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Research Article

Comparison and Determination of Sun Protecting Factor (SPF) Of Some Citrus Fruit Juices

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ABSTRACT

The aim behind doing this work is to determine and comparison of SPF (sun protecting factor) of citrus fruit juices which is previously used in cosmetics as flavor agent or a cleansing agent here determination of its SPF gives a safe and Excellency parameter to its use. SPF is a laboratory measure of effectiveness of sunscreen factor. Higher the SPF value more protection against ultra violet radiations which causes sun burn disease. SPF determination is the in vitro testing of sunscreen activity with the help of UV spectrophotometer (290nm-320nm). Here different concentrations of citrus fruit juices like Lemon (Citrus medica), Orange (Citrus sinensis), and Mosambi/Sweet lime (Citrus limetta) were taken under consideration of photo protective test to prove its efficiency in the sunscreen activity and also for the comparison of SPF factor.

Keywords: Citrus fruits; Sun Protecting Factor and Cosmetics.

INTRODUCTION

Ultra Violet Radiations (UVR) exposure to skin causes skin disorders such as squamous cell carcinoma, basal cell carcinoma, accelerated skin ageing, immune depression of skin and photodermatoses. The UV radiations are categories in three categories as such UV-C (200-280nm), UV –B (280-320nm) UV-A (320-400nm) (Chanchal et al., 2009; Malsawmtluangi et al., 2013). From above three categories of UV radiations, UV-C radiation can cause severe biological damage to skin as compared to UV-B and UV-A radiation. But UV-C radiations are filtered by the ozone layer, so UV-B and UV-A radiation are currently the reason for causing skin cancer. So as to avoid this radiation to cause damages to the skin, sunscreen agents are used, which act as a photo protective agents against harmful UV radiations (Nohynek, 2010).

There are so many Sunscreen agent formulations are available in market today obtained either for synthetic or natural source. The example for synthetic agents are Octabenzol, Ocetylmethoxyciinan-ate, Benzophenone-3, Provatene, 2-Ethoxy ethyl p-methoxycinnamate, Sulisobenzone, Mexenone, Avobenzone, Dioxybenzone, 4-dimethyl amino benzoic acid, etc. and the example to natural agents are Antioxidant (alpha carotene, Ascorbic acid, Flavonone and Flavones), Vitamins and Enzymes (Superoxidedismutase, Peroxidase and Proteolytic) (Afaq, 2006; Kaur, 2010).

Sunscreen agents are to be considered as an effective agent against photo toxicity, when they have good sun protecting factor (SPF). SPF is a ratio of UV spectrometric energy required to produce a minimal erythemal dose (MEDprotected skin) in protected skin to (MED unprotected skin) unprotected skin. The in vitro model for determination of SPF is to take the absorbance of prepared solution of herbal extract between 290nm to 320 nm at every 5 nm intervals. SPF can be calculated by applying the following formula known as Mansur equation (Mishra et al., 2012).

$$SPF = CF \times \sum_{290}^{320} EE(\lambda) \times I(\lambda) \times Abs(\lambda)$$

Where,

CF = Correction factor (10).

EE (λ) = Erythmogenic effect of radiation with wavelength λ.

Abs (λ) = Spectrophotometric absorbance values at wavelength λ.

The values of EE(λ) x I(λ) are constants and given in table 1.

Lemon (Citrus medica) is a slow-growing shrub or small tree. It has small, thick branches an tiny spines, growing in the leafs axils. Leaflets are ovoid to lanceolate,

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Table 1: The values of EE(λ) x I(λ) are constants

Wavelengths (nm)	Value of $EE(\lambda) \times I(\lambda)$
290	0.0150
295	0.0817
300	0.2874
305	0.3278
310	0.1864
315	0.0837
320	0.0180

Table 2: The SPF of extracts of different citrus fruits was determined by using UV spectrometric analysis

Wavelength (nm)	Value of $EE(\lambda) \times I(\lambda)$	Concentrations of extract of Orange juice		Concentrations of extract of Lemon juice		Concentrations of extract of Mosambi juice	
		10ppm	20ppm	10ppm	20ppm	10ppm	20ppm
290	0.0150	1.9720	3.1053	1.2807	2.5486	1.4573	2.0873
295	0.0817	1.6792	3.2000	1.0350	2.1391	1.1976	2.4181
300	0.2874	1.4171	2.9368	0.8334	1.7545	0.9836	2.0121
305	0.3278	1.2555	2.6820	0.7108	1.5099	0.8591	1.7704
310	0.1864	1.1842	2.5268	0.6547	1.3932	0.8035	1.6652
315	0.0837	1.1667	2.4961	0.6294	1.3404	0.7876	1.6379
320	0.0180	1.1590	2.4824	0.6070	1.2907	0.7789	1.6207

Table 3: The SPF value of different extracts and its concentrations

Citrus Fruits	SPF of Concentrations of extract	
	10ppm	20ppm
Orange	13.32	27.54
Lemon	7.61	16.06
Mosambi	9.13	18.75

The above table explains that higher the concentration of fruit juice having higher SPF value and from itscomparison the orange is having more SPF value among all the three citrus fruits and the order of photo protective value was found to Orange>Mosambi>Lemon.

with almost wingless petioles. Flowers are 4-5 petalled, purple or pink in color. Fruit is oblong, obvoid or oval, narrowing toward the top. Its skin is thick, fleshy and very aromatic. It contains citric acid, sulphuric acid, glucose, volatile oils, potassium, calcium, and vitamin C. It is used in herbal remedy for seasickness, pulmonary and intestinal disorders (Etebu et al., 2014).

Orange (Citrus sinensis) is also known as Kinnow. It is subtropical plant matures in January and February. The orange tree is branched with a rounded crown and possesses elliptical or oval leaves which are alternately arranged on the branches. It produces white flowers. The fruit is a spherical berry with green orange skin covered in indented glands and a segmented pulpy flesh and several seeds. It is good source of Thiamin, folate and potassium, and a very good source of Dietary fiber and vitamin C. It is used to reduces chronic inflammation, lowering blood pressure, may reduce the risk of developing childhood leukemia, it mainly associated with boosting the immune system (Gattuso et al., 2007).

Mosambi/Sweet lime (Citrus limetta) found in southeast Asia. These small plants may reach up to 25 feet in height. Mosambi fruits are small green citrus fruit of round oval shape, which turns yellow on ripening. This tree grows easily in tropical and subtropical climates and starts bearing fruits when it is 5-7 yrs old. It contains carbohydrates, protein, trace metals and vitamin C. It is used to treat influenza and common cold (Okwu, 2008).

MATERIALS AND METHODS

Collection of fruit juices

The fruits used in the determination of SPF was collected from market [Lemon (Citrus limon), Orange (Citrus sinensis), and Mosambi/Sweet lime (Citrus limetta)]. and their juices are taken in the consideration.

Preparation of standard solutions

The extracted juices are heated separately for the evaporation of water content, till it achieves 1/10th ratio and these jelly like extract is used for further procedure.

10 mg of extract was dissolved in 100 ml ethanol and filtered to produce 100ppm (parts per million) solution. From prepared 100ppm solution 1ml and 2ml solution

	Mode	Sample Name	Comment	290.0 nm	295.0 nm	300.0 nm	305.0 nm	310.0 nm	315.0 nm	320.0 nm
1	Blank-1			0.0665	0.0627	0.0601	0.0569	0.0545	0.0518	0.0479
2	Sample-1	10ppm	Orange	1.9720	1.6792	1.4171	1.2555	1.1842	1.1667	1.1590
3	Sample-2	20ppm	Orange	3.1053	3.2000	2.9368	2.6820	2.5268	2.4961	2.4824
4	Sample-3	10ppm	Lemon	1.2807	1.0350	0.8334	0.7108	0.6547	0.6294	0.6070
5	Sample-4	20ppm	Lemon	2.5486	2.1391	1.7545	1.5099	1.3932	1.3404	1.2907
6	Sample-5	10ppm	Mosambi	1.4573	1.1976	0.9836	0.8591	0.8035	0.7876	0.7789
7	Sample-6	20ppm	Mosambi	2.8073	2.4181	2.0121	1.7704	1.6652	1.6379	1.6207

Figure 1: (JASCO SPECTROPHOTOMETER152761148) and the spectrometric analysis

is pipette out and diluted up to 10ml to produce 10ppm and 20ppm. This procedure is followed for all extracts. These prepared dilutions of three juices are subjected to determination of SPF with the use of UV spectrophotometer (Panchal et al., 2014).

Determination of SPF Value

The absorbance of working standards (dilutions of the extracts) were taken in the fixed wavelength mode and wavelengths are 390nm, 295nm, 300nm, 305nm, 310nm, 315nm and 320nm with the help of UV spectrophotometer (JASCO SPECTROPHOTOMETER152761148) and obtained absorbance were multiplied with EE values and their summation was multiplied with correlation factor 10 (Panchal et al., 2014).

RESULT AND DISCUSSION

The SPF of extracts of different citrus fruits was determined by using UV spectrometric analysis is shown in table 2. (JASCO SPECTROPHOTOMETER152761148) and the spectrometric analysis is recorded in Image. 1 The comparison of the photo protective value is shown in the table 3

CONCLUSION

The research provides highlight on the use of herbal ingredient in the preparation of sunscreen formulation by proving its potency against sun burns. Here used citrus fruits, which is used on daily basis to improve the diet or to gain antioxidants, vitamin C etc. From this parameter we can focus on it's another potent activity that is photo protecting activity. Which give us a safe, potent and reliable ingredient for the sunscreen preparations. So, now we can formulate safe cosmetics by using this type of safe ingredient, which is a step towards healthy living.

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