003532	-2.46086
3525	93.5	.0292	10.2630	.997	0.09773	0.002842	-2.54638
3575	94.9	.0227	10.2630	.997	0.09773	0.002209	-2.65580
3625	96.2	.0168	10.2630	.997	0.09773	0.001644	-2.78410
3675	97.0	.0132	10.2630	.997	0.09773	0.001285	-2.89110
3725	98.2	.0079	10.2630	.997	0.09773	0.000769	-3.11407
3750	98.2	.0079	10.2630	.997	0.09773	0.000769	-3.11407
3800	98.8	.0052	10.2630	.997	0.09773	0.000506	-3.29585
3850	99.1	.0039	10.2630	.997	0.09773	0.000380	-3.42022
3900	99.1	.0039	10.2630	.997	0.09773	0.000380	-3.42022
3950	99.1	.0039	10.2630	.997	0.09773	0.000380	-3.42022
4000	99.5	.0022	10.2630	.997	0.09773	0.000214	-3.66936

Table No. 19

Preparation: Phenyl Salicylate

irradiated three hours

Wave Length $m\mu$	Extinction Coefficient, K	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2825	0.4092	1.1390	0.4441		
2875	0.5205	6.5100	1.9638		
3025	0.5917	10.0000	2.5595		
3075	0.6054	3.5770	0.8874		
3125	0.5558	0.9743	0.2710		
3175	0.4415	0.5670	0.2051		
3225	0.2814	0.4550	0.2380	1.0790	0.5643
3275	0.1399	0.2890	0.2094	1.0200	0.7291
3325	0.03937	0.1290	0.1178	0.8360	0.8548
3375	0.01284	<u>0.0455</u>	<u>0.0443</u>	0.7980	0.7748
3435	0.005499			0.6690	0.6604
3475	0.003532			0.5700	0.5655
3525	0.002843			0.4680	0.4851
3575	0.002209			0.4560	0.4537
3625	0.001644			0.3560	0.3549
3675	0.001285			0.3100	0.3094
3725	0.000769			<u>0.2600</u>	<u>0.2597</u>
3750	0.000769				
3800	0.000596				
3850	0.000380				
	Total....	23.6850	6.9404	6.9420	6.0217
			% Transmitted = 29.3%		% Transmitted = 26.7%

* E-ritons/cm² x 10

Fig. 9

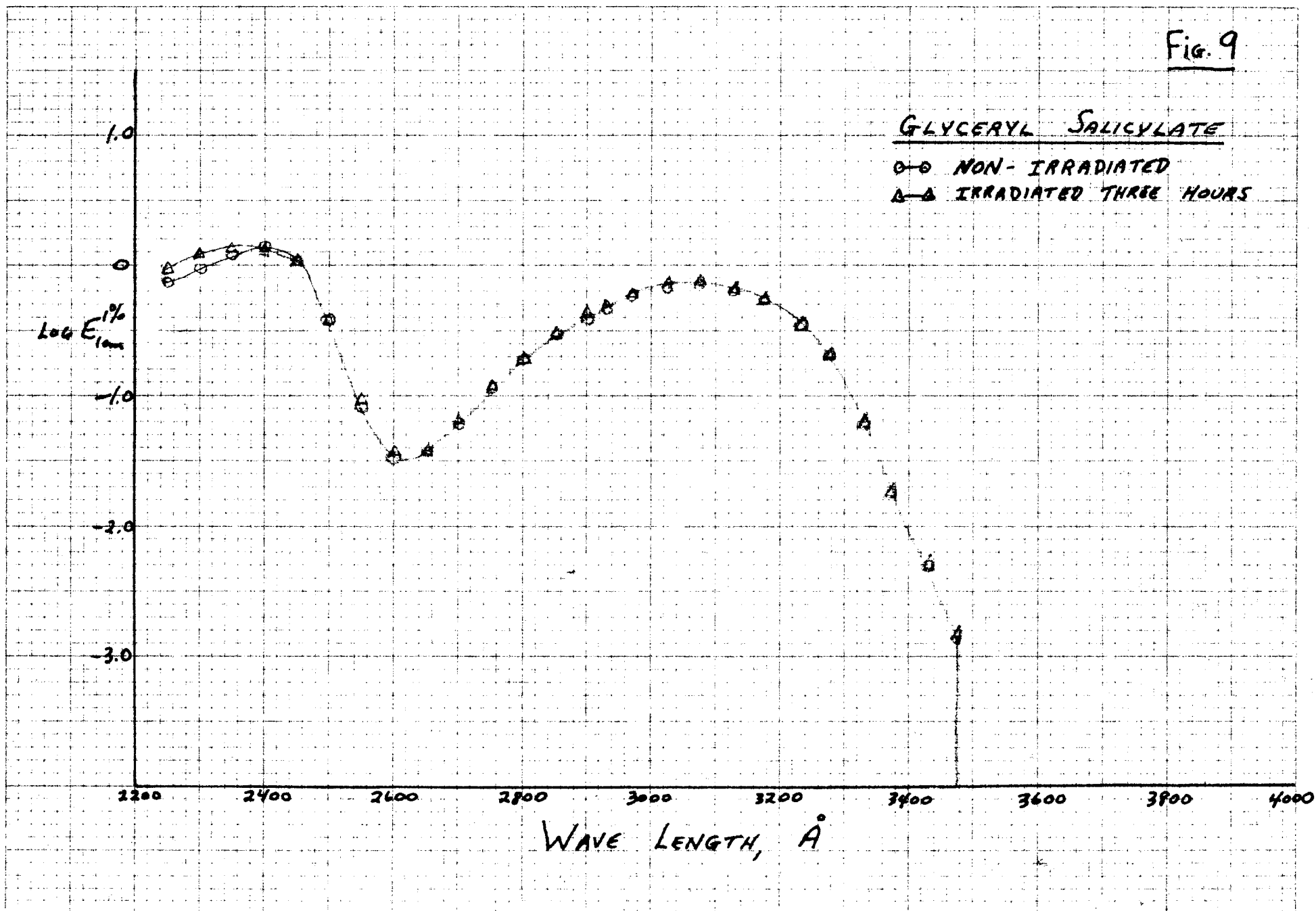


Table No. 20

Preparation: Glyceryl Salicylate

non-irradiated

Solvent: Methyl Alcohol, Spectre grade

Wave Length	Trans-mission	Optical Density	Conc., c	Cell Thickness, cm.	$\frac{1}{t \times c}$	Absorption Coefficient, K	Log K
$m\mu$	% T	$\text{Log} \left(\frac{100}{\%T} \right)$	Gm/1000 ml	t			
2250	84.9	0.0711	0.09887	.998	10.1348	0.7206	-0.14230
2300	82.4	0.0841	0.09887	.998	10.1348	0.8524	-0.06936
2350	76.2	0.1180	0.09887	.998	10.1348	1.1959	0.07775
2400	74.5	0.1278	0.09887	.998	10.1348	1.2953	0.11227
2450	9.2	1.0362	0.9887	.998	1.01348	1.0692	0.02119
2500	42.2	0.3747	0.9887	.998	1.01348	0.3798	-0.42644
2550	16.8	0.7750	9.8870	.997	0.10150	0.0766	-1.10458
2600	48.0	0.3182	9.8870	.997	0.10150	0.3123	-1.49080
2650	46.9	0.3288	9.8870	.997	0.10150	0.3233	-1.47756
2700	27.9	0.5540	9.8870	.998	0.10150	0.5562	-1.25026
2750	76.1	0.1186	0.9887	.998	1.01348	0.1202	-0.92010
2800	65.9	0.1811	0.9887	.998	1.01348	0.1835	-0.73636
2850	53.8	0.2692	0.9887	.998	1.01348	0.2728	-0.56418
2900	41.8	0.3788	0.9887	.998	1.01348	0.3839	-0.41578
2925	36.2	0.4342	0.9887	.998	1.01348	0.4401	-0.35645
2975	28.5	0.5452	0.9887	.998	1.01348	0.5526	-0.25759
3025	23.9	0.6220	0.9887	.998	1.01348	0.6304	-0.20038
3075	21.6	0.6660	0.9887	.998	1.01348	0.6759	-0.17070
3125	24.4	0.6130	0.9887	.998	1.01348	0.6213	-0.20670
3175	30.5	0.5157	0.9887	.998	1.01348	0.5227	-0.28175
3225	44.0	0.3565	0.9887	.998	1.01348	0.3613	-0.44213
3275	63.9	0.1945	0.9887	.998	1.01348	0.1971	-0.70531
3325	26.1	0.5830	9.8870	.997	0.10150	0.0591	-1.22841
3375	66.2	0.1791	9.8870	.997	0.10150	0.0182	-1.73993
3425	89.5	0.0482	9.8870	.997	0.10150	0.00488	-02.31158
3475	96.8	0.0141	9.8870	.997	0.10150	0.00143	-2.84466
3525	100.0	0.0000	9.8870	.997	0.10150	0.00000	-----
3575	100.0	0.0000	9.8870	.997	0.10150	0.00000	-----
3625	100.0	0.0000	9.8870	.997	0.10150	0.00000	-----
3675	100.0	0.0000	9.8870	.997	0.10150	0.00000	-----
3725	100.0	0.0000	9.8870	.997	0.10150	0.00000	-----
3750	100.0	0.0000	9.8870	.997	0.10150	0.00000	-----
3800	100.0	0.0000	9.8870	.997	0.10150	0.00000	-----
3850	100.0	0.0000	9.8870	.997	0.10150	0.00000	-----
3900	100.0	0.0000	9.8870	.997	0.10150	0.00000	-----
3950	100.0	0.0000	9.8870	.997	0.10150	0.00000	-----
4000	100.0	0.0000	9.8870	.997	0.10150	0.00000	-----

Table No. 21

Preparation: Glyceryl Salicylate

non-irradiated

Wave Length m μ	Extinction Coefficient E	Incident Erythema , Energy *	Transmitted Erythema Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	0.4401	1.1390	0.4134		
2975	0.5526	6.5100	1.8235		
3025	0.6304	10.0000	2.3419		
3075	0.6750	3.5770	0.7559		
3125	0.6213	0.9743	0.2330		
3175	0.5227	0.5670	0.1702		
3225	0.3613	0.4550	0.1980	1.0790	0.4695
3275	0.1971	0.2890	0.2522	1.0200	0.8901
3325	0.0591	0.1290	0.1126	0.9360	0.8168
3375	0.0182	<u>0.0456</u>	<u>0.0438</u>	0.7980	0.7658
3425	0.00488			0.6690	0.6617
3475	0.00143			0.5700	0.5683
3525	0.00000			0.4880	0.4880
3575	0.00000			0.4560	0.4560
3625	0.00000			0.3560	0.3560
3675	0.00000			0.3100	0.3100
3725	0.00000			<u>0.2600</u>	<u>0.2600</u>
Total...		23.6850	6.3445	6.9420	6.0422
			% Transmitted = 26.8%		% Transmitted = 87.0%

* E-vitons/cm² x 10

Table No. 22

Preparation: Glyceryl Salicylate

Irradiated 3 hrs.

Solvent: Methyl Alcohol, Spectro Grade

Wave Length	Transmission	Optical Density,	Conc., C	Cell Thickness	Absorption Coefficient,		
$m\mu$	%T	$\text{Log} \left(\frac{100}{\%T} \right)$	Gm/1000 ml	cm	$\frac{1}{t \times C}$	K	$\text{Log } K_{1cm}^{1\%}$
2250	15.1	0.8210	1.0168	0.998	0.9854	0.8090	-0.09205
2300	8.51	1.0701	1.0168	0.998	0.9854	1.0545	0.02325
2350	76.2	0.1180	0.10168	0.998	9.854	2.1628	0.06558
2400	73.8	.1319	0.10168	0.998	9.854	1.2997	0.11394
2450	80.9	.0921	0.10168	0.998	9.854	0.9076	-0.04211
2500	41.1	.3862	1.0168	0.998	0.9854	0.3806	-0.42953
2550	14.9	.8270	10.168	0.997	0.09865	0.0815	-1.08884
2600	44.1	.3556	10.168	0.997	0.09865	0.0351	-1.45469
2650	41.9	.3778	10.168	0.997	0.09865	0.0373	-1.42839
2700	23.2	.6380	10.168	0.997	0.09865	0.0626	-1.20343
2750	74.9	.1255	1.0168	0.998	0.9854	0.1237	-0.91763
2800	63.5	.1972	1.0168	0.998	0.9854	0.1943	-0.71153
2850	50.5	.2967	1.0168	0.998	0.9854	0.2924	-0.52402
2900	37.9	.4214	1.0168	0.998	0.9854	0.4162	-0.28174
2925	32.8	.4841	1.0168	0.998	0.9854	0.4770	-0.32148
2975	25.1	.6000	1.0168	0.998	0.9854	0.5912	-0.22827
3025	19.5	.7100	1.0168	0.998	0.9854	0.6996	-0.18515
3075	18.8	.7260	1.0168	0.998	0.9854	0.7154	-0.14845
3125	20.9	.6800	1.0168	0.998	0.9854	0.6701	-0.17386
3175	28.2	.5498	1.0168	0.998	0.9854	0.5418	-0.26616
3225	43.2	.3645	1.0168	0.998	0.9854	0.3592	-0.44486
3275	63.5	.1972	1.0168	0.998	0.9854	0.1943	-0.71153
3325	24.1	.6220	10.168	0.997	0.09865	0.0575	-1.24033
3375	66.8	.1752	10.168	0.997	0.09865	0.0173	-1.76195
3425	90.5	.0424	10.168	0.997	0.09865	0.00428	-2.26856
3475	98.1	.0082	10.168	0.997	0.09865	0.000818	-3.08725
3525	100	0	10.168	0.997	0.09865	0.0	-
3575	100	0	10.168	0.997	0.09865	0.0	-
3625	100	0	10.168	0.997	0.09865	0.0	-
3675	100	0	10.168	0.997	0.09865	0.0	-
3725	100	0	10.168	0.997	0.09865	0.0	-
3750	100	0	10.168	0.997	0.09865	0.0	-
3800	100	0	10.168	0.997	0.09865	0.0	-
3850	100	0	10.168	0.997	0.09865	0.0	-
3900	100	0	10.168	0.997	0.09865	0.0	-
3950	100	0	10.168	0.997	0.09865	0.0	-
4000	100	0	10.168	0.997	0.09865	0.0	-

Table No. 23

Preparation: Glyceryl Salicylate

Irradiated 3 hours

Solvent: Methyl Alcohol, Spectro Grade

Wave Length m/μ	Extinction Coefficient E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	0.4770	1.1390	0.3798		
2975	0.5912	6.5100	1.6731		
3025	0.6996	10.0000	1.9972		
3075	0.7154	3.5770	0.6888		
3125	0.6701	0.9734	0.2083		
3175	0.5418	0.5670	0.1629		
3225	0.3592	0.4550	0.1990	1.0790	0.4718
3275	0.1943	0.2890	0.1848	1.0200	0.6522
3325	0.0575	0.1290	0.1131	0.9360	0.8203
3375	0.0173	<u>0.0456</u>	<u>0.0438</u>	0.7980	0.7666
3425	0.00428			0.6690	0.6624
3475	0.000818			0.5700	0.5689
3525	0.0000			0.4880	0.4880
3575	0.0000			0.4560	0.4560
3625	0.0000			0.3560	0.3560
3675	0.0000			0.3100	0.3100
3725	0.0000			<u>0.2600</u>	<u>0.2600</u>
	Total...	23.6850	5.6508	6.9420	5.8122
		% Transmitted = 23.9%		% Transmitted = 83.7%	

* E-ritons/cm² x 10

Fig. 10

HOMOMENTHYL SALICYLATE

○—○ NON-IRRADIATED
△—△ IRRADIATED THREE HOURS

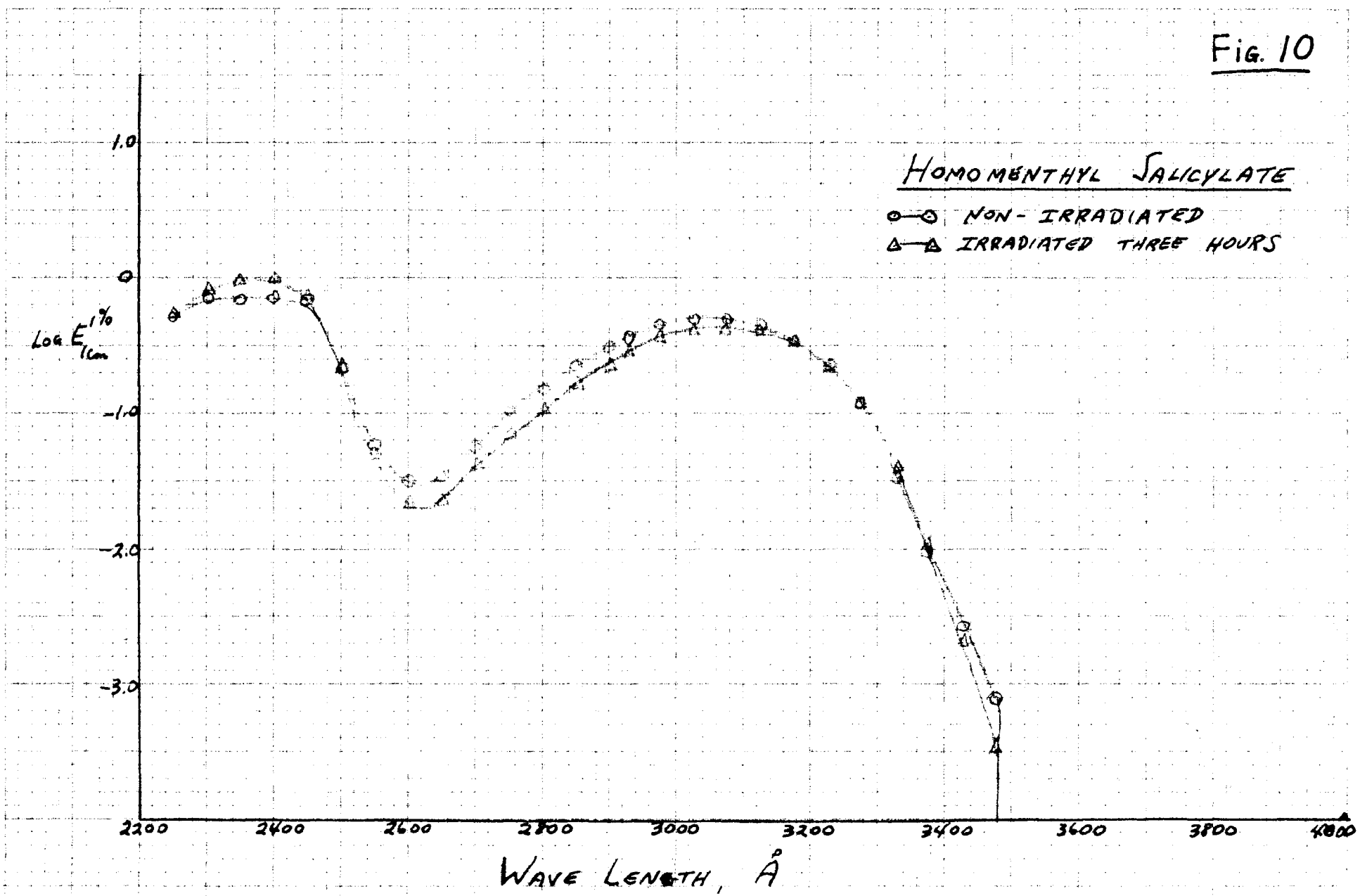


Table No. 24

Preparation: Homomenthyl Salicylate

Non-irradiated

Solvent: Methyl Alcohol, Spectro Grade

Wave Length μ	Trans- mission $\%$	Optical Density, $\text{Log} \left(\frac{100}{T} \right)$	Conc., G cm/1000 ml	Cell Thick- ness cm t	$\frac{1}{k \times c}$	Absorption Coefficient, K	$\text{Log} K \frac{1\%}{1\text{cm}}$
2250	26.0	.585	1.0274	.998	0.9752	0.5705	-0.24374
2300	17.1	.787	1.0274	.998	0.9752	.7480	-0.12610
2350	95.1	.0701	0.10274	.998	9.752	.6836	-0.16520
2400	84.2	.0747	0.10274	.998	9.752	.7285	-0.13757
2450	17.2	.764	1.0274	.998	0.9752	.7451	-0.12778
2500	56.8	.2457	1.0274	.998	0.9752	.2396	-0.62051
2550	22.9	.640	10.274	.997	0.9763	.06248	-1.20426
2600	47.1	.3270	10.274	.997	0.9763	.08193	-1.49580
2650	43.8	.3585	10.274	.997	0.9763	.03800	-1.46593
2700	26.9	.570	10.274	.997	0.9763	.05565	-1.25453
2750	77.8	.1090	1.0274	.998	0.9752	.1063	-0.97847
2800	69.6	.1574	1.0274	.998	0.9752	.1526	-0.81361
2850	59.2	.2294	1.0274	.998	0.9752	.2227	-0.65228
2900	48.2	.3179	1.0274	.998	0.9752	.3091	-0.50990
2925	42.8	.3686	1.0274	.998	0.9752	.3595	-0.44430
2975	34.8	.4584	1.0274	.998	0.9752	.4470	-0.34969
3025	30.5	.5157	1.0274	.998	0.9752	.5029	-0.29852
3075	29.9	.5343	1.0274	.998	0.9752	.5113	-0.29152
3125	33.1	.4802	1.0274	.998	0.9752	.4683	-0.32948
3175	41.2	.3851	1.0274	.998	0.9752	.3755	-0.42439
3225	56.4	.2407	1.0274	.998	0.9752	.2425	-0.61529
3275	75.1	.1244	1.0274	.998	0.9752	.01215	-0.91543
3325	44.3	.3536	10.274	.997	0.99763	.03482	-1.46193
3375	79.2	.1013	10.274	.997	0.99763	.009899	-2.00480
3425	94.1	.0264	10.274	.997	0.99763	.002577	-2.59889
3475	98.2	.0079	10.274	.997	0.99763	.0007893	-3.10774
3525	100	0	10.274	.997	0.99763	-	-
3575	100	0	10.274	.997	0.99763	-	-
3625	100	0	10.274	.997	0.99763	-	-
3675	100	0	10.274	.997	0.99763	-	-
3725	100	0	10.274	.997	0.99763	-	-
3750	100	0	10.274	.997	0.99763	-	-
3800	100	0	10.274	.997	0.99763	-	-
3850	100	0	10.274	.997	0.99763	-	-
3900	100	0	10.274	.997	0.99763	-	-
3950	100	0	10.274	.997	0.99763	-	-
4000	100	0	10.274	.997	0.99763	-	-

Table No. 25

Preparation: Homomenthyl Salicylate

non-irradiated

Solvent: Methyl Alcohol, Spectro Grade

Wave Length <i>mμ</i>	Extinction Coefficient E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	0.3595	1.1390	0.4975		
2975	0.4470	6.5100	2.3258		
3025	0.5029	10.0000	3.1407		
3075	0.5113	3.5770	1.1023		
3125	0.4683	0.9743	0.3314		
3175	0.3755	0.5670	0.2388		
3225	0.2425	0.4550	0.2603	1.0790	0.6172
3275	0.01215	0.2890	0.2811	1.0200	0.9921
3325	0.03452	0.1290	0.1192	0.9360	0.8651
3375	0.00989	<u>0.0456</u>	<u>0.0446</u>	0.7980	0.7801
3425	0.002577			0.6690	0.6650
3475	0.0007803			0.5700	0.5694
3525	0.0000			0.4880	0.4880
3575	0.0000			0.4560	0.4560
3625	0.0000			0.3560	0.3560
3675	0.0000			0.3100	0.3100
3725	0.0000			<u>0.2600</u>	<u>0.2600</u>
	Total...	23.6850	8.3417	6.9420	6.3589
		% Transmitted = 35.2%		% Transmitted = 91.6%	

* E-vitons/cm² x 10

Table No. 26

Preparation: Homomenthyl Salicylate

Irradiated 3 hrs.

Solvent: Methyl Alcohol, Spectro Grade

Wave Length	Transmission %T	Optical Density, $\log \left(\frac{100}{\%T} \right)$	Conc., Gm/1000 ml	Cell Thickness cm	$\frac{1}{t \times C}$	Absorption Coefficient, E	$\log K \frac{1}{cm}$
2250	81.0	.5086	1.015	.998	0.9871	0.5021	-0.29921
2300	19.5	.7100	1.015	.998	0.9871	0.7001	-0.15484
2350	10.9	.9630	1.015	.998	0.9871	0.9507	-0.02196
2400	9.72	1.0123	1.015	.998	0.9871	0.9993	-0.00020
2450	19.8	.7030	1.015	.998	0.9871	0.6940	-0.15864
2500	59.8	.2233	1.015	.998	0.9871	0.2204	-0.65679
2550	30.2	.5200	10.150	.997	0.09881	0.0514	-1.28994
2600	60.9	.2154	10.150	.997	0.09881	0.0213	-1.67162
2650	58.7	.2314	10.150	.997	0.09881	0.0229	-1.64016
2700	38.9	.4101	10.150	.997	0.09881	0.0405	-1.39254
2750	18.4	.7350	10.150	.997	0.09881	0.0726	-1.12906
2800	77.2	.1123	1.015	.998	0.9871	0.1169	-0.95537
2850	66.1	.1798	1.015	.998	0.9871	0.1775	-0.75080
2900	54.3	.2660	1.015	.998	0.9871	0.2626	-0.58070
2925	49.1	.3089	1.015	.998	0.9871	0.3049	-0.51584
2975	40.1	.3969	1.015	.998	0.9871	0.3918	-0.40694
3025	34.5	.4622	1.015	.998	0.9871	0.4563	-0.34075
3075	33.1	.4802	1.015	.998	0.9871	0.4741	-0.32413
3125	26.2	.4413	1.015	.998	0.9871	0.4357	-0.36081
3175	44.2	.3546	1.015	.998	0.9871	0.3501	-0.45581
3225	58.8	.2306	1.015	.998	0.9871	0.2276	-0.64283
3275	76.4	.1169	1.015	.998	0.9871	0.1154	-0.92779
3325	47.8	.3306	10.15	.997	0.09881	0.0317	-0.49894
3375	81.2	.0906	10.15	.997	0.09881	0.00894	-2.04856
3425	95.1	.0218	10.15	.997	0.09881	0.00215	-2.66756
3475	99.2	.0035	10.15	.997	0.09881	0.000346	-3.46092
3525	100	0	10.15	.997	0.09881	0	-
3575	100	0	10.15	.997	0.09881	0	-
3625	100	0	10.15	.997	0.09881	0	-
3675	100	0	10.15	.997	0.09881	0	-
3725	100	0	10.15	.997	0.09881	0	-
3750	100	0	10.15	.997	0.09881	0	-
3800	100	0	10.15	.997	0.09881	0	-
3850	100	0	10.15	.997	0.09881	0	0
3900	100	0	10.15	.997	0.09881	0	-
3950	100	0	10.15	.997	0.09881	0	-
4000	100	0	10.15	.997	0.09881	0	-

Table No. 27

Preparation: Homomenthyl Salicylate

Irradiated 3 hours

Solvent: Methyl Alcohol, Spectro Grade

Wave Length $m\mu$	Extinction Coefficient E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	0.3049	1.1390	0.5644		
2975	0.3918	6.5100	2.6410		
3025	0.4563	10.0000	3.4965		
3075	0.4741	3.5770	1.2003		
3125	0.4357	0.9743	0.3573		
3175	0.3501	0.5670	0.2531		
3225	0.2276	0.4550	0.2694	1.0790	0.6388
3275	0.1154	0.2890	0.2216	1.0200	0.7822
3325	0.0317	0.1290	0.1200	0.9360	0.8707
3375	0.00894	<u>0.0456</u>	<u>0.0447</u>	0.7980	0.7816
3425	0.00215			0.6690	0.6657
3475	0.000346			0.5700	0.5655
3525	0.0000			0.4880	0.4880
3575	0.0000			0.4560	0.4560
3625	0.0000			0.3560	0.3560
3675	0.0000			0.3100	0.3100
3725	0.0000			<u>0.2600</u>	<u>0.2600</u>
Total...		23.6850	9.1683	6.9420	6.1745
		% Transmitted = 38.7%		% Transmitted = 88.9%	

* E-vitons/cm² x 10

Fig. 11

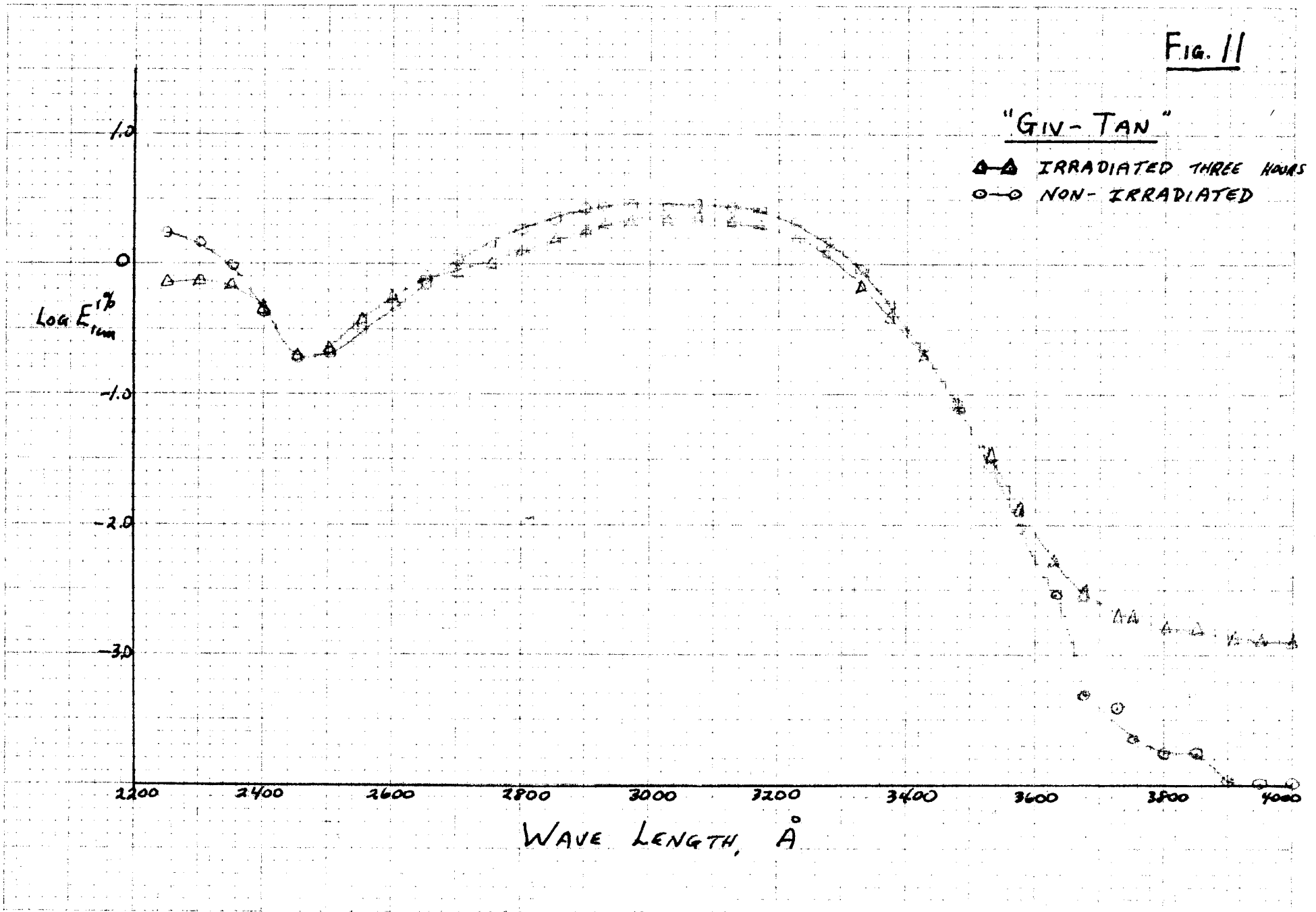


Table No. 28

Preparation : "Giv-Tan"

non-irradiated

Solvent: Methyl Alcohol, Spectro Grade

Wave Length μ	Trans- mission %T	Optical Density, $\text{Log}(\frac{100}{\%T})$	Conc., Gm/1000 ml	Cell Thick- ness, cm	$\frac{1}{t \times c}$	Absorption Coefficient, K	$\text{Log } K \frac{1}{\text{cm}}$
2250	67.6	.1701	.10246	.998	0.10226	1.6634	0.22089
2300	68.9	.1618	.10246	.998	0.10226	1.5823	0.19921
2350	8.23	1.0846	1.0246	.998	1.0226	1.0606	0.02572
2400	34.5	.4622	1.0246	.998	1.0226	0.4520	-0.34486
2450	63.7	.1959	1.0246	.998	1.0226	.1916	- .71760
2500	61.5	.2111	1.0246	.998	1.0226	.2064	-.68529
2550	47.2	.3261	1.0246	.998	1.0226	.3189	-.49634
2600	31.1	.5072	1.0246	.998	1.0226	.4960	- .30452
2650	17.3	.762	1.0246	.998	1.0226	.7452	- .12773
2700	76.4	.1169	.10246	.998	0.10226	1.1432	0.05805
2750	70.8	.1500	.10246	.998	0.10226	1.4669	.16643
2800	63.8	.1952	.10246	.998	0.10226	1.9089	.27081
2850	56.8	.2306	.10246	.998	0.10226	2.2550	.35315
2900	54.2	.2660	.10246	.998	0.10226	2.6012	.41514
2925	53.3	.2733	.10246	.998	0.10226	2.6726	.42700
2975	51.9	.2848	.10246	.998	0.10226	2.7851	.44483
3025	51.2	.2907	.10246	.998	0.10226	2.8428	.45378
3075	49.9	.3019	.10246	.998	0.10226	2.9523	.47012
3125	50.9	.2932	.10246	.998	0.10226	2.8682	.45758
3175	54.2	.2660	.10246	.998	0.10226	2.6012	.41514
3225	61.7	.2097	.10246	.998	0.10226	2.0507	.31197
3275	71.0	.1487	.10246	.998	0.10226	1.4541	.16256
3325	12.2	.914	1.0246	.998	1.0226	0.8938	-0.04876
3375	32.0	.4948	1.0246	.998	1.0226	0.4839	-0.31524
3425	57.5	.2403	1.0246	.998	1.0226	0.2350	-0.62893
3475	16.2	.790	10.246	.997	10.2153	0.0773	-1.11182
3525	52.1	.2832	10.246	.997	10.2153	0.0277	-1.55752
3575	81.0	.0915	10.246	.997	10.2153	0.00896	-2.04789
3625	93.9	.0273	10.246	.997	10.2153	0.00267	-2.57349
3675	98.9	.0048	10.246	.997	10.2153	0.000470	-3.32790
3725	99.1	.0039	10.246	.997	10.2153	0.000382	-3.40794
3750	99.5	.0022	10.246	.997	10.2153	0.000215	-3.66756
3800	99.6	.0017	10.246	.997	10.2153	0.000166	-3.77989
3850	99.6	.0017	10.246	.997	10.2153	0.000166	-3.77989
3900	99.8	.0009	10.246	.997	10.2153	0.0000881	-4.05502
3950	100	0	10.246	.997	10.2153	0	-
4000	100	0	10.246	.997	10.2153	0	-

Table No. 29

Preparation: " Giv-Tan "

non-irradiated

Solvent: Methyl Alcohol, Spectro Grade

Wave Length m μ	Extinction Coefficient, E	Incident Erythmal Energy *	Transmitted Erythmal Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	2.6726	1.1390	0.0024		
2975	2.7851	6.5100	0.0011		
3025	2.8428	10.0000	0.0144		
3075	2.9523	3.5770	0.0040		
3125	2.8682	0.9734	0.0013		
3175	2.6012	0.5670	0.0014		
3225	2.0507	0.4550	0.0040	1.0790	0.0096
3275	1.4541	0.2890	0.0102	1.0200	0.0359
3325	0.8938	0.1290	0.0165	0.9360	0.0120
3375	0.4839	<u>0.0456</u>	<u>0.0150</u>	0.7980	0.2619
3425	0.2350			0.6690	0.3894
3475	0.0773			0.5790	0.4770
3525	0.0277			0.4880	0.4582
3575	0.00896			0.4560	0.4466
3625	0.00267			0.3560	0.3539
3675	0.00047			0.3100	0.3097
3725	0.000382			<u>0.2600</u>	<u>0.2597</u>
Total...		23.6850	0.0703	6.9420	3.0139
			% Transmitted = 0.30%		% Transmitted = 43.4%

* E-ritons/cm² x 10

Table No. 30

Preparation: "Giv-Tan"

Irradiated 3 hrs.

Solvent: Methyl Alcohol, Spectro Grade

Wave Length μ	Trans- mission, %	Optical Density, $\text{Log} \left(\frac{100}{\%T} \right)$	Conc., C Gm/1000 ml	Cell Thick- ness, cm t	$\frac{1}{t \times c}$	Absorption Coefficient, E	$\text{Log} K_{1\%}^{1\text{cm}}$
2250	84.2	0.0747	0.10207	.998	9.8161	0.7333	-0.13472
2300	83.7	0.0773	0.10207	.998	9.8161	.7588	-.12987
2350	9.6	1.0177	1.0207	.998	0.9816	.9990	-.00436
2400	32.8	.4641	1.0207	.998	0.9816	.4752	-.32312
2450	55.2	.2581	1.0207	.998	0.9816	.2535	-.59613
2500	52.7	.2782	1.0207	.998	0.9816	.2731	-.56368
2550	40.8	.3893	1.0207	.998	0.9816	.3821	-.41782
2600	28.2	.5498	1.0207	.998	0.9816	.5397	-.26785
2650	16.8	.7750	1.0207	.998	0.9816	.7607	-.11879
2700	8.1	1.0915	1.0207	.998	0.9816	1.0714	0.02979
2750	80.5	.0942	0.10207	.998	9.8161	0.9247	-0.02400
2800	73.2	.1355	0.10207	.998	9.8161	1.3301	0.12385
2850	68.0	.1675	0.10207	.998	9.8161	1.6442	.21590
2900	63.0	.2007	0.10207	.998	9.8161	1.9701	.29447
2925	61.2	.2132	0.10207	.998	9.8161	2.0928	.32977
2975	58.3	.2343	0.10207	.998	9.8161	2.2999	.36173
3025	56.2	.2503	0.10207	.998	9.8161	2.4569	.38041
3075	54.7	.2600	0.10207	.998	9.8161	2.5710	.40027
3125	55.8	.2534	0.10207	.998	9.8161	2.4874	.39568
3175	60.0	.2218	0.10207	.998	9.8161	2.1772	.33786
3225	67.2	.1726	0.10207	.998	9.8161	1.6942	.22891
3275	75.8	.1203	0.10207	.998	9.8161	1.1809	.07223
3325	16.4	.7850	1.0207	.998	0.9816	0.7706	-0.11317
3375	36.4	.4389	1.0207	.998	0.9816	.4308	-0.36572
3425	60.5	.2182	1.0207	.998	0.9816	.2142	-0.66918
3475	15.1	.8210	10.207	.997	0.0982	.0806	-1.09386
3525	46.2	.3354	10.207	.997	0.0982	.0230	-1.48185
3575	73.9	.1314	10.207	.997	0.0982	.0129	-1.88941
3625	87.8	.0565	10.207	.997	0.0982	.00555	-2.25571
3675	93.0	.0315	10.207	.997	0.0982	.00310	-2.50864
3725	95.2	.0214	10.207	.997	0.0982	.00210	-2.67778
3750	95.2	.0214	10.207	.997	0.0982	.00210	-2.67788
3800	95.8	.0186	10.207	.997	0.0982	.00183	-2.73755
3850	96.0	.0177	10.207	.997	0.0982	.00174	-2.78945
3900	96.7	.0146	10.207	.997	0.0982	.00143	-2.84456
3950	96.9	.0137	10.207	.997	0.0982	.00135	-2.86967
4000	96.9	.0137	10.207	.997	0.0982	.00135	-2.86967

Table No. 31

Preparation: "Giv-Tan"

Irradiated three hours

Wave Length m	Extinction Coefficient, E	Incident Erythmal Energy *	Transmitted Erythmal Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925,	2.0928	1.1990	0.0092		
2975	2.2999	6.5100	0.0326		
3025	2.4569	10.0000	0.0349		
3075	2.5718	3.5770	0.0096		
3125	2.4874	0.9734	0.0032		
3175	2.1772	0.5670	0.0038		
3225	1.6942	0.4550	0.0917	1.0790	0.0218
3275	1.1809	0.2890	0.0191	1.0200	0.0672
3325	0.7706	0.1290	0.0219	0.9360	0.1588
3375	0.4308	<u>0.0456</u>	<u>0.0169</u>	0.7980	0.2959
3425	0.2142			0.6690	0.4084
3475	0.0806			0.5700	0.4738
3525	0.0330			0.4880	0.4523
3575	0.0129			0.4560	0.4427
3625	0.00555			0.3560	0.3514
3675	0.00310			0.3100	0.3078
3725	0.00210			<u>0.2600</u>	<u>0.2587</u>
	Total.....	23.6850	0.2429	6.9420	3.2388
		% Transmitted = 1.0%		% Transmitted = 46.6%	

*E-vitons/cm² x 10

Fig. 12

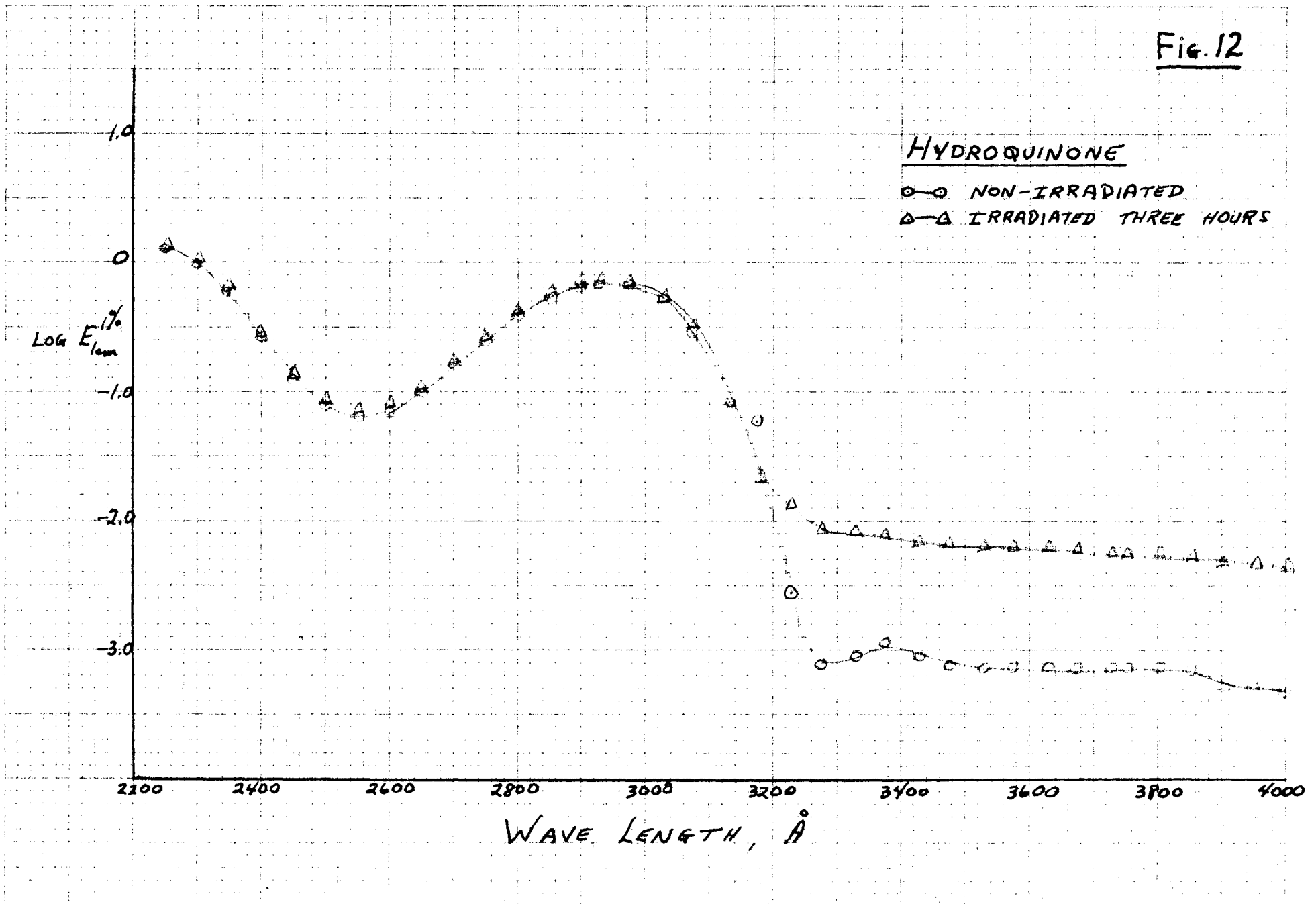


Table No. 32

Preparation: Hydroquinone

Non-irradiated

Solvent: Methyl Alcohol, Spectro Grade

Wave Length μ	Trans- mission, $\%$	Optical Density, $\text{Log} \left(\frac{100}{\%T} \right)$	Conc., C Gm/1000 ml	Cell Thick- ness, cm t	$\frac{1}{t \times c}$	Absorption Coefficient, E	$\text{Log} K_{1\%}^{1\text{cm}}$
2250	5.23	1.2815	1.0239	.998	0.9785	1.2539	0.09830
2300	11.4	.9430	1.0239	.998	0.9785	0.9227	-0.03494
2350	27.1	.5670	1.0239	.998	0.9785	0.5548	-0.25586
2400	56.9	.2449	1.0239	.998	0.9785	0.2396	-0.62051
2450	78.2	.1180	1.0239	.998	0.9785	0.1155	-0.93742
2500	83.2	.0799	1.0239	.998	0.9785	0.0782	-1.10679
2550	86.6	.0625	1.0239	.998	0.9785	0.0612	-1.21325
2600	86.1	.0650	1.0239	.998	0.9785	0.0636	-1.19654
2650	80.1	.0964	1.0239	.998	0.9785	0.0943	-1.02549
2700	69.4	.1586	1.0239	.998	0.9785	0.1552	-0.80911
2750	55.2	.2581	1.0239	.998	0.9785	0.2524	-0.59757
2800	40.2	.3958	1.0239	.998	0.9785	0.3873	-0.41195
2850	29.9	.5243	1.0239	.998	0.9785	0.5130	-0.28988
2900	22.6	.6460	1.0239	.998	0.9785	0.6321	-0.19921
2925	21.5	.6680	1.0239	.998	0.9785	0.6536	-0.18469
2975	21.9	.6600	1.0239	.998	0.9785	0.6458	-0.18990
3025	29.4	.5317	1.0239	.998	0.9785	0.5203	-0.28375
3075	49.9	.3019	1.0239	.998	0.9785	0.2954	-0.52959
3125	17.5	.7570	10.239	.997	0.0979	0.0742	-1.12960
3175	72.9	.6400	10.239	.997	0.0979	0.0627	-1.20277
3225	94.0	.0269	10.239	.997	0.0979	0.00264	-2.57840
3275	98.2	.0079	10.239	.997	0.0979	0.000774	-3.11126
3325	97.9	.0092	10.239	.997	0.0979	0.000901	-3.04527
3375	97.5	.0110	10.239	.997	0.0979	0.001080	-2.96658
3425	98.0	.0088	10.239	.997	0.0979	0.000862	-3.06449
3475	98.2	.0079	10.239	.997	0.0979	0.000774	-3.11126
3525	98.2	.0079	10.239	.997	0.0979	0.000774	-3.11126
3575	98.2	.0079	10.239	.997	0.0979	0.000774	-3.11126
3625	98.2	.0079	10.239	.997	0.0979	0.000774	-3.11126
3675	98.2	.0079	10.239	.997	0.0979	0.000774	-3.11126
3725	98.2	.0079	10.239	.997	0.0979	0.000774	-3.11126
3750	98.2	.0079	10.239	.997	0.0979	0.000774	-3.11126
3800	98.2	.0079	10.239	.997	0.0979	0.000774	-3.11126
3850	98.4	.0070	10.239	.997	0.0979	0.000686	-3.16368
3900	98.8	.0052	10.239	.997	0.0979	0.000599	-3.29328
3950	98.8	.0052	10.239	.997	0.0979	0.000599	-3.29328
4000	98.9	.0048	10.239	.997	0.0979	0.000470	-3.32790

Table No. 33

Preparation: Hydroquinone

Non-irradiated

Solvent: Methyl Alcohol, Spectro Grade

Wave Length m μ	Extinction Coefficient, E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	0.6536	1.1390	0.2528		
2975	0.6458	6.5100	1.4715		
3025	0.5203	10.0000	3.0184		
3075	0.2954	3.5770	1.8120		
3125	0.0742	0.9743	0.8208		
3175	0.0627	0.5679	0.4909		
3225	0.00264	0.4550	0.4527	1.0790	1.0736
3275	0.000774	0.2890	0.2884	1.0200	1.0180
3325	0.000901	0.1290	0.1287	0.9360	0.9341
3375	0.001080	<u>0.0456</u>	<u>0.0455</u>	0.7980	0.7972
3425	0.000862			0.6690	0.6677
3475	0.000774			0.5700	0.5689
3525	0.000774			0.4880	0.4870
3575	0.000774			0.4560	0.4551
3625	0.000774			0.3560	0.3552
3675	0.000774			0.3100	0.3094
3725	0.000774			<u>0.2600</u>	<u>0.2595</u>
Total...		23.6850	8.7817	6.9420	6.9258
		% Transmitted = 37.1%		% Transmitted = 99.8%	

* E-vitons/cm² x 10

Table No. 34

Preparation: Hydroquinone

Irradiated 3 hrs.

Solvent: Methyl Alcohol, Spectro Grade

Wave Length $m\mu$	Trans- mission, $\%T$	Optical Density, $\text{Log} \left(\frac{100}{\%T} \right)$	Conc., C Gm/1000 ml	Cell Thick- ness, cm t	$\frac{1}{t \times c}$	Absorption Coefficient, E	$\text{Log} K \frac{1\%}{1\text{cm}}$
2250	3.89	1.4101	1.0032	.998	0.9988	1.4084	0.14860
2300	8.90	1.0506	1.0032	.998	0.9988	1.0493	0.01078
2350	24.5	.6110	1.0032	.998	0.9988	0.6103	-0.21446
2400	54.6	.2628	1.0032	.998	0.9988	0.2625	-0.58087
2450	73.1	.1361	1.0032	.998	0.9988	0.1359	-0.86678
2500	11.9	.9240	10.032	.997	0.0999	0.09238	-1.03442
2550	17.1	.7670	10.032	.997	0.0999	0.07668	-1.11582
2600	23.9	.6762	1.0032	.998	0.9988	0.67611	-1.11856
2650	78.1	.1073	1.0032	.998	0.9988	0.1072	-0.96980
2700	68.1	.1669	1.0032	.998	0.9988	0.1667	-0.77806
2750	54.1	.2668	1.0032	.998	0.9988	0.2665	-0.57430
2800	29.0	.4089	1.0032	.998	0.9988	0.4084	-0.38891
2850	27.2	.5659	1.0032	.998	0.9988	0.5643	-0.24849
2900	20.9	.6800	1.0032	.998	0.9988	0.6792	-0.16800
2925	18.4	.7350	1.0032	.998	0.9988	0.7341	-0.13424
2975	21.9	.6600	1.0032	.998	0.9988	0.6592	-0.18098
3025	28.8	.5406	1.0032	.998	0.9988	0.5400	-0.26761
3075	48.1	.3179	1.0032	.998	0.9988	0.3175	-0.49826
3125	11.7	.9320	10.032	.997	0.0999	0.09318	-1.03068
3175	58.4	.2336	10.032	.997	0.0999	0.02336	-1.62153
3225	72.5	.1397	10.032	.997	0.0999	0.01397	-1.85480
3275	81.9	.0867	10.032	.997	0.0999	0.008668	-2.06208
3325	83.9	.0814	10.032	.997	0.0999	0.008138	-2.08948
3375	83.0	.0809	10.032	.997	0.0999	0.008088	-2.09218
3425	84.9	.07110	10.032	.997	0.0999	0.007109	-2.14819
3475	85.2	.0696	10.032	.997	0.0999	0.006958	-2.15752
3525	85.2	.0696	10.032	.997	0.0999	0.006958	-2.15752
3575	85.4	.0685	10.032	.997	0.0999	0.006848	-2.16444
3625	86.0	.0655	10.032	.997	0.0999	0.006548	-2.18289
3675	86.7	.0620	10.032	.997	0.0999	0.006199	-2.20768
3725	87.1	.0600	10.032	.997	0.0999	0.005999	-2.22192
3750	87.9	.0560	10.032	.997	0.0999	0.005599	-2.25189
3800	88.1	.0550	10.032	.997	0.0999	0.005499	-2.26972
3850	88.8	.0516	10.032	.997	0.0999	0.005159	-2.28742
3900	89.4	.0487	10.032	.997	0.0999	0.004869	-2.31256
3950	90.2	.0448	10.032	.997	0.0999	0.004479	-2.34882
4000	90.2	.0448	10.032	.997	0.0999	0.004479	-2.34882

Table No. 35

Preparation: Hydroquinone

Irradiated 3 hrs.

Solvent: Methyl Alcohol, Spectro Grade

Wave Length $m\mu$	Extinction Coefficient, E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	0.7341	1.1390	0.2101		
2975	0.6592	6.5100	1.4270		
3025	0.5400	10.0000	2.8843		
3075	0.3175	3.5770	1.7222		
3125	0.09318	0.9743	0.7857		
3175	0.02336	0.5670	0.5374		
3225	0.01397	0.4550	0.4409	1.0790	1.0455
3275	0.008668	0.2890	0.2831	1.0200	0.9990
3325	0.008138	0.1290	0.1266	0.9360	0.9185
3375	0.008088	<u>0.0456</u>	<u>0.0447</u>	0.7980	0.7831
3425	0.007109			0.6690	0.6585
3475	0.006958			0.5700	0.5610
3525	0.006958			0.4880	0.4803
3575	0.006848			0.4560	0.4488
3625	0.006548			0.3560	0.3507
3675	0.006199			0.3100	0.3087
3725	0.005999			<u>0.2600</u>	<u>0.2564</u>
	Total..	23.6850	8.4620	6.9420	6.8075
		% Transmitted = 35.7%		% Transmitted = 98.1%	

* E-vitons/cm² x 10

Fig. 13

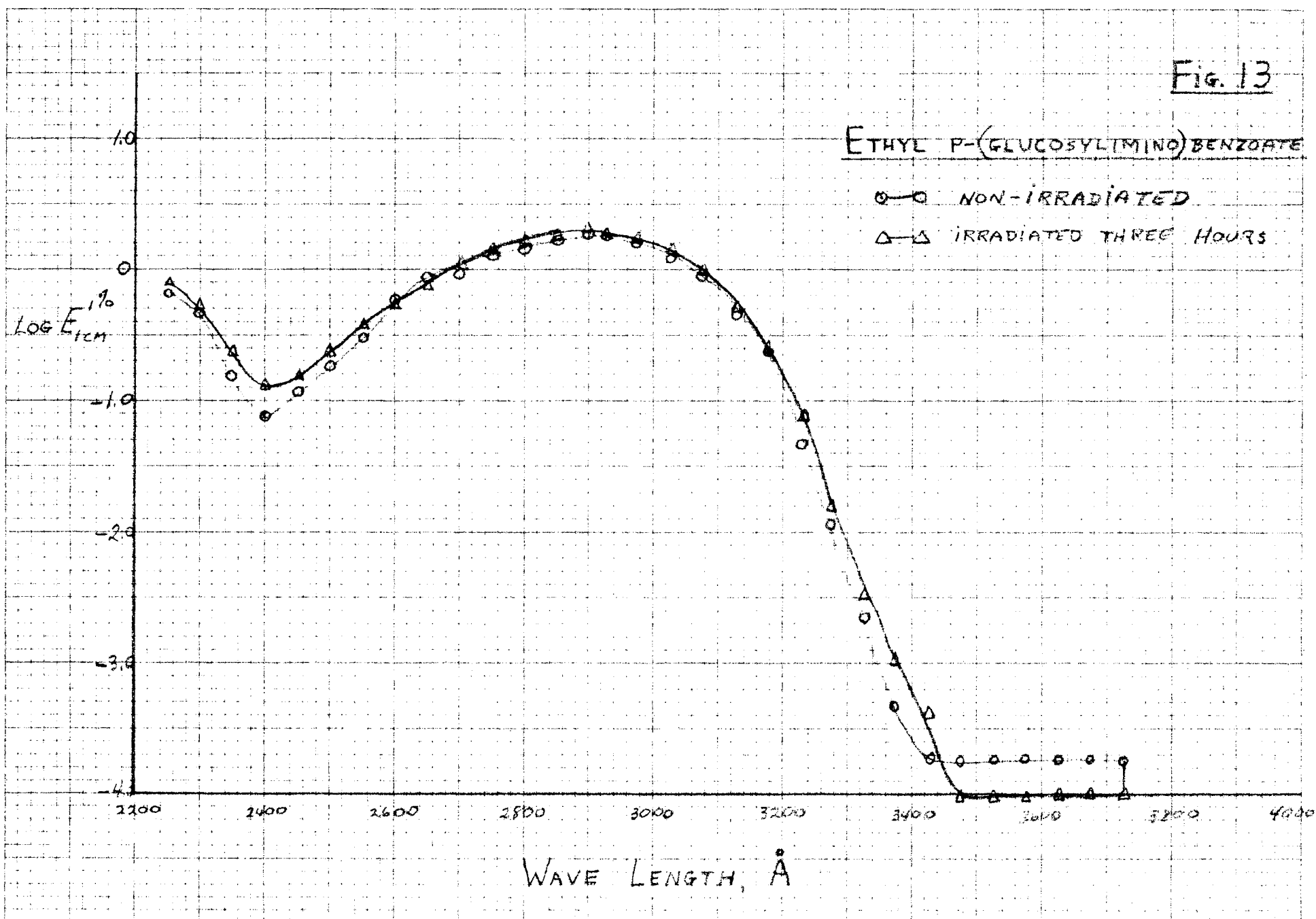


Table No. 36

Preparation: Ethyl p-(glucoacylimino)benzoate		non-irradiated					
Solvent: Methyl Alcohol, Solvent Grade							
Wave Length	Trans- mission	Optical Density	Conc., C	Cell Thick- ness,	$\frac{1}{T \times C}$	Absorption Coefficient, ϵ	Log E $\frac{1\%}{1cm}$
m μ	% T	Log $(\frac{100}{\%T})$	Gm/1000ml	cm,			
2250	22.9	.6400	1.0254	.998	0.9772	0.6254	-0.20384
2300	38.2	.4179	1.0254	.998	0.9772	0.4084	-0.38891
2350	70.3	.1530	1.0254	.998	0.9772	0.1495	-0.82536
2400	84.3	.0742	1.0254	.998	0.9772	0.0725	-1.13966
2450	77.9	.1085	1.0254	.998	0.9772	0.1060	-0.97469
2500	66.4	.1778	1.0254	.998	0.9772	0.1737	-0.76020
2550	48.3	.3161	1.0254	.998	0.9772	0.3089	-0.51018
2600	30.4	.5171	1.0254	.998	0.9772	0.5059	-0.29645
2650	15.8	.8010	1.0254	.998	0.9772	0.7827	-0.10640
2700	80.9	.0921	0.10254	.998	9.772	0.9000	-0.09457
2750	76.8	.1146	0.10254	.998	9.772	1.1199	0.04922
2800	72.2	.1415	0.10254	.998	9.772	1.3827	0.13082
2850	69.2	.1599	0.10254	.998	9.772	1.5625	0.19396
2900	66.9	.1746	0.10254	.998	9.772	1.7062	0.23198
2925	67.3	.1720	0.10254	.998	9.772	1.6898	0.22557
2975	69.2	.1599	0.10254	.998	9.772	1.5625	0.19396
3025	75.8	.1203	0.10254	.998	9.772	1.1756	0.06041
3075	13.5	.8700	1.0254	.998	0.9772	0.8502	-0.07048
3125	35.2	.4535	1.0254	.998	0.9772	0.4236	-0.37304
3175	66.2	.1791	1.0254	.998	0.9772	0.1750	-0.75696
3225	34.8	.4584	10.254	.997	0.09782	0.04484	-1.34833
3275	76.9	.1141	10.254	.997	0.09782	0.01116	-1.95234
3325	95.5	.0200	10.254	.997	0.09782	0.001956	-2.70863
3375	99.0	.0044	10.254	.997	0.09782	0.000430	-3.36653
3425	99.6	.0017	10.254	.997	0.09782	0.000166	-3.77989
3475	99.6	.0017	10.254	.997	0.09782	0.000166	-3.77989
3525	99.6	.0017	10.254	.997	0.09782	0.000166	-3.77989
3575	99.6	.0017	10.254	.997	0.09782	0.000166	-3.77989
3625	99.6	.0017	10.254	.997	0.09782	0.000166	-3.77989
3675	99.6	.0017	10.254	.997	0.09782	0.000166	-3.77989
3725	99.6	.0017	10.254	.997	0.09782	0.000166	-3.77989
3750	100.0	.0000	10.254	.997	0.09782	0.000000	---
3800	100.0	.0000	10.254	.997	0.09782	0.000000	---
3850	100.0	.0000	10.254	.997	0.09782	0.000000	---
3900	100.0	.0000	10.254	.997	0.09782	0.000000	---
3950	100.0	.0000	10.254	.997	0.09782	0.000000	---
4000	100.0	.0000	10.254	.997	0.09782	0.000000	---

Table No. 37

Preparation: Ethyl p-(glucosylimino)benzoate

non-irradiated

Wave Length $m\mu$	Extinction Coefficient E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	1.6808	1.1390	0.0238		
2975	1.5625	6.5100	0.1783		
3025	1.1756	10.0000	0.6671		
3075	0.8502	3.5770	0.5051		
3125	0.4236	0.9734	0.3669		
3175	0.1750	0.5670	0.3790		
3225	0.04484	0.4550	0.4103	1.0790	0.9729
3275	0.01116	0.2890	0.2817	1.0200	0.9942
3325	0.001956	0.1290	0.1286	0.9360	0.9332
3375	0.000430	<u>0.0456</u>	<u>0.0456</u>	0.7980	0.7972
3425	0.000166			0.6690	0.6690
3475	0.000166			0.5700	0.5700
3525	0.000166			0.4880	0.4880
3575	0.000166			0.4560	0.4560
3625	0.000166			0.3560	0.3560
3675	0.000166			0.3100	0.3100
3725	0.000166			<u>0.2600</u>	<u>0.2600</u>
Total...		23.6850	2.9863	6.9420	6.8065
			% Transmitted = 12.6%		% Transmitted = 98.1%

* E-vitons/cm² x 10

Table No. 38

Preparation: Ethyl p-(glucosylimino)Benzoate

Irradiated 3 hrs.

Solvent: Methyl Alcohol, Spectro Grade

Wave Length m	Trans- mission $\frac{I}{I_0}$	Optical Density, Log $\left(\frac{100}{\frac{I}{I_0}}\right)$	Conc., C Gm/1000 ml	Cell Thick- ness, cm t	$\frac{1}{t \times C}$	Absorption Coefficient, K	Log $K \frac{1}{l} \%$ lcm
2250	18.3	0.7380	1.000	.998	1.0020	0.7395	-0.12196
2300	31.8	0.4976	1.000	.998	1.0020	0.4986	-0.30225
2350	61.2	0.2132	1.000	.998	1.0020	0.2137	-0.67019
2400	75.2	0.1238	1.000	.998	1.0020	0.1240	-0.90658
2450	70.1	0.1583	1.000	.998	1.0020	0.1546	-0.81079
2500	59.3	0.2269	1.000	.998	1.0020	0.2274	-0.64331
2550	43.1	0.3655	1.000	.998	1.0020	0.3662	-0.43628
2600	26.9	0.5700	1.000	.998	1.0020	0.5711	-0.24329
2650	85.2	0.0696	0.100	.998	10.020	0.6974	-0.15652
2700	78.6	0.1046	0.100	.998	10.020	1.0480	0.02026
2750	73.5	0.1337	0.100	.998	10.020	1.3397	0.12710
2800	69.2	0.1599	0.100	.998	10.020	1.6022	0.20466
2850	65.9	0.1811	0.100	.998	10.020	1.8146	0.25888
2900	64.0	0.1938	0.100	.998	10.020	1.9419	0.28825
2925	64.2	0.1925	0.100	.998	10.020	1.9289	0.28533
2975	66.4	0.1778	0.100	.998	10.020	1.7816	0.25091
3025	73.0	0.1367	0.100	.998	10.020	1.2697	0.13672
3075	11.8	0.9280	1.000	.998	1.0020	0.9299	-0.03156
3125	32.6	0.4868	1.000	.998	1.0020	0.4878	-0.31176
3175	62.2	0.2062	1.000	.998	1.0020	0.2066	-0.68487
3225	31.5	0.5017	10.000	.997	0.1003	0.05032	-1.29826
3275	73.8	0.1319	10.000	.997	0.1003	0.01323	-1.87844
3325	92.5	0.0329	10.000	.997	0.1003	0.00340	-2.46852
3375	97.6	0.0105	10.000	.997	0.1003	0.00105	-2.97757
3425	99.1	0.0039	10.000	.997	0.1003	0.000391	-3.40760
3475	99.8	0.0009	10.000	.997	0.1003	0.0000903	-4.04431
3525	99.8	0.0009	10.000	.997	0.1003	0.0000903	-4.04431
3575	99.8	0.0009	10.000	.997	0.1003	0.0000903	-4.04431
3625	99.8	0.0009	10.000	.997	0.1003	0.0000903	-4.04431
3675	99.8	0.0009	10.000	.997	0.1003	0.0000903	-4.04431
3725	99.8	0.0009	10.000	.997	0.1003	0.0000903	-4.04431
3750	100.0	0.0000	10.000	.997	0.1003	0.00000	-4.04431
3800	100.0	0.0000	10.000	.997	0.1003	0.00000	-4.04431
3850	100.0	0.0000	10.000	.997	0.1003	0.00000	-4.04431
3900	100.0	0.0000	10.000	.997	0.1003	0.00000	-4.04431
3950	100.0	0.0000	10.000	.997	0.1003	0.00000	-4.04431
4000	100.0	0.0000	10.000	.997	0.1003	0.00000	-4.04431

Table No. 39

Preparation: Ethyl para-(glucosylimino)benzoate Irradiated 3 hours

Wave Length m	Extinction Coefficient, E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	1.9289	1.1390	0.0134		
2975	1.7816	6.5100	0.1077		
3025	1.3697	10.0000	0.4868		
3075	0.9299	3.5770	0.4207		
3125	0.4878	0.9734	0.3169		
3175	0.2066	0.5670	0.3525		
3225	0.05032	0.4550	0.4052	1.0790	0.9608
3275	0.01323	0.2890	0.2806	1.0200	0.9902
3325	0.00340	0.1290	0.1280	0.9360	0.9286
3375	0.00105	<u>0.0456</u>	<u>0.0455</u>	0.7980	0.7964
3425	0.000391			0.6690	0.6683
3475	0.0000903			0.5700	0.5697
3525	0.0000903			0.4880	0.4555
3575	0.0000903			0.4560	0.4555
3625	0.0000903			0.3560	0.3556
3675	0.0000903			0.3100	0.3097
3725	0.0000903			<u>0.2600</u>	<u>0.2597</u>
Total.....		23.6850	2.4971	6.9420	6.7820
			% Transmitted = 10.5%		% Transmitted = 97.7%

* E-vitons/cm² x 10

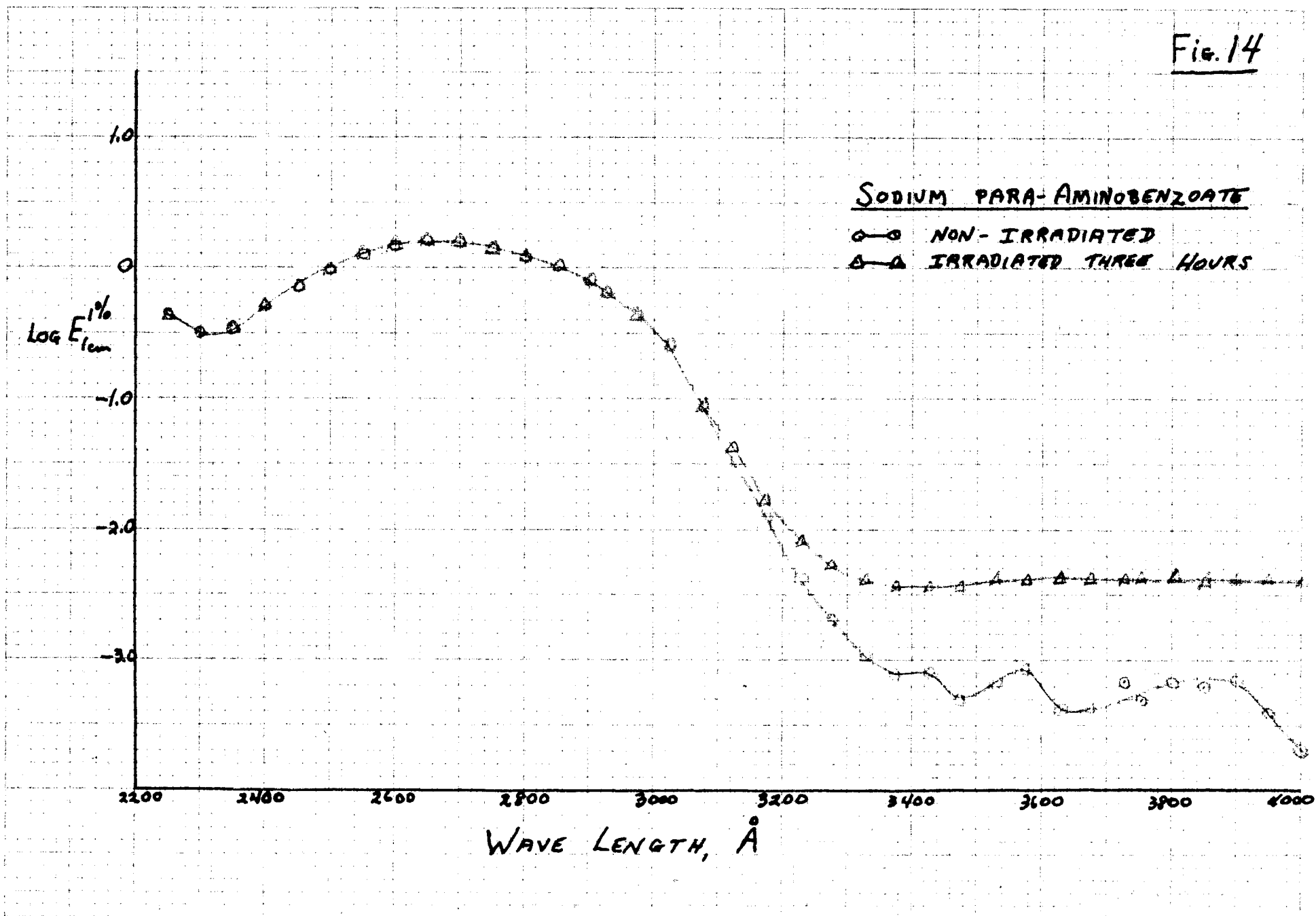


Table No. 40

Preparation: Sodium Para-aminobenzoate

non-irradiated

Solvent: Distilled Water

Wave Length μ	Trans- mission $\%$	Optical Density, $\text{Log}\left(\frac{100}{\%T}\right)$	Conc., C Gm/1000 ml	Cell Thick- ness cm t	$\frac{1}{t \times C}$	Absorption Coefficient, K	$\text{Log } K \frac{1}{\text{cm}}$
2250	32.6	.4868	1.0032	.998	0.9988	0.4868	-0.31319
2300	46.0	.3372	1.0032	.998	0.9988	0.3368	-0.47263
2350	43.3	.3635	1.0032	.998	0.9988	0.3631	-0.44009
2400	31.0	.5086	1.0032	.998	0.9988	0.5080	-0.29414
2450	18.2	.740	1.0032	.998	0.9988	0.7391	-0.13150
2500	79.8	.0980	0.10032	.998	9.988	0.9788	-0.00931
2550	74.4	.1284	0.10032	.998	9.988	1.2825	0.10823
2600	69.5	.1580	0.10032	.998	9.988	1.5781	0.19811
2650	68.0	.1675	0.10032	.998	9.988	1.6730	0.22350
2700	68.7	.1630	0.10032	.998	9.988	1.6280	0.21165
2750	70.7	.1506	0.10032	.998	9.988	1.5042	0.17725
2800	73.2	.1355	0.10032	.998	9.988	1.3535	0.13146
2850	77.8	.1090	0.10032	.998	9.988	1.0887	0.03703
2900	18.4	.8120	1.0032	.998	0.9988	0.8110	-0.09098
2925	20.2	.6950	1.0032	.998	0.9988	0.8110	-0.15882
2975	34.9	.4572	1.0032	.998	0.9988	0.4567	-0.34027
3025	54.0	.2676	1.0032	.998	0.9988	0.2673	-0.57300
3075	10.7	.9710	10.032	.997	0.09998	0.0971	-1.01278
3125	41.8	.3788	10.032	.997	0.09998	0.0379	-1.42136
3175	73.9	.1314	10.032	.997	0.09998	0.0131	-1.84273
3225	89.8	.0467	10.032	.997	0.09998	0.00467	-2.33068
3275	95.2	.0214	10.032	.997	0.09988	0.00214	-2.66959
3325	97.3	.0119	10.032	.997	0.09988	0.00119	-2.92445
3375	98.1	.0083	10.032	.997	0.09988	0.000830	-3.08092
3425	98.1	.0083	10.032	.997	0.09988	0.000830	-3.08092
3475	98.8	.0052	10.032	.997	0.09988	0.00052	-3.28400
3525	98.2	.0079	10.032	.997	0.09988	0.00079	-3.10237
3575	97.8	.0097	10.032	.997	0.09988	0.00097	-3.01323
3625	99.0	.0044	10.032	.997	0.09988	0.00044	-3.35655
3675	98.9	.0048	10.032	.997	0.09988	0.00048	-3.31876
3725	98.2	.0079	10.032	.997	0.09978	0.00079	-3.10237
3750	98.8	.0052	10.032	.997	0.09988	0.00052	-3.28400
3800	98.2	.0079	10.032	.997	0.09988	0.00079	-3.10237
3850	98.4	.0070	10.032	.997	0.09988	0.00070	-3.15490
3900	98.2	.0079	10.032	.997	0.09988	0.00079	-3.10237
3950	99.0	.0044	10.032	.997	0.09988	0.00044	-3.35655
4000	99.5	.0032	10.032	.997	0.09988	0.00032	-3.65752

Table No. 41

Preparation: Sodium Para-aminobenzoate

non-irradiated

Solvent: Distilled Water

Wave Length $m\mu$	Extinction Coefficient E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	0.6942	1.1390	0.2903		
2975	0.4567	6.5100	2.2746		
3025	0.2673	10.0000	5.4050		
3075	0.0971	3.5770	2.8593		
3125	0.0379	0.9734	0.8922		
3175	0.0131	0.5670	0.5505		
3225	0.00467	0.4550	0.4505	1.0790	1.0683
3275	0.00214	0.2890	0.2876	1.0200	1.0149
3325	0.00119	0.1290	0.1287	0.9360	0.9341
3375	0.00083	<u>0.0456</u>	<u>0.0455</u>	0.7980	0.7964
3425	0.00083			0.6690	0.6677
3475	0.00052			0.5700	0.5694
3525	0.00079			0.4880	0.4875
3575	0.00097			0.4560	0.4551
3625	0.00044			0.3560	0.3556
3675	0.00048			0.3100	0.3097
3725	0.00079			<u>0.2600</u>	<u>0.2597</u>
	Total...	23.6850	13.1242	6.9420	6.9184
		% Transmission = 55.4%		% Transmission = 99.7%	

* E-ritons/cm² x 10

Table No. 42

Preparation: Sodium Para-aminobenzoate

Irradiated 3 hrs.

Solvent: Distilled Water

Wave Length	Trans- mission %	Optical Density, Log $\left(\frac{100}{\%T}\right)$	Conc., G Gm/1000 ml	Cell Thick- ness cm t	$\frac{1}{t \times C}$	Absorption Coefficient, K	Log $K \frac{1}{cm}$
2250	27.6	0.5590	1.1265	.998	0.8895	0.4972	-.30347
2300	41.3	.3840	1.1265	.998	0.8895	.3416	-.46648
2350	38.9	.4101	1.1265	.998	0.8895	.3648	-.43795
2400	26.8	.5720	1.1265	.998	0.8895	.5088	-.29345
2450	15.2	.8180	1.1265	.998	0.8895	.7276	-.13811
2500	77.3	.1118	0.11265	.998	8.8950	.9945	-.00240
2505	71.9	.1433	0.11265	.998	8.8950	1.2747	0.10534
2600	67.6	.1701	0.11265	.998	8.8950	1.5130	.17984
2650	65.0	.1871	0.11265	.998	8.8950	1.6643	.23115
2700	65.1	.1864	0.11265	.998	8.8950	1.6580	.21958
2750	67.2	.1726	0.11265	.998	8.8950	1.5353	.18611
2800	70.4	.1524	0.11265	.998	8.8950	1.3556	.13203
2850	73.8	.1319	0.11265	.998	8.8950	1.1733	.06930
2900	11.9	.9240	1.1265	.998	0.8895	.8219	-.08518
2925	16.8	.7750	1.1265	.998	0.8895	.6894	-.16153
2975	30.0	.5229	1.1265	.998	0.8895	.4561	-.33245
3025	48.2	.3170	1.1265	.998	0.8895	.2820	-.54975
3075	8.10	1.0915	11.265	.997	0.08904	.0978	-1.01233
3125	34.8	.4584	11.265	.997	0.08904	.0408	-1.38934
3175	65.2	.1858	11.265	.997	0.08904	.0165	-1.78352
3225	81.5	.0888	11.265	.997	0.08904	.00791	-2.10182
3275	87.2	.0595	11.265	.997	0.08904	.00530	-2.27572
3325	90.0	.0487	11.265	.997	0.08904	.00530	-2.39041
3375	90.8	.0419	11.265	.997	0.08904	.00373	-2.42829
3425	90.4	.0438	11.265	.997	0.08904	.00390	-2.40894
3475	90.7	.0424	11.265	.997	0.08904	.00378	-2.42351
3525	90.2	.0448	11.265	.997	0.08904	.00399	-2.39903
3575	90.0	.0457	11.265	.997	0.08904	.00407	-2.39041
3625	89.4	.0487	11.265	.997	0.08904	.00454	-2.36251
3675	90.0	.0457	11.265	.997	0.08904	.00407	-2.39041
3725	89.8	.0467	11.265	.997	0.08904	.00416	-2.38091
3750	89.8	.0467	11.265	.997	0.08904	.00416	-2.38091
3800	89.5	.0483	11.265	.997	0.08904	.00429	-2.36754
3850	90.4	.0438	11.265	.997	0.08904	.00390	-2.40894
3900	90.0	.0457	11.265	.997	0.08904	.00407	-2.39041
3950	90.1	.0453	11.265	.997	0.08904	.00403	-2.39489
4000	90.4	.0438	11.265	.997	0.08904	.00390	-2.40894

Table No. 43

Preparation: Sodium Para-aminobenzoate

irradiated 3 hours

Solvent: Distilled Water

Wave Length m μ	Extinction Coefficient E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	0.6894	1.1390	0.2328		
2975	0.4561	6.5100	2.2310		
3025	0.2820	10.0000	5.2247		
3075	0.0972	3.5770	2.8593		
3125	0.0408	0.9734	0.8865		
3175	0.0165	0.5670	0.5457		
3225	0.00791	0.4550	0.4470	1.0790	1.0069
3275	0.00530	0.2890	0.2853	1.0000	1.0599
3325	0.00407	0.1290	0.1278	0.9360	0.9277
3375	0.00373	<u>0.0456</u>	<u>0.0452</u>	0.7900	0.7925
3425	0.00390			0.6690	0.6630
3475	0.00378			0.5700	0.5649
3525	0.00399			0.4880	0.4836
3575	0.00407			0.4560	0.4519
3625	0.00434			0.3560	0.3525
3675	0.00407			0.3100	0.3072
3725	0.00416			<u>0.2600</u>	<u>0.2577</u>
	Total...	23.6850	12.8853	6.9420	6.8670
		% Transmitted = 54.4 %		% Transmitted = 98.9%	

* E-ritons/cm² x 10

Fig. 15

TANNIC ACID

○-○ NON-IRRADIATED
△-△ IRRADIATED THREE HOURS

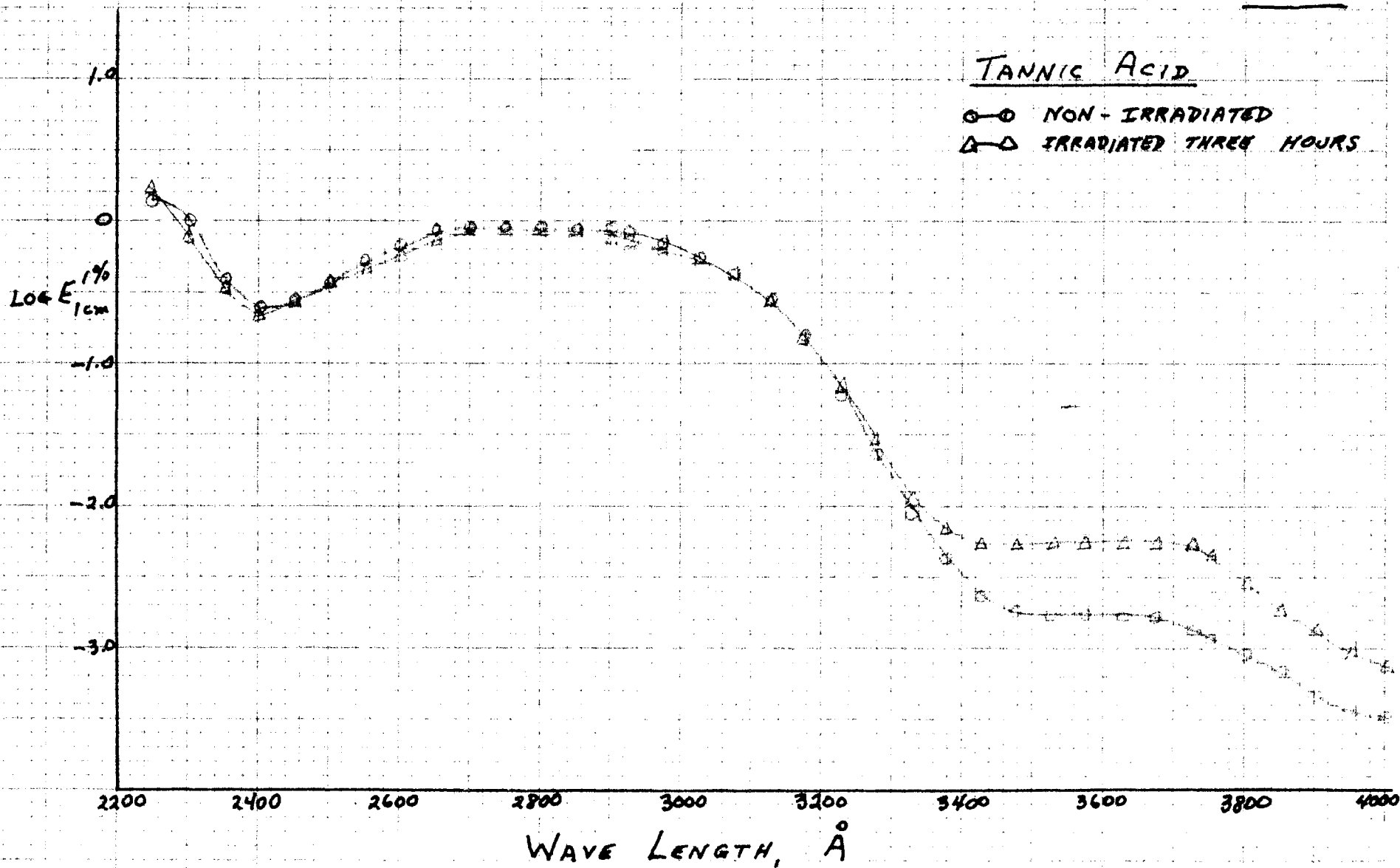


Table No. 44

Preparation: Tannic Acid

Non-irradiated

Solvent: Methyl Alcohol, Spectro Grade

Wave Length	Transmission	Optical Density,	Conc., C	Cell Thickness		Absorption Coefficient,	
$m\mu$	%T	$\text{Log} \left(\frac{100}{\%T} \right)$	Gm/1000 ml	cm	$\frac{1}{t \times C}$	K	$\text{Log} K \frac{1\%}{1\text{cm}}$
2250	1.99	1.7210	1.2165	.998	0.8237	1.4176	0.15155
2300	6.22	1.2082	1.2165	.998	0.8237	0.9935	0.00039
2350	32.8	0.4841	1.2165	.998	0.8237	.3988	-0.40954
2400	50.1	0.3002	1.2165	.998	0.8237	.2473	-0.60672
2450	46.0	0.5372	1.2165	.998	0.8237	.2778	-0.55627
2500	34.9	0.4572	1.2165	.998	0.8237	.3766	-0.42412
2550	24.3	0.6140	1.2165	.998	0.8237	.3058	-0.29602
2600	16.0	0.7960	1.2165	.998	0.8237	.6557	-0.18329
2650	10.8	0.9679	1.2165	.998	0.8237	.7965	-0.09881
2700	7.79	1.1085	1.2165	.998	0.8237	.9131	-0.03948
2750	7.00	1.1549	1.2165	.998	0.8237	.9513	-0.02168
2800	7.13	1.1469	1.2165	.998	0.8237	.9447	-0.02471
2850	7.55	1.1221	1.2165	.998	0.8237	.9245	-0.03412
2900	9.47	1.0236	1.2165	.998	0.8237	.8431	-0.07412
2925	10.8	.9679	1.2165	.998	0.8237	.7965	-0.09881
2975	13.8	.8600	1.2165	.998	0.8237	.7084	-0.14972
3025	19.0	.7210	1.2165	.998	0.8237	.5939	-0.22629
3075	28.1	.5510	1.2165	.998	0.8237	.4539	-0.34309
3125	44.4	.3516	1.2165	.998	0.8237	.3896	-0.53320
3175	64.2	.1925	1.2165	.998	0.8237	.1586	-0.79970
3225	18.5	.7330	12.165	.997	0.08245	.0604	-1.31896
3275	51.1	.2916	12.165	.997	0.08245	.0240	-1.61979
3325	78.1	.1073	12.165	.997	0.08245	.00885	-2.05396
3375	89.3	.0492	12.165	.997	0.08245	.00406	-2.39147
3425	93.5	.0292	12.165	.997	0.08245	.00241	-2.61798
3475	95.0	.0223	12.165	.997	0.08245	.00184	-2.73518
3525	95.2	.0214	12.165	.997	0.08245	.00176	-2.75449
3575	95.2	.0214	12.165	.997	0.08245	.00176	-2.75449
3625	95.5	.0200	12.165	.997	0.08245	.00165	-2.78252
3675	95.8	.0186	12.165	.997	0.08245	.00153	-2.81531
3725	96.5	.0153	12.165	.997	0.08245	.00128	-2.89279
3750	96.8	.0141	12.165	.997	0.08245	.00116	-2.92554
3800	97.4	.0114	12.165	.997	0.08245	.000940	-3.02687
3850	98.2	.0079	12.165	.997	0.08245	.000651	-3.18642
3900	98.8	.0052	12.165	.997	0.08245	.000429	-3.36754
3950	99.0	.0044	12.165	.997	0.08245	.000363	-3.44009
4000	99.1	.0039	12.165	.997	0.08245	.000322	-3.49214

Table No. 45

Preparation: Tannic Acid

Non-irradiated

Solvent: Methyl Alcohol, Spectro Grade

Wave Length $m\mu$	Extinction Coefficient, K	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	.7965	1.1390	0.1620		
2975	.7084	6.5100	1.2740		
3025	.5939	10.0000	2.5471		
3075	.4539	3.5770	1.2577		
3125	.2896	0.9734	0.6755		
3175	.1586	0.5670	0.4935		
3225	.0604	0.4550	0.4305	1.0790	0.9391
3275	.0240	0.2890	0.2831	1.0200	0.9649
3325	.00885	0.1290	0.1278	0.9360	0.9167
3375	.00406	<u>0.0456</u>	<u>0.0453</u>	0.7980	0.7909
3425	.00241			0.6990	0.6650
3475	.00184			0.5700	0.5679
3525	.00176			0.4880	0.4865
3575	.00176			0.4560	0.4546
3625	.00165			0.3560	0.3549
3675	.00153			0.3100	0.3091
3725	.00128			<u>0.2600</u>	<u>0.2595</u>
Total...		23.6850	7.3165	6.9420	6.7089
		% Transmitted = 30.9%		% Transmitted = 96.6%	

* E-vitons/cm² x 10

Table No. 46

Preparation: Tannic Acid

Irradiated 3 hrs.

Solvent: Methyl Alcohol, Spectro Grade

Wave Length $m\mu$	Trans- mission, $\%$	Optical Density, $\text{Log} \left(\frac{100}{\%T} \right)$	Conc., C Gm/1000 ml	Cell Thick- ness, cm t	$\frac{l}{t \times c}$	Absorption Coefficient, K	$\text{Log} K \frac{l}{1\text{cm}}$
2250	1.55	1.8100	1.112	0.998	0.90106	1.6310	0.21248
2300	10.1	.9960	1.112	0.998	0.90106	.8775	-0.05675
2350	38.2	.4191	1.112	0.998	0.90106	.3777	-0.42285
2400	54.2	.2660	1.112	0.998	0.90106	.2397	- .62033
2450	50.2	.2993	1.112	0.998	0.90106	.2697	- .57912
2500	39.9	.3990	1.112	0.998	0.90106	.3595	- .44430
2550	29.7	.5272	1.112	0.998	0.90106	.4751	- .32321
2600	21.2	.6740	1.112	0.998	0.90106	.6073	- .21660
2650	15.3	.8150	1.112	0.998	0.90106	.7344	- .13407
2700	12.0	.9200	1.112	0.998	0.90106	.8290	- .08144
2750	11.2	.9510	1.112	0.998	0.90106	.8569	- .06707
2800	11.2	.9510	1.112	0.998	0.90106	.8569	- .06707
2850	12.8	.8930	1.112	0.998	0.90106	.8047	- .09437
2900	15.1	.8210	1.112	0.998	0.90106	.7398	- .13089
2925	16.5	.7830	1.112	0.998	0.90106	.7056	- .15144
2975	19.8	.7030	1.112	0.998	0.90106	.6235	- .19825
3025	25.5	.5930	1.112	0.998	0.90106	.5344	- .27213
3075	35.5	.4498	1.112	0.998	0.90106	.4053	- .39232
3125	50.9	.2933	1.112	0.998	0.90106	.2643	- .57790
3175	68.1	.1669	1.112	0.998	0.90106	.1504	- .82275
3225	19.6	.7080	11.120	0.997	0.09019	.0629	-1.19450
3275	50.9	.2923	11.120	0.997	0.09019	.0265	-1.57675
3325	75.0	.1249	11.120	0.997	0.09019	.0112	-1.94692
3375	84.9	.0711	11.120	0.997	0.09019	.00641	-2.19314
3425	87.5	.0580	11.120	0.997	0.09019	.00523	-2.28150
3475	87.8	.0565	11.120	0.997	0.09019	.00510	-2.29243
3525	87.8	.0565	11.120	0.997	0.09019	.00510	-2.29243
3575	86.8	.0615	11.120	0.997	0.09019	.00555	-2.25571
3625	86.2	.0645	11.120	0.997	0.09019	.00582	-2.23508
3675	86.2	.0645	11.120	0.997	0.09019	.00582	-2.23508
3725	87.8	.0565	11.120	0.997	0.09019	.00510	-2.29243
3750	89.2	.0496	11.120	0.997	0.09019	.00447	-2.34969
3800	92.9	.0320	11.120	0.997	0.09019	.00289	-2.53910
3850	95.2	.0214	11.120	0.997	0.09019	.00193	-2.71444
3900	96.8	.0141	11.120	0.997	0.09019	.00193	-2.89620
3950	97.6	.0105	11.120	0.997	0.09019	.000947	-2.02365
4000	98.1	.0083	11.120	0.997	0.09019	.000749	-3.12552

Table No. 47

Preparation: Tannic Acid

Irradiated 3 hrs.

Solvent: Methyl Alcohol, Spectro Grade

Wave Length m μ	Extinction Coefficient, E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	.7956	1.1390	0.2243		
2975	.6335	6.5100	1.5139		
3025	.5344	10.0000	2.9213		
3075	.4053	3.5770	1.4110		
3125	.2643	0.9734	0.5296		
3175	.1504	0.5670	0.4010		
3225	.0639	.4550	0.3929	1.0790	0.9318
3275	.0265	.2890	0.2719	1.0200	0.9595
3325	.0113	.1290	0.1256	0.9360	0.9114
3375	.00641	<u>.0456</u>	<u>0.0449</u>	0.7980	0.7862
3425	.00523			0.6690	0.6611
3475	.00510			0.5700	0.5632
3525	.00510			0.4880	0.4822
3575	.00555			0.4560	0.4501
3625	.00582			0.3560	0.3514
3675	.00582			0.3100	0.3060
3725	.00510			<u>0.2600</u>	<u>0.2562</u>
Total....		23.6850	7.8364	6.9420	6.6598

% Transmitted = 33.1%

% Transmitted = 95.9%

* E-vitons/cm² x 10

Fig. 16

SUNSCREEN "75-A"

○-○ NON-IRRADIATED
△-△ IRRADIATED THREE HOURS

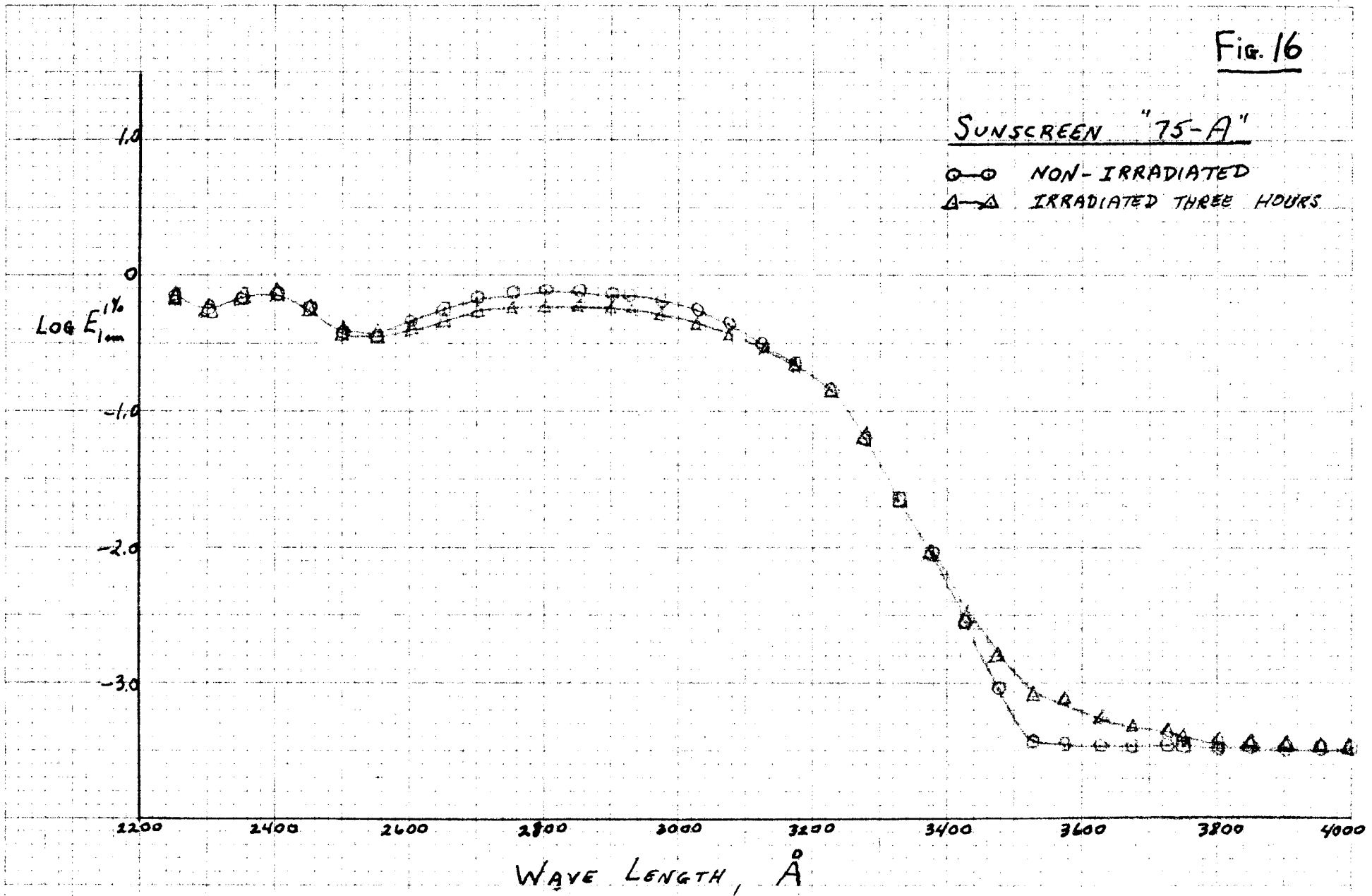


Table No. 48

Preparation: Sunscreen "75-A"

non-irradiated

Solvent: Methyl Alcohol, Spectro Grade

Wave Length	Trans- mission	Optical Density,	Conc., C	Cell Thick- ness	Absorption Coefficient,	Log $E_{1\%}^{1\text{cm}}$	
$m\mu$	%T	Log $(\frac{100}{\%T})$	Gm/1000 ml	cm	$\frac{1}{t \times C}$	E	
2250	18.2	.7400	1.0575	.998	0.9415	0.7012	-0.15416
2300	24.8	.6060	1.0575	.998	0.9415	.5742	-0.24094
2350	20.2	.6950	1.0575	.998	0.9415	.6585	- .18144
2400	18.2	.7400	1.0575	.998	0.9415	.7012	- .15416
2450	24.0	.6200	1.0575	.998	0.9415	.5875	- .23099
2500	38.3	.4168	1.0575	.998	0.9415	.3849	- .40351
2550	40.2	.3958	1.0575	.998	0.9415	.3750	- .43597
2600	33.1	.4802	1.0575	.998	0.9415	.4550	- .34199
2650	25.8	.5880	1.0575	.998	0.9415	.5571	- .25407
2700	20.3	.6930	1.0575	.998	0.9415	.6566	- .18270
2750	17.2	.7640	1.0575	.998	0.9415	.7239	- .14022
2800	16.0	.7960	1.0575	.998	0.9415	.7542	- .12251
2850	16.1	.7930	1.0575	.998	0.9415	.7514	- .12412
2900	17.6	.7540	1.0575	.998	0.9415	.7144	- .14606
2925	18.8	.7260	1.0575	.998	0.9415	.6879	- .16247
2975	22.2	.6540	1.0575	.998	0.9415	.6197	- .20782
3025	26.8	.5720	1.0575	.998	0.9415	.5420	- .26600
3075	36.0	.4427	1.0575	.998	0.9415	.4294	- .37634
3125	46.5	.3323	1.0575	.998	0.9415	.3150	- .50169
3175	57.0	.2441	1.0575	.998	0.9415	.2312	- .63582
3225	68.8	.1624	1.0575	.998	0.9415	.1539	- .81276
3275	21.9	.6600	10.575	.997	0.0949	.0626	-1.20242
3325	25.2	.5981	10.575	.997	0.0949	.0645	-1.61022
3375	22.4	.641	10.575	.997	0.0949	.00798	-2.09800
3425	23.2	.6306	10.575	.997	0.0949	.00290	-2.52760
3475	27.8	.5597	10.575	.997	0.0949	.000920	-3.03621
3525	29.1	.5359	10.575	.997	0.0949	.000370	-3.43180
3575	29.2	.5335	10.575	.997	0.0949	.000332	-3.47886
3625	29.2	.5335	10.575	.997	0.0949	.000332	-3.47886
3675	29.2	.5335	10.575	.997	0.0949	.000332	-3.47886
3725	29.2	.5335	10.575	.997	0.0949	.000332	-3.47886
3750	29.2	.5335	10.575	.997	0.0949	.000332	-3.47886
3800	29.2	.5335	10.575	.997	0.0949	.000332	-3.47886
3850	29.2	.5335	10.575	.997	0.0949	.000332	-3.47886
3900	29.2	.5335	10.575	.997	0.0949	.000332	-3.47886
3950	29.2	.5335	10.575	.997	0.0949	.000332	-3.47886
4000	29.2	.5335	10.575	.997	0.0949	.000332	-3.47886

Table No. 49

Preparation: Sunscreen " 75-A "

non-irradiated

Solvent: Methyl Alcohol, Spectro Grade

Wave Length $m\mu$	Extinction Coefficient, E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	0.6879	1.1390	0.2336		
2975	0.6197	6.5100	1.5602		
3025	0.5420	10.0000	2.8711		
3075	0.4204	3.5770	1.3590		
3125	0.3150	0.9734	0.4714		
3175	0.2313	0.5670	0.3329		
3225	0.1539	0.4550	0.3193	1.0790	0.7552
3275	0.0626	0.2890	0.2504	1.0200	0.8839
3325	0.0245	0.1290	0.1219	0.9360	0.8847
3375	0.00798	<u>0.0456</u>	<u>0.0448</u>	0.7980	0.7893
3425	0.00290			0.6690	0.6643
3475	0.000920			0.5700	0.5689
3525	0.000370			0.4880	0.4875
3575	0.000332			0.4560	0.4555
3625	0.000332			0.3560	0.3556
3675	0.000332			0.3100	0.3097
3725	0.000332			<u>0.2600</u>	<u>0.2597</u>
	Total...	23.6850	7.5646	6.9420	6.4163
		% Transmitted = 31.0%		% Transmitted = 92.4%	

* E-vitons/cm² x 10

Table No. 50

Preparation: Sunscreen "75-A"

Irradiated 3 hrs.

Solvent: Methyl Alcohol, Spectro Grade

Wave Length	Trans- mission,	Optical Density,	Conc., G	Cell Thick- ness,	Absorption Coefficient,		
$m\mu$	% T	$\text{Log} \left(\frac{100}{\%T} \right)$	Gm/1000 ml	cm t	$\frac{1}{t \times c}$	E	$\text{Log} E \frac{1\%}{1\text{cm}}$
2250	18.2	.7400	1.1088	.998	0.9037	0.6687	-0.17477
2300	21.2	.6740	1.1088	.998	0.9037	.6091	- .21531
2350	17.1	.7670	1.1088	.998	0.9037	.6931	- .15920
2400	16.0	.7960	1.1088	.998	0.9037	.7193	- .14309
2450	20.9	.6800	1.1088	.998	0.9037	.6145	- .21478
2500	36.7	.4353	1.1088	.998	0.9037	.3934	- .40517
2550	41.0	.3872	1.1088	.998	0.9037	.3499	- .45606
2600	36.1	.4425	1.1088	.998	0.9037	.3499	- .39805
2650	29.8	.5258	1.1088	.998	0.9037	.4752	- .32312
2700	26.2	.5820	1.1088	.998	0.9037	.5260	- .27901
2750	23.0	.6380	1.1088	.998	0.9037	.5766	- .23912
2800	21.8	.6620	1.1088	.998	0.9037	.5982	- .22315
2850	22.0	.6580	1.1088	.998	0.9037	.5946	- .22577
2900	22.8	.6420	1.1088	.998	0.9037	.5802	- .23642
2925	23.8	.6230	1.1088	.998	0.9037	.5630	- .24949
2975	25.8	.5880	1.1088	.998	0.9037	.5314	- .27458
3025	28.4	.5467	1.1088	.998	0.9037	.4941	- .30618
3075	26.8	.4342	1.1088	.998	0.9037	.3934	- .40517
3125	45.2	.3449	1.1088	.998	0.9037	.3117	- .50626
3175	55.8	.2534	1.1088	.998	0.9037	.2290	- .64016
3225	67.2	.1726	1.1088	.998	0.9037	.1560	- .80687
3275	17.8	.7500	11.088	.997	0.09046	.0678	-1.16877
3325	50.2	.2993	11.088	.997	0.09046	.0271	-1.56703
3375	78.2	.1068	11.088	.997	0.09046	.00966	-2.01502
3425	91.8	.0372	11.088	.997	0.09046	.00337	-2.47237
3475	95.8	.0186	11.088	.997	0.09046	.00168	-2.77469
3525	98.0	.0088	11.088	.997	0.09046	.000796	-3.09909
3575	98.0	.0088	11.088	.997	0.09046	.000796	-3.09909
3625	98.5	.0066	11.088	.997	0.09046	.000597	-3.22403
3675	98.8	.0052	11.088	.997	0.09046	.000470	-3.32790
3725	98.8	.0052	11.088	.997	0.09046	.000470	-3.32790
3750	99.0	.0044	11.088	.997	0.09046	.000398	-3.40002
3800	99.0	.0044	11.088	.997	0.09046	.000398	-3.40002
3850	99.0	.0044	11.088	.997	0.09046	.000398	-3.40002
3900	99.2	.0035	11.088	.997	0.09046	.000317	-3.49894
3950	99.2	.0035	11.088	.997	0.09046	.000317	-3.49894
4000	99.2	.0035	11.088	.997	0.09046	.000317	-3.49894

Table No. 51

Preparation: Sunscreen "75-A"

Irradiated 3 hrs.

Solvent: Methyl Alcohol, Spectro Grade

Wave Length $m\mu$	Extinction Coefficient, E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	.5630	1.1390	0.3115		
2975	.5314	6.5100	1.9147		
3025	.4941	10.0000	3.2051		
3075	.3934	3.5770	1.4458		
3125	.3117	0.9734	0.4751		
3175	.2290	0.5670	0.3347		
3225	.1560	0.4550	0.3177	1.0790	0.7535
3275	.0678	0.2890	0.2472	1.0200	0.8725
3325	.0271	0.1390	0.1212	0.9260	0.8797
3375	.00966	<u>0.0456</u>	<u>0.0446</u>	0.7980	0.7908
3425	.00337			0.6690	0.6637
3475	.00168			0.5700	0.5883
3525	.000796			0.4880	0.4875
3575	.000796			0.4560	0.4555
3625	.000597			0.3560	0.3555
3675	.000470			0.3100	0.3097
3725	.000470			<u>0.2600</u>	<u>0.2597</u>
	Total..	23.6850	8.4176	6.9420	6.3864

% Transmitted = 35.8%

% Transmitted = 92.0%

* E-vitons/cm² x 10

Fig. 17

ISOBUTYL PARA-AMINO BENZOATE

○-○ NON-IRRADIATED
△-△ IRRADIATED THREE HOURS

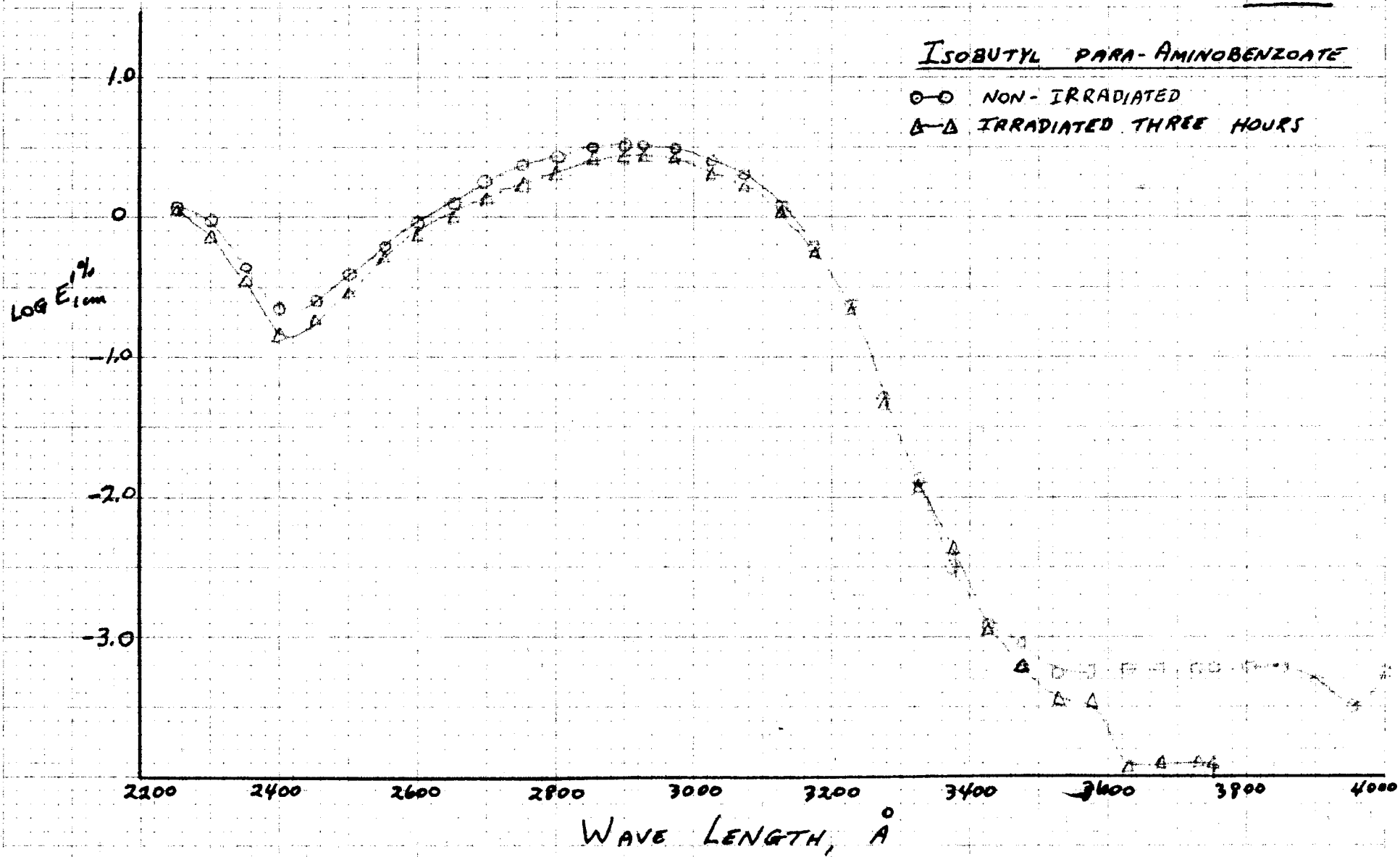


Table No. 51

Preparation: Isobutyl Para-aminobenzoate

Non-irradiated

Solvent: Methyl Alcohol, Spectro Grade

Wave Length	Transmission, %T	Optical Density, $\log \left(\frac{100}{\%T} \right)$	Conc., Gm/1000 ml	Cell Thickness, cm	$\frac{1}{t \times c}$	Absorption Coefficient, E	$\log K_{1\text{cm}}^{1\%}$
2250	6.23	1.2055	1.0274	.998	0.9753	1.1757	0.07041
2300	14.3	.845	1.0274	.998	0.9753	0.8241	-0.08402
2350	39.2	.4067	1.0274	.998	0.9753	0.3967	-0.40154
2400	60.6	.2175	1.0274	.998	0.9753	0.2121	-0.67346
2450	55.5	.2557	1.0274	.998	0.9753	0.2494	-0.60210
2500	42.8	.3686	1.0274	.998	0.9753	0.3595	-0.44430
2550	26.4	.578	1.0274	.998	0.9753	0.5637	-0.24895
2600	14.2	.848	1.0274	.998	0.9753	0.8271	-0.08244
2650	75.0	.1249	0.10274	.998	9.753	1.2181	0.08565
2700	67.5	.1707	0.10274	.998	9.753	1.6648	0.22141
2750	60.8	.2161	0.10274	.998	9.753	2.1076	0.32387
2800	55.4	.2565	0.10274	.998	9.753	2.5016	0.38829
2850	52.2	.2823	0.10274	.998	9.753	2.7533	0.43981
2900	50.0	.3010	0.10274	.998	9.753	2.9337	0.46776
2925	49.8	.3028	0.10274	.998	9.753	2.9532	0.47026
2975	50.8	.2942	0.10274	.998	9.753	2.8693	0.45773
3025	55.3	.2573	0.10274	.998	9.753	2.5994	0.39950
3075	64.1	.1931	0.10274	.998	9.753	1.8833	0.27850
3125	76.8	.1146	0.10274	.998	9.753	1.1177	0.04844
3175	27.5	.561	1.0274	.998	0.9753	0.5472	-0.26185
3225	60.8	.2161	1.0274	.998	0.9753	0.2107	-0.67633
3275	32.8	.4841	10.274	.997	0.0976	0.0473	-1.32514
3325	74.9	.1255	10.274	.997	0.0976	0.0123	-1.91009
3375	93.2	.0306	10.274	.997	0.0976	0.00299	-2.52433
3425	97.5	.0110	10.274	.997	0.0976	0.00108	-2.96658
3475	98.1	.0083	10.274	.997	0.0976	0.000810	-3.09151
3525	98.8	.0052	10.274	.997	0.0976	0.000508	-3.29414
3575	98.8	.0052	10.274	.997	0.0976	0.000508	-3.29414
3625	98.8	.0052	10.274	.997	0.0976	0.000508	-3.29414
3675	98.8	.0052	10.274	.997	0.0976	0.000508	-3.29414
3725	98.8	.0052	10.274	.997	0.0976	0.000508	-3.29414
3750	98.8	.0052	10.274	.997	0.0976	0.000508	-3.29414
3800	98.8	.0052	10.274	.997	0.0976	0.000508	-3.29414
3850	98.8	.0052	10.274	.997	0.0976	0.000508	-3.29414
3900	99.00	.0044	10.274	.997	0.0976	0.000430	-3.36653
3950	99.4	.0026	10.274	.997	0.0976	0.000254	-3.59517
4000	98.8	.0052	10.274	.997	0.0976	0.000508	-3.29414

Table No. 52

Preparation: Isobutyl Para-aminobenzoate

Non-irradiated

Solvent: Methyl Alcohol, Spectro Grade

Wave Length $m\mu$	Extinction Coefficient E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	2.9532	1.1390	0.0013		
2975	2.8693	6.5100	0.0088		
3025	2.5094	18.0000	0.0310		
3075	1.8833	3.5770	0.0468		
3125	1.1177	0.9743	0.0743		
3175	0.5472	0.5670	0.1608		
3225	0.2107	0.4550	0.2800	1.0790	0.6640
3275	0.0473	0.2890	0.2592	1.0200	0.9143
3325	0.0123	0.1290	0.1254	0.9360	0.9096
3375	0.00299	<u>0.0456</u>	<u>0.0453</u>	0.7980	0.7925
3425	0.00108			0.6690	0.6677
3475	0.000810			0.5700	0.5689
3525	0.000598			0.4880	0.4875
3575	0.000508			0.4560	0.4555
3625	0.000508			0.3560	0.3556
3675	0.000508			0.3100	0.3097
3725	0.000508			<u>0.2600</u>	<u>0.2597</u>
Total....		23.6850	1.0329	6.9420	6.3855
			% Transmitted = 4.4%		% Transmitted = 92.0%

* E-vitons/cm² x 10

Table No. 53

Preparation: Isobutyl Para-aminobenzoate

Irradiated 3 hrs.

Solvent: Methyl Alcohol, Spectro Grade

Wave Length	Transmission, %T	Optical Density, Log ($\frac{100}{\%T}$)	Conc., g/1000 ml	Cell Thickness, cm	$\frac{1}{t \times c}$	Absorption Coefficient, E	Log $E \frac{1\%}{1\text{cm}}$
2250	7.00	1.1550	1.0582	.998	0.9469	1.0937	0.03883
2300	16.3	.7830	1.0582	.998	0.9469	0.7462	-0.12714
2350	45.0	.3468	1.0582	.998	0.9469	0.3284	-0.48360
2400	69.7	.1562	1.0582	.998	0.9469	0.1485	-0.82827
2450	63.8	.1952	1.0582	.998	0.9469	0.1848	-0.73330
2500	47.1	.3270	1.0582	.998	0.9469	0.3096	-0.51919
2550	28.4	.5467	1.0582	.998	0.9469	0.5177	-0.28592
2600	14.9	.827	1.0582	.998	0.9469	0.7831	-0.10618
2650	80.0	.0969	0.10582	.998	9.469	0.9175	-0.03739
2700	70.9	.1494	0.10582	.998	9.469	1.4147	0.14138
2750	63.8	.1952	0.10582	.998	9.469	1.8483	0.26670
2800	57.9	.2373	0.10582	.998	9.469	2.2470	0.35160
2850	54.1	.2662	0.10582	.998	9.469	2.5263	0.40243
2900	51.2	.2907	0.10582	.998	9.469	2.7526	0.43981
2925	50.4	.2976	0.10582	.998	9.469	2.8180	0.44994
2975	51.3	.2899	0.10582	.998	9.469	2.7451	0.42854
3025	55.7	.2541	0.10582	.998	9.469	2.4060	0.38120
3075	63.8	.1952	0.10582	.998	9.469	1.8483	0.26670
3125	6.13	1.2125	1.0582	.998	0.9469	1.1481	0.05994
3175	27.0	.5690	1.0582	.998	0.9469	0.5388	-0.26857
3225	61.2	.2132	1.0582	.998	0.9469	0.2019	-0.69486
3275	70.2	.15200	10.582	.997	0.0948	0.0493	-1.30715
3325	73.0	.1367	10.582	.997	0.0948	0.0130	-1.88606
3375	92.0	.0362	10.582	.997	0.0948	0.00343	-2.46471
3425	97.1	.0127	10.582	.997	0.0948	0.00120	-2.92082
3475	98.4	.0070	10.582	.997	0.0948	0.000664	-3.17783
3525	99.2	.0035	10.582	.997	0.0948	0.000332	-3.47886
3575	99.2	.0035	10.582	.997	0.0948	0.000332	-3.47886
3625	99.7	.0013	10.582	.997	0.0948	0.000123	-3.91009
3675	99.7	.0013	10.582	.997	0.0948	0.000123	-3.91009
3725	99.7	.0013	10.582	.997	0.0948	0.000123	-3.91009
3750	99.7	.0013	10.582	.997	0.0948	0.000123	-3.91009
3800	100.0	.0000	10.582	.997	0.0948	0	-
3850	100.0	.0000	10.582	.997	0.0948	0	-
3900	100.0	.0000	10.582	.997	0.0948	0	-
3950	100.0	.0000	10.582	.997	0.0948	0	-
4000	100.0	.0000	10.582	.997	0.0948	0	-

Table No. 54

Preparation: Isobutyl Para-aminobenzoate

Irradiated 3 hrs.

Solvent: Methyl Alcohol, Spectro Grade

Wave Length m μ	Extinction Coefficient, E	Incident Erythemat Energy *	Transmitted Erythemat Energy *	Incident Tanning Energy *	Transmitted Tanning Energy *
2925	2.8180	1.1390	0.0013		
2975	2.7451	6.5100	0.0117		
3025	2.4060	10.0000	0.0393		
3075	1.8483	3.5770	0.0507		
3125	1.1481	0.9743	0.0693		
3175	0.5388	0.5670	0.1640		
3225	0.2019	0.4550	0.2858	1.0790	0.6778
3275	0.0493	0.2890	0.2580	1.0200	0.9107
3325	0.0130	0.1390	0.1252	0.9360	0.9087
3375	0.00343	<u>0.0456</u>	<u>0.0452</u>	0.7980	0.7917
3425	0.00120			0.6690	0.6677
3475	0.000664			0.5700	0.5694
3525	0.000332			0.4880	0.4875
3575	0.000332			0.4560	0.4555
3625	0.000123			0.3560	0.3560
3675	0.000123			0.3100	0.3100
3725	0.000123			<u>0.2600</u>	<u>0.2600</u>
	Total..	23.6850	1.0509	6.9420	6.2950
		% Transmitted = 4.4%		% Transmitted = 92.1%	

* E-vitons/cm² x 10

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