



**UV PROTECTING ABILITY OF SUNSCREEN LOTIONS PREPARED
WITH EXTRACTS OF *PISONIA GRANDIS* R.BR**

P. Lalitha*, Shubashini K Sripathi¹ and P.Jayanthi²

*Assistant Professor (SG) Department of Chemistry, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore-43.

¹Professor, Department of Chemistry, Avinashilingam Institute for Home Science and Higher education for Women Coimbatore-43.

²Assistant Professor in Chemistry, Dr.Mahalingam College of Engineering and Technology Pollachi - 642001.

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*Correspondence for
Author

Dr. P.Lalitha

Assistant Professor (SG),
Department of Chemistry,
Avinashilingam Institute
for Home Science and
Higher education for
Women, Coimbatore-43

1. INTRODUCTION

The skin, especially epidermis acts as a barrier and immunological organ in the human body and hence is particularly subjected to external harmful effects. Electromagnetic radiation is the chief environmental component to which skin is exposed daily and this comprises of UV radiation (UV-A (320-400 nm), UV-B (290-320 nm) and UV-C (200-290 nm), which have been reported to cause damaging effects to the skin.^[1] UV-C radiation at short exposure time is extremely damaging to the skin^[2] but is filtered by the atmosphere before reaching the earth. The ozone layer does not filter UV-B radiation completely and this is responsible for the damage due to sunburn (acute inflammation)^[3] and intensification of photo-ageing.^[4] UV-A radiation reaches the deeper layers of the epidermis and dermis resulting in damage to the

elastic and collagen fibers of connective tissue of skin. and aggravates the premature aging of the skin. Ultraviolet radiations are considered a causative factor of skin cancer.^[3] UV irradiation initiates and activates a complex cascade of biochemical reactions in human skin resulting in inflammation and free radical generation (both reactive oxygen and nitrogen species), which causes damage to the cellular proteins, lipids and carbohydrates accumulated in the dermal and epidermal compartments and thus contributing to the etiology of photoaging.^[5] One of the strategies to prevent the damage caused by this cascade of reactions

initiated by UV is prevention of its penetration into skin by the use of sunscreens containing antioxidants capable of quenching ROS.

A sunscreen is a topical product that protects the skin against harmful effects of the sun and has two important functions;

- (i) Protecting the skin against UV-A and UV-B rays
- (ii) Maintaining moisture and natural oils of the skin

Organic sunscreens, inorganic sunscreens, and herbal sunscreens are normally used for protection from sunrays. Organic sunscreens have been increasingly reported to cause allergic and contact dermatitis, phototoxic and photo-allergic reactions, contact urticaria producing skin rash notable for pale red, raised, itchy bumps and even severe anaphylactic reactions. Inorganic sunscreens are cosmetically unacceptable because of their opaque and occlusive nature. Hence herbal sunscreens have gained substantial attention and many plant extracts have been tested for their sunscreen activity.^[6]

Pisonia grandis R.Br is a medicinal plant reported to possess numerous bio-active compounds like β -sitosterol, α -spinasterol, β -sitosterol glucoside, octocosanol, dulcitol, and quercetin.^[7] Recently, allantoin and pinitol have been isolated from the leaves of this plant.^{[8][9]} Allantoin is a safe and effective skin protectant and reported to be used in numerous cosmetic products at concentrations upto 2.0%.^[10] *Pisonia grandis* has been reported to possess antimicrobial^[11], anti-arthritis^[12], anti-diabetic and wound healing ability.^[13] In this light, the present study, designed to evaluate the UV protecting efficiency of the sunscreen lotions prepared with the extracts of *Pisonia grandis* R.Br. also provides a simple method of establishing the UV protecting efficacy of formulations using a UV light meter.

2. MATERIALS AND METHODS

2.1 Plant material

Leaves of *Pisonia grandis* R.Br were collected from local areas of Coimbatore district of Tamil Nadu and authenticated by taxonomist, Dr. C. Kunhikannan, Scientist D, Biodiversity Division, Institute of Forest Genetics & Tree Breeding, Coimbatore. The collected plant material was shade dried, pulverized and used for the study.

2.2 Extraction of plant material

The dried plant material (100 g) was extracted with ethanol for 6h under reflux. The filtrate was concentrated and macerated with petroleum ether. The petroleum ether layer was separated to get defatted ethanol extract (DW). This extract was further macerated with chloroform. The chloroform layer was separated to yield doubly dewaxed ethanol extract (DDW).

2.3 Preparation of sunscreen lotion

The sunscreen lotion was prepared by the method of **Jayanthi and Lalitha, 2014**.^[14] Glycerol and water in 1:10 ratio constituted the aqueous phase and emulsifying wax (100 mg) comprised the oil phase. The plant extract (100 mg) was added to the oil phase followed by the addition of aqueous phase with continuous stirring until homogeneity and heated to ~80°C. The lotions prepared with extracts DW and DDW were designated as DWP and DDWP respectively.

2.4 Measurement of UV protecting efficiency by Transpore tape method

The UV protecting ability of the sunscreen lotions was tested by Transpore Tape method^[14] using Lutron UV-340A light meter. The lotions at varying concentrations (50, 40, 30, 20 and 10 mg) were coated uniformly onto the tape over an area of 1 cm². After 20 min, the tape was placed over the UV sensor probe and the reading noted in both daylight and UV light (365 nm). The amount of UV rays falling on the UV sensor is a measure of the UV protective ability of the lotion. Lower the absorbance, higher is the UV protecting capacity of the lotion.

3. RESULTS

3.1 UV protection ability of sunscreen lotions DWP and DDWP

The UV protecting ability of the lotions DWP and DDWP expressed in units of transmittance increased with increase in concentration in both daylight and UV light (365nm) (Tables 1 and 2). This might be due to the increase in concentration of the active ingredients spread over an equal area (1 cm²).^[14] UV protecting ability of the sunscreen lotion DDWP was higher compared to that of DWP. This may be attributed to the difference in the phytochemical constituents of the extracts. Dewaxing of the ethanol extract would have resulted in the elimination of non-polar compounds in the extract resulting in relatively higher proportion of polar constituents in the extract DDW.

Table 1: UV transmittance of DWP and DDWP at daylight in $\mu\text{W}/\text{cm}^2$

S.No	Lotions	Transmittance of the sunscreen lotions ($\mu\text{W}/\text{cm}^2$)				
	Concentration of the sunscreen lotion (mg)	50	40	30	20	10
1	DWP	116	207	388	418	461
2	DDWP	114	175	186	252	269

Table 2: Transmittance of DWP and DDWP at UV (365 nm) in $\mu\text{W}/\text{cm}^2$

S.No	Lotions	Transmittance of the sunscreen lotions ($\mu\text{W}/\text{cm}^2$)				
	Concentration of the sunscreen lotion (mg)	50	40	30	20	10
1	DWP	133	191	245	262	316
2	DDWP	93	148	150	210	234

4. DISCUSSION

In vivo methods together with *in vitro* methods have been adopted to test the UV protecting ability offered by the sunscreen products. Most of the published test methods adopt an *in vivo* approach based on measurements on human skin, and are time-consuming, expensive and ethically questionable. Therefore, researchers are keen on constructing an *in vitro* method capable of correlating well with *in vivo* methods of measurement of Sun Protection Factor (SPF).

In the present study, sunscreen lotions prepared with dewaxed ethanol extract of *Pisonia grandis* were tested for their photoprotective ability using an UV light meter. The extracts of this plant exhibit antioxidant activity.^{[12][15][16]} Antioxidants help the body's defense mechanism to protect against the damage caused by the free radicals and plants with good antioxidant potential exhibit good UV protecting ability. Quercetin, a flavonol present in this plant^[7] has anti-inflammatory and antioxidant effects^[17] and may contribute to the antioxidant potential of the plant. Allantoin, a biomolecule recently reported from this plant has been reported to possess UV protecting ability.^[12] Hence it can be proposed that the biomolecules allantoin and quercetin present in the extracts of *P. grandis* might be largely contributing to its UV protecting ability.

5. CONCLUSION

Sunscreen lotions prepared with the extracts of *Pisonia grandis* demonstrated UV protecting ability of the plant. It is proposed that allantoin and quercetin present in the extracts of *Pisonia grandis* may contribute to the UV protecting ability of the formulated sunscreen lotions.

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