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Anti Solar Activity of *Costus Speciosus* Leaves of Sikkim Himalayas: Effects of Time & Temperature on Extraction Process

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Abstract **Original Research Article**

It is known that pharmacological action of a plant depends on time and temperature of extraction process. Recently we have noted anti solar activity of ethanol extract of *Costus speciosus (C. speciosus)* leaves of Sikkim Himalayas. Aim of the present work was to note effects of time and temperature of the extraction process on anti solar activity of *C. speciosus* leaves. *C. speciosus* leaves were collected from the local market and identified by the taxonomist. Ethanol extracts of the leaves were prepared for 15, 30, 45, 60, minutes at temperatures 30, 40, 50, 60 degree centigrade. Anti solar activity of different extracts was checked by a spectrophotometer taking absorption in UV region (200 – 400 nm). Results showed that ethanol extract of *C. speciosus* leaves of 15 minutes at 40^0 C showed maximum anti solar activity. These conditions may be maintained for isolation of the anti solar compound from *C. speciosus* leaves.

Keywords: *Costus speciosus* leaves; Solvent extractions; Time; Temperature; Anti solar activity.

INTRODUCTION

Extraction process is carried out to demonstrate biological / pharmacological activities of a plant or isolation of active substances from plants and other sources. Time of extraction has great influence on the extracting material. Mahmoud *et al.* showed that forty five minutes extraction was needed to get maximum antioxidant activity of one species of Lavandula [1]. Effect of duration time of maceration on nitrate content of *Vernonia cinerea* (L.) was studied by Chaowalit and Chitradee [2]. Authors opined that sixty minute maceration time is needed to get maximum nitrate from *V. cinerea.* Intan *et al.* studied effect of time on the extraction of phenolic compounds and the anti–radical activity of *Clinacanthus nutans* Lindau leaves. The authors observed that an extraction time of 120 min is needed to get maximum phenolic compounds thereby the anti–radical activity of *C. nutans* Lindau leaves [3].

Temperature has also a considerable effect on the rate of extraction of active compounds from plants or other sources. Wingard and Phillips studied effect of temperature the rate of extraction of crude oils from vegetable oil seeds with solvents and noted that rate of extraction varied with temperature [4]. Effect of extraction temperature on the extraction of phenolic compounds from *Orthosiphon stamineus* leaves was studied by Amir *et al.* Authors stated that a temperature of 160^0 C is required for optimum extraction of phenolic compounds from *O. stamineus* leaves [5]. Tan *et al.*, studied effects of temperature on extraction process of total phenolic content of henna (*Lawsonia inermis*) stems and observed that 55^0 C temperature was most suitable for extraction process to collect maximum amount of phenolic compounds from henna [6].

C. speciosus (family, Costaceae) is an erect perennial herb [7] found in moist tropical evergreen forests [8]. The plant is edible. Other names of the plant are Channakoova in Malayalam, Kostam in Tamil, keu in Bengali and Hindi, Kashmeeramu in Telegu, Kembuka in Sanskrit, Paskarmula in Guajarati, Tara in Assamese, Spiral flag in English etc [9]. Since long *C. speciosus* is used in traditional medicine as drug for skin diseases, cough and cold, rheumatism, diarrhea, fever, bronchial asthma, dysentery, dyspepsia, pneumonia, dropsy, urinary diseases etc [10]. *C. speciosus* has also vast pharmacological activities like anti cancer, anti-inflammatory, anti oxidant, anti

bacterial, anti fungal, anti diabetic, antipyretic, antifertility etc [11, 12].

Recently, we have shown anti solar activity of ethanol extract of *C. speciosus* leaves. Aim of the present work was to see effects of time and temperature on the extraction process to get maximum anti solar activity of *C. speciosus* leaves.

MATERIAL AND METHODS

Plant Material

Leaves of *C. speciosus* were collected from the local market during June – July and authenticated by the taxonomist of the department of Botany of the University of North Bengal, Siliguri. A voucher specimen (No.SM-MB-011) was kept in the department of Medical Biotechnology, Sikkim Manipal Institute of Medical Sciences of Sikkim Manipal University, Gangtok, Sikkim, India for future reference.

Fig-1: *Costus speciosus* leaves

Test Drug

Leaves of *C. speciosus* were washed thoroughly under tap and then by distilled water. Leaves were then shed dried and powered. The powder, used as test drug, was stored desiccated at 4 ^{0}C until further use.

Solvent Extraction

Test drug (100g) was extracted with 500 ml of ethanol. Ethanol was chosen as solvent because in our earlier experiments we noted that ethanol extract of *C. speciosus* leaves had maximum anti solar activity.

Effect of time on extraction process

Extraction processes were done separately for 15, 30, 45 and 60 minutes.

Effect of temperature on extraction process

In separate experiments extraction processes were conducted at 30, 40, 50 and 60 degree centigrade.

The extract was filtered and the filtrate was evaporated to dryness *in vacuo* with rotary evaporator. This was applied separately for all extracts. Brown masses obtained.

Anti solar activity

10 mg of this mass was dissolved in 100 ml distilled water. The solution was processed in a spectrophotometer for UV ray absorption at the range of 200-400 nm.

Chemicals

Chemicals required for the study were purchased from Loba Chem. Lab, Himedia Lab, India and from Merck, Germany

STATISTICAL ANALYSIS

All experiments were conducted for three times. Data were analysed statistically by SPSS 20. The statistical significance between UV absorption spectra of different extracts was evaluated with Duncan's multiple range test (DMRT). 5% were considered to be statistically significant [13].

RESULTS

Effect of time on extraction process for determination of anti solar activity of *C. speciosus* leaves is shown in Table – 1. UV ray absorptions of 15 minutes ethanol extract of *C. speciosus* leaves at 200 nm, 250 nm, 300 nm, 350 nm and 400 nm were 1.4, 0.91, 0.86, 0.77, 0.62 respectively. For 30 min extraction time the values came 1.3 (200 nm), 0.90 (250 nm), 0.84 (300 nm), 0.75 (350 nm) and 0.60 (400 nm). UV ray absorptions of 45 minutes ethanol extract of *C. speciosus* leaves at 200 nm, 250 nm, 300 nm, 350 nm and 400 nm were 1.4, 0.90, 0.85, 0.76, 0.61 respectively and for 60 min extraction time the values came 1.3 (200 nm), 0.92 (250 nm), 0.87 (300 nm), 0.75 (350 nm) and 0.58 (400 nm).

Effect of temperature on extraction process for determination of anti solar activity of *C. speciosus* leaves is shown in Table – 2. UV ray absorptions of ethanol extract of *C. speciosus* leaves at 30^0 C for 15 min were 1.0, 0.81, 0.73, 0.67, 0.50 at 200 nm, 250 nm, 300 nm, 350 nm and 400 nm respectively. For temperature 40^0 C under same conditions values came 1.2 (200 nm), 0.90 (250 nm), 0.86 (300 nm), 0.75 (350 nm) and 0.60 (400 nm).UV ray absorptions of ethanol extract of *C. speciosus* leaves at 50^0 C for 15 min were 1.2, 0.90, 0.85, 0.75, 0.58 at 200 nm, 250 nm, 300 nm, 350 nm and 400 nm respectively. For temperature 60^0 C under same conditions values came 1.2 (200 nm), 0.91 (250 nm), 0.76 (300 nm), 0.74 (350 nm) and 0.60 (400 nm).

Table-1: Anti solar activity of ethanol extract of *C. speciosus* leaves: Effect of time on extraction process

Solvent	Time (minutes)	Anti solar activity (absorptions at 200/ 250/ 300/ 350/ 400 nm)
Ethanol	15	1.4/ 0.91/ 0.86/ 0.77/ 0.62
	30	1.3/ 0.90/ 0.84/ 0.75/ 0.60
	45	1.4/ 0.90/ 0.85/ 0.76/ 0.61
	60	1.3/ 0.92/ 0.87/ 0.75/ 0.58

Table-2: Anti solar activity of ethanol extract of *C. speciosus* leaves: Effect of temperature on extraction process

Solvent	Degree centigrade	Anti solar activity (absorptions at 200/ 250/ 300/ 350/ 400 nm)
Ethanol	30	1.0/ 0.81/ 0.73/ 0.67/ 0.50
	40	1.2/ 0.90/ 0.86/ 0.75/ 0.60
	50	1.2/ 0.90/ 0.85/ 0.75/ 0.58
	60	1.2/ 0.91/ 0.76/ 0.74/ 0.60

DISCUSSION

It appears from figure -2 that ethanol extracts of *C. speciosus* leaves for the periods of 15 min, 30 min, 45 min and 60 min exert anti solar activity. All extracts absorbed UV rays at 250 nm, 300 nm, 350 nm and 400 nm wave lengths. Maximum absorption, however, was found at 200 nm. It was also found that UV ray absorption values of 15 min ethanol extract of *C. speciosus* leaves were comparatively higher than that of 30 min, 45 min and 60 min ethanol extracts but the values were not statistically significant (Figure-3).

Figure-4 indicates effect of temperature of ethanol extract of *C. speciosus* leaves on anti solar activity. Ethanol extracts done at 30^0 C, 40^0 C, 50^0 C and 60^0 C absorbed UV rays at 200 nm, 250 nm, 300 nm, 350 nm and 400 nm wave lengths. Maximum absorption for all extracts was found at 200 nm. Ethanol extract of *C. speciosus* leaves done at 40^0 C had more UV ray absorption capacity than that of 30^0 C extract but the results were not statistically significant. Ethanol extract of *C. speciosus* leaves done at 50^0 C and 60^0 C had more or less same UV ray absorption capacity when compared with that of ethanol extract done at 40^0 C (Figure-5).

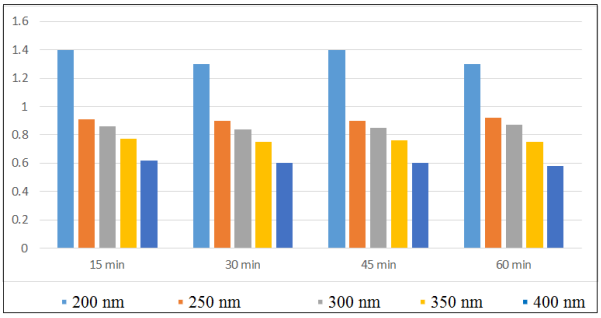

Fig-2: Anti solar activity of ethanol extract of *C. speciosus* leaves: Effect of time on extraction process

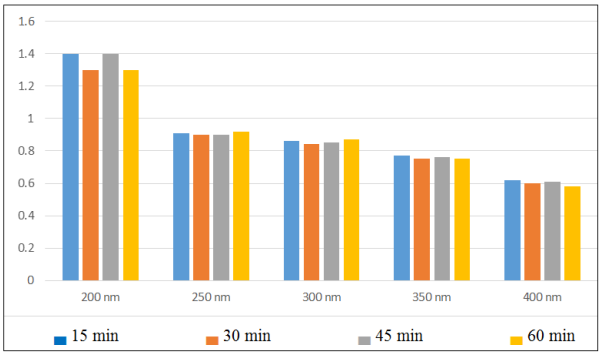

Fig-3: Comparison of anti solar activity of time based ethanol extract of *C. speciosus* leaves

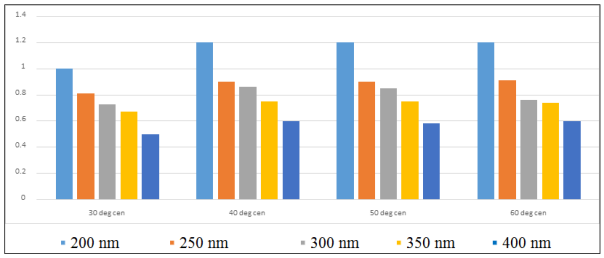

Fig-4: Anti solar activity of ethanol extract of *C. speciosus* leaves: Effect of temperature on extraction process

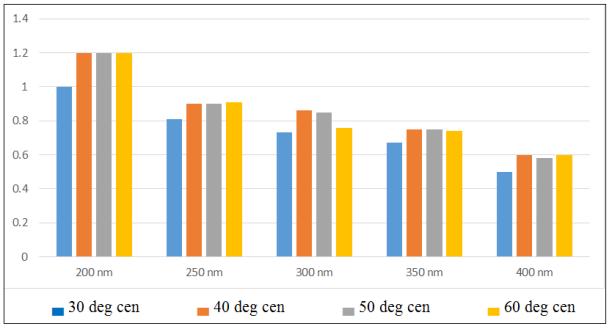

Fig-5: Comparison of anti solar activity of temperature based ethanol extract of *C. speciosus* leaves

Reports are available on effect of time and temperature on extraction process [1-6]. In the present work we found that ethanol extract of *C. speciosus* leaves for a period of 15 min at temperature 40^0 C had maximum UV ray absorption capacity.

UV ray is both good and bad for human body. It is needed for synthesis of vitamin D which helps to maintain strong bones. Humans get cutaneous synthesis of vitamin D from solar UV-radiation. This covers almost 90% of the vitamin D requirement in human body. Solar UV radiation is, therefore, good for humans. But this radiation has bad effect too. Skin is severely affected if there is over exposure of UV rays. Pigmentary changes atrophy, wrinkling and malignancy may occur. Basal cell carcinoma or malignant melanoma and skin cancer like squamous cell carcinoma may develop. Solar UV-radiation can cause eye and skin injury, stimulate genetically determined photo sensitivities and photosensitivity reactions to ingested drugs. UV radiation also affects eye. Cornea, the outer protective coating of the eye, may be affected. Painful inflammation of eye is seen and if the eye gets chronic UV exposure, then it lead to formation of cataracts. Over-exposure to UV radiation also changes distribution and function of white blood cells in human body. This may cause harmful suppressing effect on the immune system [14, 15].

Under the circumstances efforts are going on to search the sources which can absorb UV radiation. Medicinal plants were found the good source. Many medicinal plants like *Lycopersicon esculantum, Oscimum sanctum, Azadirachta indica, Mentha piperita,* Calotropis gigantean, *Aloe vera, Carica papaya, Phyllostachys pubescens* etc. are now known which can absorb solar UV radiation [16, 17]. Present work has included *C. speciosus* in the list of medicinal plants responsible for absorption of solar UV radiation.

It is known that biological activity of medicinal plants varies with season [18-20]. We are now interested to see the effect of season on solar UV radiation absorption by *C. speciosus* leaves. Work is going on in our laboratory in this direction.

CONCLUSION

Present study confirmed extraction time and temperature for preparation of ethanol extract of *C. speciosus* leaves required for maximum UV radiation absorption. The methodology may be utilized in preparation of sun screen lotions to protect humans from UV radiation.

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Conflict of interest: Nil

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