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Study of Effect of Temperature on Commercial Moisturising Cream by UV-Visible Spectroscopy

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Abstract: ***Skin moisturisation has become a part of our daily skin care routine whether the skin is dry or normal. To keep the skin hydrated moisturising creams are widely used across the world. Antioxidants are important ingredients in commercial cosmetic skin creams. It helps in extending the shelf life of a cream and preventing them from becoming rancid. α-Tocopherol acetate is a popular antioxidant in moisturising skin creams whether it is a herbal moisturising cream or a synthetic moisturising cream. The matrix of cosmetic creams is very complex due to the presence of several ingredients and therefore their extraction needs a special process. In this paper concentration of antioxidant in herbal and synthetic moisturizing creams have been calculated at various temperatures and at a specific time period by UV-Visible spectroscopy. This method is simple, sensitive, cost effective and reliable.***

Keywords: UV-Visible Spectroscopy, Moisturising cream, Tocopherol acetate, Antioxidant

I. INTRODUCTION

Healthy skin requires moisturisation. Dryness makes skin rough, leads to discoloration and increased flakiness. Moisturisers help prevent one's skin from becoming dry by acting as a barrier and restricting water evaporation so that the skin's moisture is maintained and improved [Fabrizio et al., 2018]. Thus, moisturising creams play an important role in keeping the skin smooth and soft, increasing skin hydration, and improving the skins optical characteristics. There are a variety of skin creams available in the Indian cosmetic market.

They contain trendy ingredients and often make attractive claims. Though synthetic moisturising creams are popular among consumers, herbal moisturising creams are also making their place in the market. Faith in nature has changed the perception of consumers towards herbal products. Consumers are becoming conscious and prefer to buy product which will naturally benefit the skin and are free from harmful chemicals. Herbal Cosmetics, referred as products, are formulated, using various permissible cosmetic ingredients to form the base in which one or more herbal ingredients are used to provide, defined cosmetic benefits only, and shall be called as "Herbal Cosmetics"[Laxmi & Harshal, 2015, Shweta et al., 2011, Kumar et al., 2012].

Antioxidants are one of the prominent ingredients in moisturising creams. Both synthetic and herbal moisturising creams contains antioxidant in their formulation. Antioxidants are not only effective in protecting the skin from oxidative stress from environment but it also helps in extending the shelf life of cream by retarding oxidation of oil and fat and preventing them from becoming rancid. They also fight against deleterious effect of free radicals. The ability of vitamin E ester to penetrate the epidermis over the counter makes it a prominent ingredient for cosmetic creams [Anca Maria & Teodor, 2011, Dolas & Gotmare. 2020]. There are several antioxidants used in cosmetic creams some synthetic antioxidants like BHA (Butylated Hydroxyanisole) and BHT (Butylated Hydroxytoluene) which may be carcinogenic if used extensively and also cause allergic reaction in the skin (Laxmi et al., 2015, Anca, 2011). α-tocopherol acetate which is ester form of tocopherol is considered as the most stable and safe ingredient in cosmetic creams as an antioxidant [Anca et al., 2012, Dolas & Gotmare. 2021].

The matrix of cosmetic skin cream is very complex as it contains several ingredients of different functional groups and hence extraction of a specific ingredient like α-tocopheryl acetate becomes very tedious. Large number of ingredients may interfere in the result during the analysis of α-tocopherol acetate using UV-Visible spectroscopy technique. Therefore, an effective extraction process which includes extensive treatments like reflux condensation is required. In presence of α-tocopheryl acetate, bipyridyl, Fe(III) gets reduced to an intense pink coloured Fe(II)-bipyridyl chelate (Khalid et al., 2020).

II. MATERIALS & METHODS

All reagents used were of analytical grade without further purification. α-tocopheryl acetate, potassium hydroxide, glycerol, methanol HPLC grade, ether, anhydrous sodium sulphate, 2,2'-bipyridyl, ferric chloride.

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A. Commercial Cosmetic Products

Two commercial cosmetic (1-herbal and 1-synthetic) moisturising skin creams were purchased from a retail pharmacy in Navi Mumbai, India containing α-tocopheryl acetate without specifying its quantity. Analysis study was performed before reaching the date of expiry. Each cream was stored at 37^0 C and 47^0 C for six days. To evaluate chemical stability samples were taken out at zero-time, 3rd day (72 hours) and 6th day (144 hours). Samples were kept in individual amber-light vial and same vial sample is used throughout the study. The details of the samples are listed below.

Sr. No.	Sample	Abbreviation
1.	Synthetic Moisturising Cream	SA
2.	Herbal Moisturising Cream	HA

TABLE I: List of Studied Samples

B. UV- VIS Spectrophotometer Instrumentation

Spectroscopic study performed on Agilent Carry 100, 4.20 UV-VIS spectrophotometer in a dark room at an ambient temperature. Analysis was performed with 1 cm path length and a pair of matched quartz cuvettes.

C. Extraction Method

1000 mg of sample was transferred into a round bottom flask containing 2 ml of potassium hydroxide solution and 10 ml glycerol. 25 ml of methanol added and mixed well. The solution refluxed on a boiling water bath and transferred into a separating funnel after cooling, extracted it with 50 ml ether and collected ether layer filtered through anhydrous sodium sulphate. Ether layer evaporated to dryness. Reconstituted the residue in a 100 ml standard volumetric flask with methanol.

D. Calibration Standard Preparation

25 mg of α- tocopheryl acetate dissolved in 100 ml methanol. A set of working solution prepared to give concentration ranging from 10 mg/L to 50 mg/L.

E. Procedure

5 ml sample, standard and blank solution taken in 25 ml standard volumetric flask. In each flask added 2ml 0.1 % of 2, 2- bipyridyl prepared in methanol and 1 ml 0.1 % ferric chloride solution prepared in distilled water. Mixed well and diluted up to the mark with methanol. Absorbance recorded at 525 nm against blank.

III.RESULT & DISCUSSION

Figure 1 shows calibration graph of α- tocopheryl acetate constructed over the covered range. Observation and concentration values of sample are shown in table 2

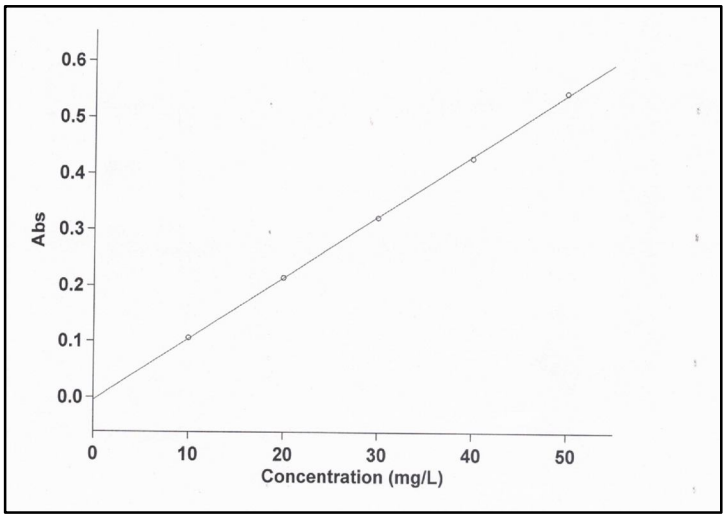


Figure: 1 Calibration Graph for α- Tocopheryl Acetate

Sample	Zero time	3rd Day (72 hour)		6th Day (144 hours)	
		37^0C	47^0C	37^0C	47^0C
SA	0.047	0.043	0.040	0.037	0.033
HA	0.21	0.184	0.162	0.163	0.145

TABLE II: Concentration of α-Tocopherol Acetate in Percentage

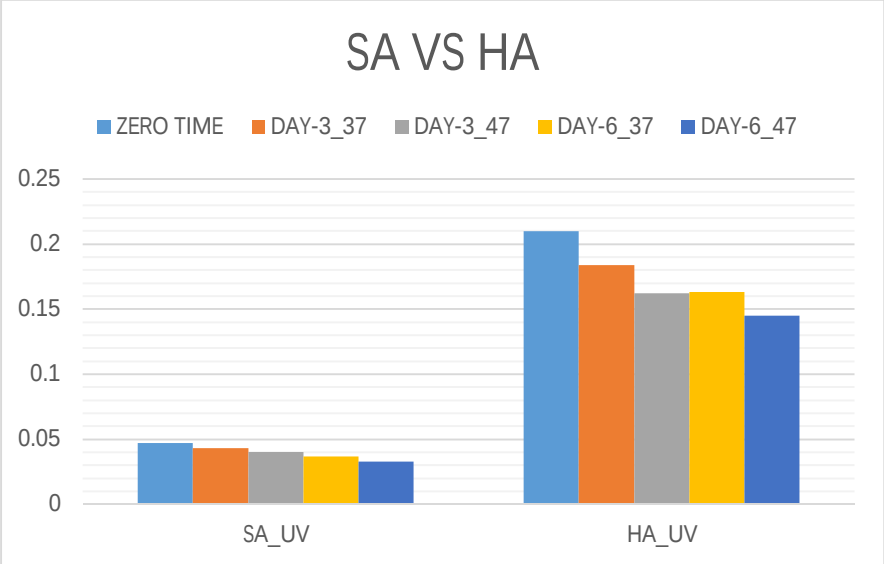


Figure 2: Graphical Representation Of Data

IV. CONCLUSION

The matrix of cosmetic creams is very complex and to extract a specific ingredient like α-tocopheryl acetate from it is a difficult task, therefore it is very important to choose an extraction method which can extract α-tocopheryl acetate with a minimum interference of other ingredients. The method mentioned above is efficient, simple and helpful to extract and determine the concentration of α-tocopheryl acetate. Development of an intense pink colour due to oxidation of α-tocopheryl acetate and reduction of Fe(III) to Fe(II) in presence of 2,2'-bipyridyl makes it a suitable method for UV-VIS Spectrophotometer. From the data in table 2 and graphical representation shown in figure 2 the concentration of α-tocopherol acetate in synthetic moisturizing cream SA is less compared to herbal moisturizing cream HA. It also indicates that α-tocopherol acetate is susceptible at a higher temperature and shows higher degradation at 47^0C compared to 37^0C. In many regions of India temperatures reach 42^0C-45^0C in summer. During summer days, at these temperatures, α-tocopherol acetate may degrade and their antioxidant & preservative properties may be lost. Therefore efficiency of α-tocopherol acetate is questionable.

V. ACKNOWLEDGEMENT

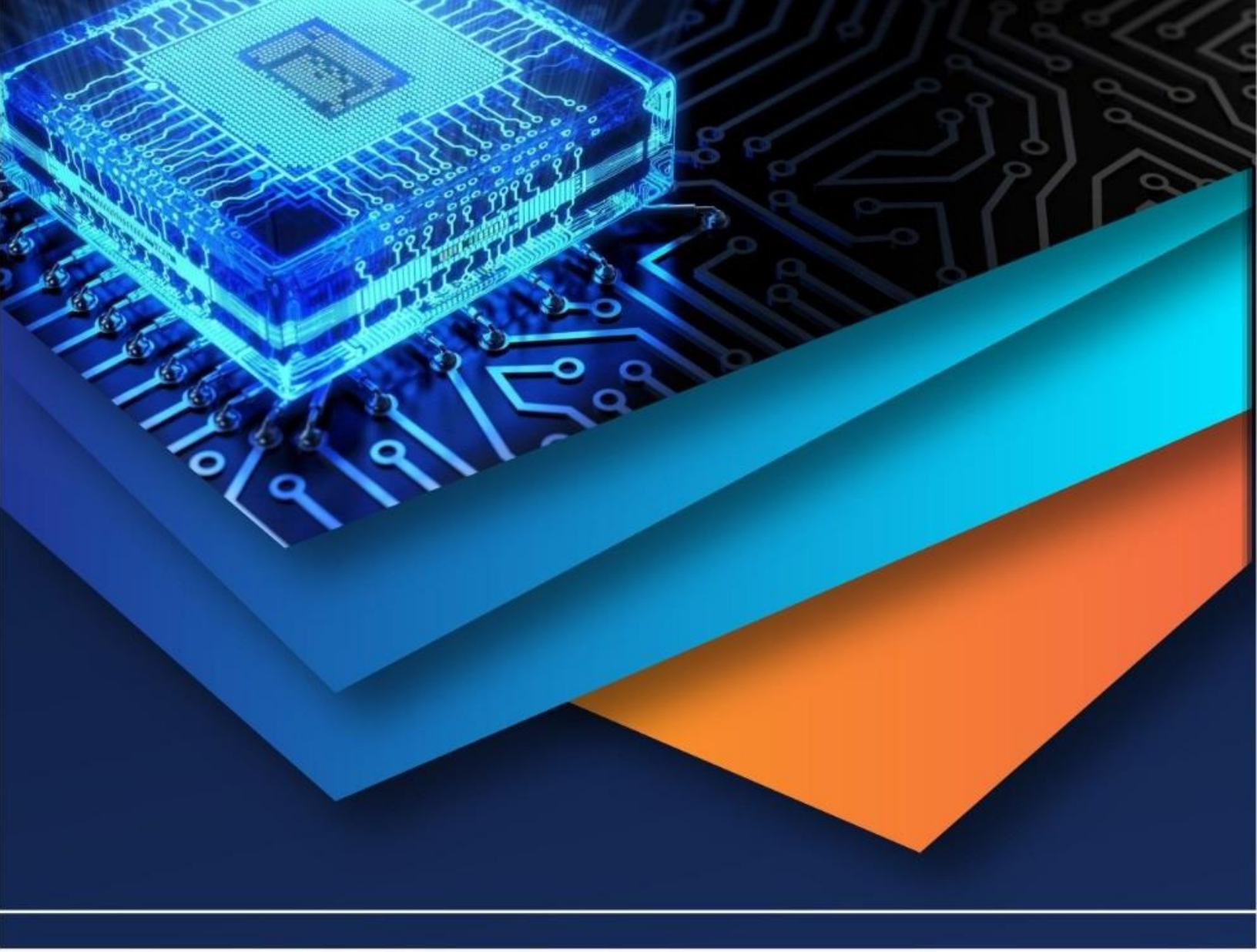
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