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Phytochemical Profile and Sun Protection Efficacy of whole plant of *Saccharum spontaneum* Extracts

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ABSTRACT
Plant extracts have been evaluated to be potential sunscreen ingredients due to their antioxidant activity and capacity to absorb ultraviolet radiation. The aim of the current study is to analyze the sun protection factor activity of several extracts of *Saccharum spontaneum*. Whole plant of *Saccharum spontaneum*was extracted using water, chloroform and ethanol applying the method of the cold maceration. Preliminary phytochemical screening of *Saccharum spontaneum* extracts was studied. Sun-protective activity of the various *Saccharum spontaneum* extracts was evaluated by determining the sun protection factor utilizing the UV spectroscopic method. The phytochemical screening showed the presence of various phytoconstituentsin all extracts of *Saccharum spontaneum*. The sun protection factor of the different extracts were found to be, 3.728±0.016, 2.339±0.003, and 9.402±0.022 respectively. This result implies that the extracts may be used in various ratios and combinations to produce photoprotective formulations that have a synergistic or additive impact.

Keywords: *Saccharum spontaneum*, Sun protection factor, UV radiation & Mansur equation

INTRODUCTION

The human skin serves as the body's initial line of defence against external threats. The skin protector can be affected by prolonged exposure to radiation, heavy metals, and pathogens on the external surface of the body[1]. It is inevitable to be exposed to sunlight in a tropical nation like Indonesia. All year long, the sun shines. It shines brightly until the temperature reaches 50°C, even in the summer. Dehydration from the heat can affect the skin, making it dry and more vulnerable to sunburn[2].

UV radiation, one type of electromagnetic radiation found in sunlight, has the ability to excite electrons in skin material from their ground state to their excited state. This damages the skin's defense system and causes aberrant tissue to develop[3]. Exposure to sun rays may prompt skin harms incorporates burns from the sun, skin malignancy, oxidative harm to skin cells, erythema, inflammation, hyperpigmentation disorders, wrinkle formation and immunosuppression[4]. Solar ultraviolet (UV) radiation is separated into three areas, UV-C 290–200 nm, UV-B 320–290 nm, and UV-A 400–320 nm [5]. UVC radiation is filtered by the climate prior to arriving at earth but radiation from UVB may still pass through the ozone layer and is liable for skin harm through burn from the sun. Moreover, UV-A radiation can arrive at the more profound layers of epidermis and dermis, and the harming impacts incite untimely skin maturing.It promotes reactive oxygen species (ROS), which leads to oxidative stress in the skin and other tissues, indirectly damaging DNA . UVA increases the percentage of inflammatory cells in the dermis while reducing the number of antigen-presenting cells. UVB rays cause sunburn and DNA strand breaks. It produces pyrimidine dimer mutations, which are linked to non-melanoma skin cancers[6].

Presently, there are a few sunscreen formulations accessible in the market as creams, gels, oils, treatments, moisturizers, ointments, margarines also, waxes. Synthetic sun screens are for the most part strong, quick acting and give wide range assurance from sun powered UV beams, yet, are generally costly and actuate unacceptable side effects (Photoaging, ocular damage,immunosuppression and skin cancer)[7].

Natural compounds extracted from plants have been recently considered as potential sunscreen assets due to their bright beam ingestion in the UV spectrum and their antioxidant activity. Herbal sunscreens are moderately cheap, reasonable and safe[8]. Various types of antioxidants such as vitamins, flavonoids, polyphenols and carotenoids show protectant activity against UV radiation[9]. There are different bioactive compounds responsible for skin protection against UV radiation are vitamin C and vitamin E. quercetin, lycopene, beta-carotene, resveratrol, phenolic compounds which act as antioxidant and protect leaf from photo damage. Various physical sunblock such as titanium dioxide, zinc oxide are also used. Besides that, the skin's natural sun blockers are lipids, proteins and nucleotides[10].

So, research on the utilization of herbal ingredients focusing on decrease of skin irritation and other destructive impacts related with sunscreens is consistently expanding. The viability of a sunscreen is generally communicated by sun protection factor (SPF) [11].

The UV energy required to produce a Minimal Erythema Dose (MED) on protected skin to the UV energy required producing a minimal erythema dose on unprotected skin is known as SPF. The term "Minimum Erythema Dose" (MED) refers to the amount of UV radiation needed to cause a minimal erythema on exposed skin[12]. A product's effectiveness in avoiding sunburn increases with its SPF level. Photo testing on human volunteers can be used to measure the level of sun protection provided by sunscreen against UV radiation exposure[13].

Sunscreen is one of the substance that helps to prevent from sunlight and protect the body from sunburn. In spite of dry out, scaly skin, sunscreen lotion may protect against (UV) A and UV B, which can be harmful to skin health[14]. Due to the sensitivity of skin, the active substance that are natural should be used in skin care application. As, it is eco-friendly, safer and has no side-effects[15]. Futhermore, the natural substance has various medical benefit such as antioxidant, wound healing, antimicrobial, antibacterial and dental therapeutic treatment etc. Artificial active chemicals have the potential to produce discomfort by stimulating the skin, but they can also induce diseases, cancer, damage to nerve cells, and disturbance of the nasal mucous membranes. Two kinds of UV filters are currently being used in sunscreens for organic (chemical) filters, e.g. octyl methoxycinnamate, benzo- phenone-3, which is responsible for neurotoxicity[15]. Antioxidant capacity contributes significantly to the photo protective action of sunscreen[16].

Previous studies have shown that *Amaranthus virdis* and *Solanum nigram* contain high levels of flavonoids, specifically quercetin and rutin. *Amaranthus virdis* and *Solanum nigram*, the two plants, both produced excellent UVR blocking. However, it was shown that methanolic extracts were more effective than aqueous extracts. Compared to *Solanum nigram*, the extract from Amaranthus virdis has a greater flavonoid and phenolic concentration and offers superior UVR blocking[17].

Extracts from *Polyalthia longifolia* have sunprotective properties. The SPF value of the *Polyalthia longifolia* bark extracts in ethanol, water, and Chloroform was measured using a UV spectrophotometer. Because of its flavonoid content and ability to act as sunscreen, a number of extracts from this plant find extensive use in skin cosmetics. It is suggested here that *Polyalthia longifolia* bark extracts be used to raise the SPF level of other sunscreen formulations[18].

Saccharum spontaneum Linn.; Synonyms-wild cane, wild sugar cane, Family-Poaceae. This is common in Andhra Pradesh and the Vellore district of Tamil nadu, and it can be found near riverbanks and in the ancient world's tropical regions[19]. It grows as a weed on waste land. In India, it is regarded as a valuable therapeutic herb in traditional medical systems[20].Presence of antioxidant-rich compounds such as flavonoids, phenolic acids, tannins, coumarins, terpenoids, alkaloids,quinones and other metabolites, the *Saccharum spontaneum* plant has a high potential for acting as a natural antioxidant[21,22].

Since the majority of diseases are caused by free radicals, antioxidant qualities are linked to a variety of biological activities, including hepatoprotective, anti-arthritic, and anticancer effects. According to research, *Saccharum spontaneum* has a wide range of pharmacological properties, including anti-inflammatory cytotoxicity, anti-diarrheal,antibacterial, antifungal, anti-urolithiasis, and anti-psychotic effects. The existence of several active ingredients and their historical applications serve as a foundation for additional research into its pharmacological properties and mechanism of action[23].

MATERIAL AND METHODS

Material

Whole plant of *Saccharum spontaneum* were collected from Khatauli, Gangnahar,UP.Authentication of the plants was done by Botanical Survey of India, Noida. U.P **(BSI/BGIR/1/TECH./2024/98).** Whole plantof *Saccharum spontaneum*were dried under shade segregated, pulverized by mechanical grinder and passed through a 40 mesh sieve. Ethanol, Chloroform & other chemicals used in pharmacognostical study were purchased from Kumar chemical, soot ki mandi,Kasganj-207123 (U.P.).

Extraction of *Saccharum spontaneum*

Saccharum spontaneum was accumulated and thereafter, it was washed and cleaned with tap water. Cutter was used to cut parts pf plant into smaller pieces. These pieces were dried in air for 8 d Using cold maceration method, *Saccharum spontaneum* powder (100 g) was extracted with 1000mL of different solvent (water, chloroform and ethanol) for 72 h[24]. Extraction was filtered by Whatmann filter paper then evaporated to dryness using rotary evaporator. After this process, the extract obtained was dark in colour. This was kept in an air tight container. This container is kept for refrigeration at 4°C[25].

Preliminary phytochemical screening of *Saccharum spontaneum*extracts

Carbohydrates, alkaloids, tannins, glycosides, flavonoids, phenol and saponin, were identified by general tests conducted according to the previously mentioned protocols[26]**.**

Using Mansur equation method for in vitro estimation of the SPF of extracts

Mansur's method was used to calculate Sun protection factors (SPFs). After weighing the 0.2 g extract (water, chloroform and ethanol), the mixture was transferred to a 100 ml volumetric flask, diluted with ethanol to volume, and filtered. Initially, 10ml of the mixture was discarded. From the remaining mixture, 25ml aliquot was transferred to volumetric flask of volume 50ml. It is further diluted with 25ml of ethanol. The resulting mixture had volume of 50ml. Prior to UV spectrophotometer measurement, the ethanol was used to dilute the final concentration of the sample. Three readings were obtained for sample absorbance at each wavelength between 290 and 320 nm in the UV-B wavelength band at intervals of 5 nm[27]. Using Mansur equation, the sunprotective factors were calculated-

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

Where CF is the correction factor (10), EE (λ) is the erythmogenic effect of radiation with wavelength λ, Abs (λ) is the spectrophotometric absorbance values at wavelength λ. The values of EE x I are constants.

Statistical analysis

The mean ± standard deviation is used to present the data. Every experiment was conducted in triplicate to ensure accuracy.

RESULT

Preliminary phytochemical screening of extract

Terpenoids, steroids, fatty acids, glycosides, flavonoids, carbohydrates and phenolic compounds were found in the preliminary phytochemical investigation. These constituents have long been known to affect the medicinal properties of plants. It was discovered that *Saccharum spontaneum* extracts included a variety of secondary metabolites **(Table1)**.It has been demonstrated that every extract of *Saccharum spontaneum* contains tannins, flavonoids, and phenols with the ability to scavenge free radicals.

Table 1. Preliminary phytochemical screening of *Saccharum spontaneum* extracts

Chemical Constituents	**Aqueous Extract**	**Chloroform Extract**	**Ethanol Extract**
Alkaloids	+	-	+
Glycosides	+	-	-
Flavanoids	+	-	+
Carbohydrates	+	-	+
Saponins	+	+	+
Phenolic Compound and Tannins	+	+	+
Test for protein	+	+	+
Test for oils & fats	-	-	-
Test for amino acid	-	-	-
Test for resin	-	-	-

Present (+), Negative (-).

The sun protection factor of *Saccharum spontaneum*s

Using an in vitro technique, the spectrophotometric approach was used to measure the sun protection factor of *Saccharum spontaneum* extracts. The absorbance properties of the sample solutions were measured using the Mansur equation approach. The extract's absorption profiles, which highlight the samples' unique UVB absorption, are displayed in **Figures 1-.** UV-B was chosen for SPF testing in this study because it happens more often during the day and exposes people to it for longer periods of time. **Table 2** displays the *Saccharum spontaneum* extracts' SPF activity data. The SPF values of, water extract (3.024±0.016), chloroform (2.159±0.003), and ethanolic extract (9.39±0.022) were determined for the various extracts.

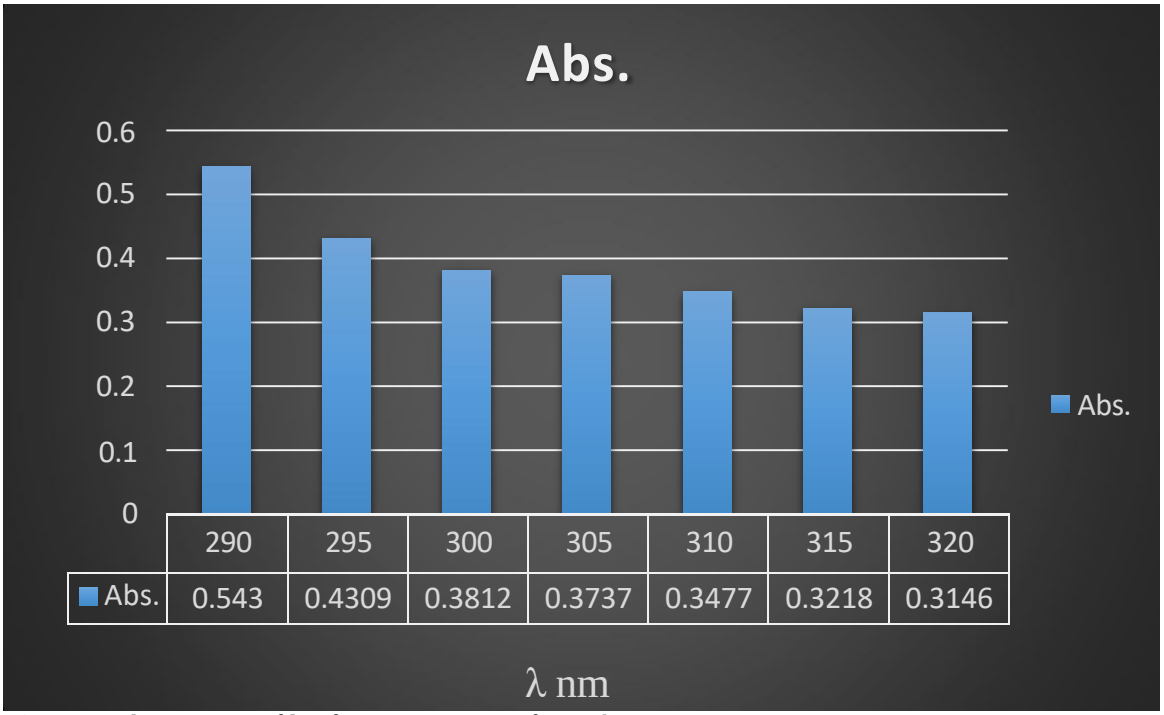

Figure 1. Absorption profile of aqueous extract of *Saccharum spontaneum.*

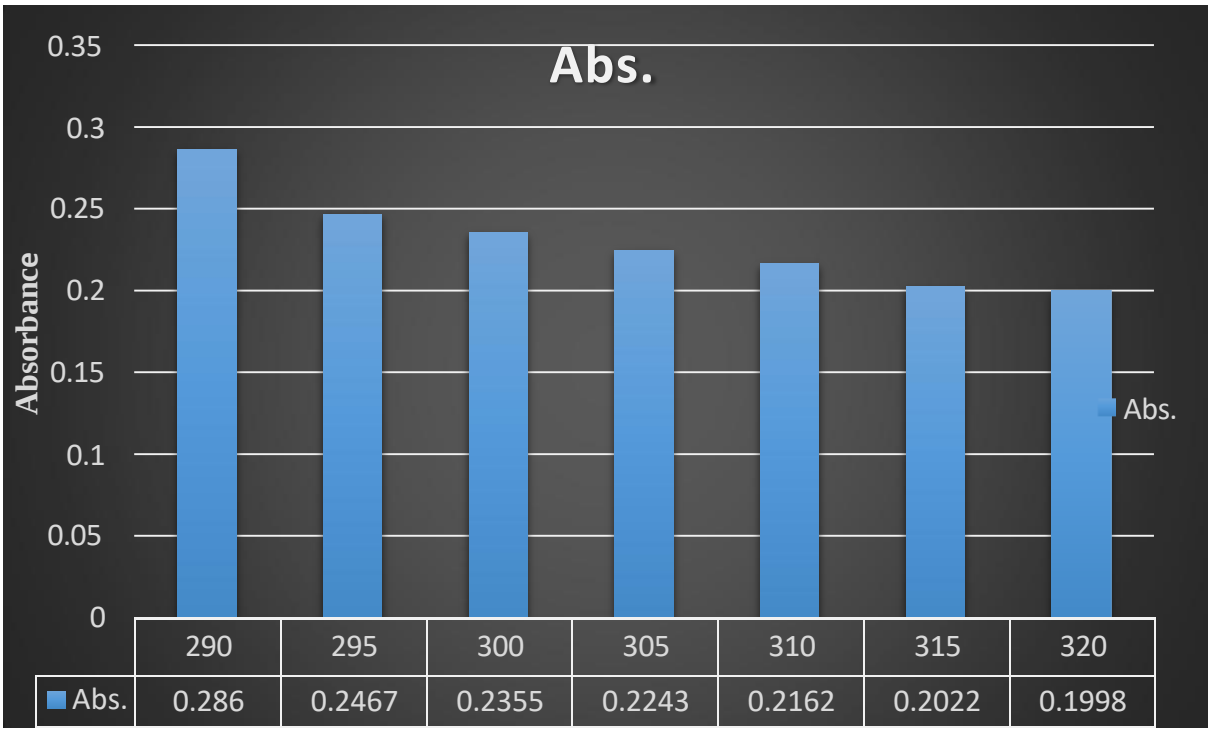

Figure 2. Absorption profile of chloroform extract of *Saccharum spontaneum.*

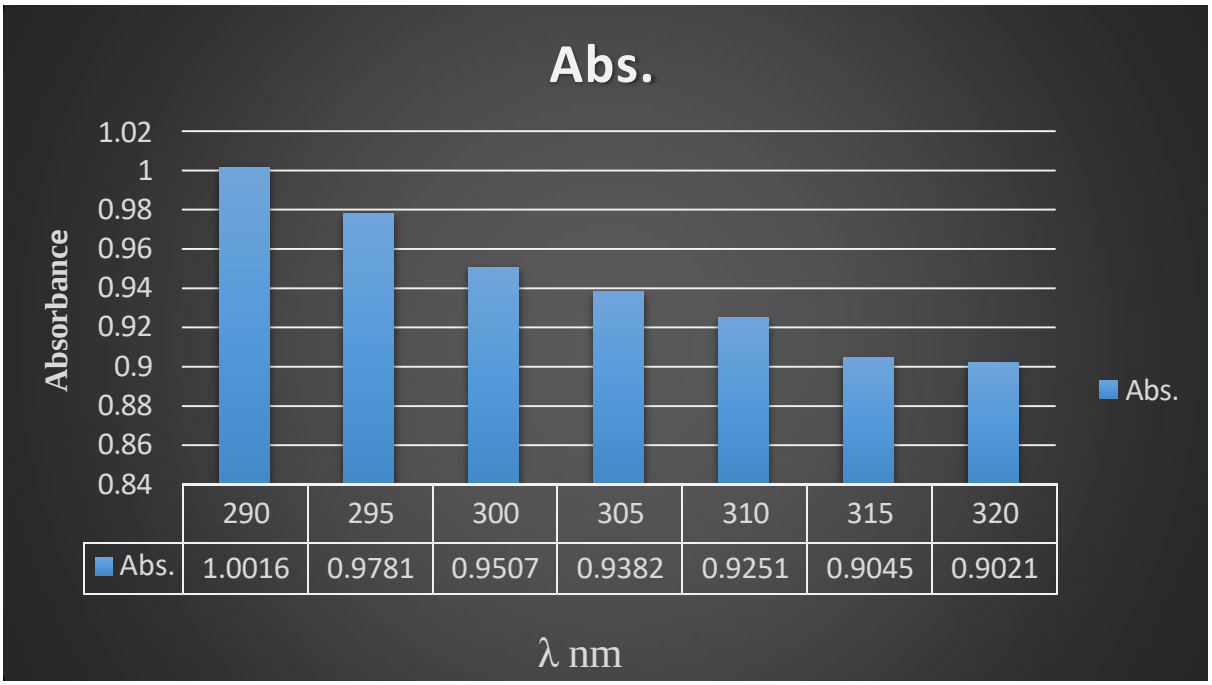

Figure 3. Absorption profile of ethanol extract of *Saccharum spontaneum.*

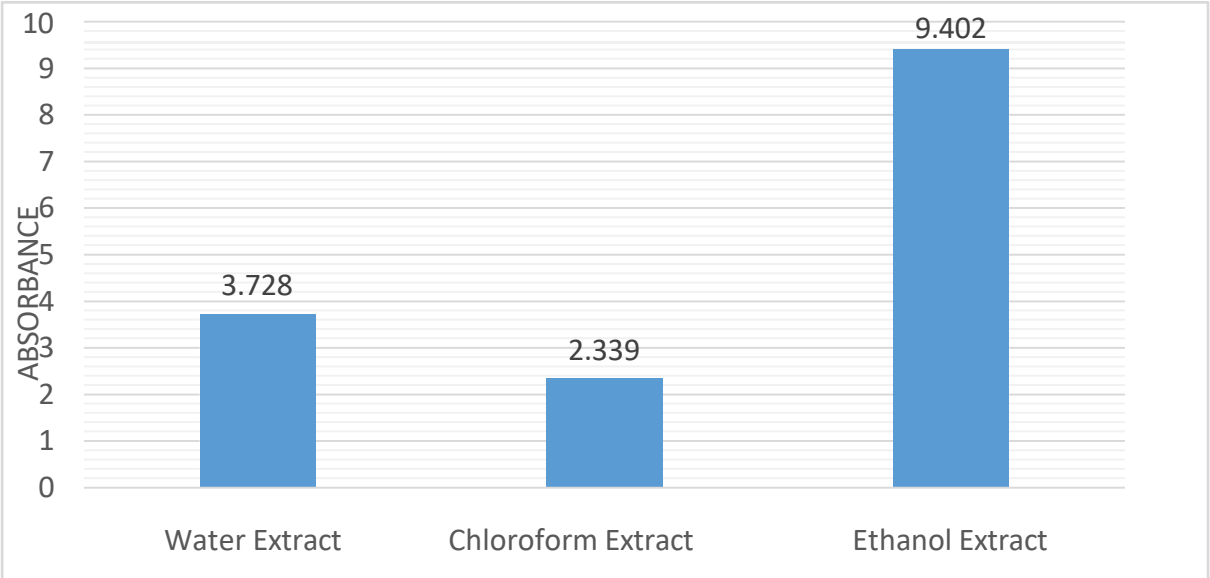

Figure 4: Comparative sun protection factor values of aqueous, chloroform, and ethanol *Saccharum spontaneum* extracts. UV absorbance was measured between 290 and 320 nm with a 5 nm interval according to the Mansur equation.

Table 2. Sun protection factor values of all extracts of *Saccharum spontaneum* plant

Type of extract	**Sun protection factor**
Water	3.728±0.016
Chloroform	2.339±0.003
Ethanolic	9.402±0.022

DISCUSSION

The SPF value of water extract was the lowest, while the SPF values of Chloroform extract and ethanol extract were the greatest, respectively. This shown that, when applied to cosmetics in its refined form, the extract may be an efficient shield against UV radiation that damages skin. Numerous studies have demonstrated the function of flavonoids and phenolics in UV protection. The ethanolic extract of *Saccharum spontaneum* extract can be utilized as a photoprotective filter or to improve the sunscreen effect of cosmetic formulations, according to the study's results.

CONCLUSION

According to this study, extracts from *Saccharum spontaneum* show sunprotective properties. The SPF value of the *Saccharum spontaneum* water, chloroform and ethanol extracts was ascertained using the UV spectrophotometer. Because of its flavonoid content and ability to act as sunscreen, a number of extracts from this plant find extensive use in skin cosmetics. It is proposed here that other sunscreen products' SPF value can be increased by using extracts of *Saccharum spontaneum*.

Conflict of Interest

The authors declare no conflict of interest.

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