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Phytochemical screening of onion skin (*Allium cepa*) dye extract

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Abstract
The phytochemicals are the wide variety of compounds produced by the plants manipulated wisely to use them in dyeing and finishing textile materials to impart antibacterial and colouring property to the textile materials. The antibacterial textiles also play an important role medical textile. Phytochemical screening is an important step which indentifies the presence of compounds in different organic solvents such as ethanol, methanol and using aqueous extracts. In the present study the phytochemical analysis of onion skin extracts was done. The results of the study indicated the presence of tannins, antraquinone, flavonoids, cadiacgycocides and reducing sugars in aqueous medium. FTIR analysis of onion skin dye powder revealed the presence of different functional groups viz. hydroxyl group, methylene–CH- stretch, carbonyl group (C=O) and aldehyde group, C=C stretch, quinone or conjugated ketone and organic sulphates, OH – bend. Among different phytochemicals the antraquinone, tannins and favonoids play an important role in imparting and enhancing the colour to cotton fabric.

Keywords: Phytochemicals, methanol, extract

1. Introduction
Natural dyes can exhibit biodegradability, medicinal properties such as antibacterial property, antioxidant, ultraviolet protection property and generally have a higher compatibility with the environment. The application of eco-friendly natural dyes on textiles has become essential because of the increased environmental awareness and concern to avoid the use of carcinogenic and hazardous synthetic dyes.
Natural dyes are environmental friendly, low toxic and less allergenic. Due to these advantages, over the last decade the use of natural dyes has gained momentum in food, pharmaceutical, cosmetic and textile dyeing industry. The dye-yielding plants, unlike synthetic dyes, may contain more than one chemical constituent, each exhibiting a different colour and properties, operating singly or in combination with different groups, depending on their chemical structure and composition**.** Natural dyes consist of catechins, rosmarinic acid, flavonoids, carotenoids, ascorbic acid and anthocyanin groups in the structure, which show natural anti-oxidant property. Natural dyes have antimicrobial properties and many of these are determined to be resistant to gram-negative bacteria (Islam and Shahid, 2013) [8].
Plant material contains large number of structurally diverse active compounds such as tannins, flavonoids, curcuminoids, alkaloids, and quinines in their extracts, the use of natural colourants offer promise in developing antimicrobial textiles for aesthetic, hygienic and medical applications Bhuyan *et al.* (2016) [7].
Red onion skin (*Alleum cepa)* is a rich source of phenolic compounds, especially of quercetin. The amounts of isolated phenolic compounds and quercetin from onion skin were approximately 3 to 5 times higher as from the onion edible part. Onion skin extracts also exhibited high antioxidant, radical scavenging and antimicrobial activities. The skin of onions is inedible however it contains a dyestuff called Pelargonidin (Skerget *et al.*, 2009, Zubairu and Mshelia, 2015) [9, 6]. In the resent study the onion outer skin was taken as dye material for the dyeing of cotton fabric. Before dyeing application phytochemical screening of the onion skin dye extract was done in three different mediums to know the presence of different bioactive compounds which are responsible for different functions such as antibacterial property and dyeing property.

2. Material and Methods
The phytochemicals analysis tests were carried out for the above mentioned plant extracts using the standard procedures to identify the components.

- **Material:** Onion skin dye powder, Ethanol, Methanol, Reagents.
- **Plant collection (source of plant material):** the outer skin of onion was collected, cleaned

to remove debris and shade dried. After being completely dried, the material was crushed into small pieces, pulverized into coarse powder and stored in a air tight containers free from environmental climatic changes, till usage.

- **Selection of extraction method for natural dye**: Extraction refers to separating the desired colour components by physical and chemical means with aid of solvent. On the review basis three different mediums of extraction were used and one medium of extraction was chosen on the basis of presence of phytochemicals in dye extract, simplicity of process and cost. The extraction of selected dye was done using following methods given by (Lokesh and Kumara-Swamy, 2013) [5]:
  - **a) Aqueous extraction:** Aqueous extraction was traditionally used to extract dyes from plants and other materials. The dye containing material was first broken into small pieces, powdered and sieved to improve extraction efficiency. Aqueous extract was prepared by soaking 10 g of dye powder in 100 ml distilled water, in a stainless steel vessel overnight to loosen the cell structure. The mixture was boiled at 80-85°C for 1 hour to get the dye solution, allowed to stand till it reached to room temperature and filtered to remove non-dye plant remnants.
  - **b) Ethanolic extraction:** Dye powder was soaked in 100% ethanol and heated in a beaker, in water bath at 45-50°C for 1 hour to get the dye solution, allowed to cool at room temperature and then filtered to remove non-dye plant remnants.
  - **c) Methanolic extraction:** 5 g of dye powder was soaked in 100 ml methanol at 45-50°C for 1 hour to get the dye solution and allowed to cool till it reached to room temperature. The solution filtered to remove non-dye plant remnants and was sieved through fine mesh nylon cloth.

The extracts were sieved through fine nylon mesh and filtrate was collected for phytochemical analysis.

- **Methods**
  - **a) Test for alkaloids (Wagner's test):** Alkaloids give reddish brown precipitate with Wagner's reagent. (Solution of iodine in potassium iodide).
  - **b) Test for Flavonoids (Alkaline Reagent Test):** 10 ml of each extract (separately) were treated with few drops of sodium hydroxide solution. Formation of intense yellow, which becomes colour less on addition of dilute acid, indicates the presence flavonoids.
  - **c) Test for Phenolic Compounds (ferric chloride test):** To test the test solution, add few drops of neutral 5% ferric chloride solution. A dark green colour indicates the presence of phenolic compounds.
  - **d) Test for Tannins (lead acetate test):** Few drops of 1% lead acetate were added to 5 ml of plant extract and appearance of yellow precipitate indicated the presence of tannins.
  - **e) Test for Glycosides:** 1 ml of dye extract was added in glacial acetic acid with few drops of ferric chloride followed by adding concentrated sulphuric acid from the walls of the test tube. Appearance of the reddish brown at the junction of two layers and the bluish green colour in the upper layer indicated the presence of cardiac glycosides.
  - **f) Test for terpenoids:** 1ml of extract was dissolved in 1ml of chloroform and 1ml of acetic anhydride was added following the addition of 2ml of concentrated sulphuric acid. Formation of reddish colour indicated the presence of terepenoids.
  - **g) Test for anthraquinones:** 5 ml of dye extract was boiled with 10 ml of sulphuric acid and filtered while hot. The filtrate was shaken with 5 ml of chloroform. The chloroform layer was pipette out into another test tube and 1 ml of dilute ammonia was added. The resulting solution was observed for colour changes. The change in colour indicated the presence of anthraquinones.
  - **h) Test for saponins (froth test):** 5 ml of extract was boiled in 10 ml distilled water in a test tube and was shaken vigorously for about 30 seconds. The test tube was allowed to settle for half an hour, formation of froth indicated the presence of saponins.

- **Fourier Transform Infrared Spectroscopy (FTIR) Analysis** Fourier transform infrared spectroscopy (FTIR) analysis was done to obtain an infrared spectrum of absorption or emission of a solid, liquid or gas. The characterization in terms of interactions and chemical composition of selected natural dye powder (onion skin) was measured using potassium bromide (KBr). FTIR analysis of dye powders was got done from *SAIF PU, Chandigarh*.

3. Results and Discussions

Phytochemical analysis of onion skin extracts using different solvent (aqueous, ethanol and methanol) revealed the presence of various phytochemical. Phytochemical screening of bioactive compounds for three extraction mediums have been analyzed in this tudy and there is wide range of phytochemical compounds present in the three medium as presented in table 1.

Table 1 depicts that the presence of anthraquinone, cardiacgycocids, flavonoids and tannins was observed in all the three medium of extraction whereas the presence of terenoids was found in ethanol and methanol extraction medium. The aqueous and methanol extract exhibited the presence of reducing sugar.

Table 1: Phytochemical analysis of onion skin dye

S. No.	Phytochemicals	Extraction mediums		
		Aqueous	Ethanol	Methanol
1.	Alkaloids	-	-	-
2.	Anthraquinone	+	+	+
3.	Cardiacgycocids	+	+	+
4.	Flavonoids	+	+	+
5.	Phenol	-	-	-
6.	Reducing Sugar	+	-	+
7.	Saponins	-	-	-
8.	Steroids	-	-	-
9.	Tannins	+	+	+
10.	Terenoids	-	+	+

By considering the cost of extraction of dye, simplicity of the method and presence of phytochemicals, the aqueous method of extraction was selected for extraction of dye from plant material for dyeing of cotton fabric for further study. Among these phytochemicals the antraquinone, tannins and favonoids play an important role in imparting and enhancing the colour to cotton fabric. Results are also supported by the finding of

Das *et al.* (2015) [1] that onion is edible and the papery skin of onion is discarded as a waste during consumption of onion as food, but this papery skin contains pelargonidin (tetrahydroxy anthocyanidin) as colouring pigment in its structure. It was also reported by Tepparin *et al.* (2012) [10] that tannins could improve the colour yield and colour fastness properties of the dyed fabrics. Antraquinone and flavonids helps in imparting the colour to any substrate besides this the presence of these phytochemical provided antimicrobial and antioxidant properties.

FTIR analysis of onion skin dye powder: Table 2 comprises the data regarding the Fourier Transformation Infrared spectroscopy (FTIR) analysis of onion skin dye powder which was done to analyze presence of functional groups.

Table 2: FTIR analysis of onion skin dye powder

S. No.	Peak ranges (cm^{-1})	Peaks	Functional groups
1.	3200-3300	3286.52	Hydroxyl group (H-bonded–OH- stretch)
2.	2900-3000	2924.57	Methylene–CH- stretch
3.	1700-1800	1732.61	Carbonyl group, aldehyde group
4.	1600-1700	1645.56	-C-double bond-C stretch/ quinone or conjugated ketone
5.	1400-1500	1423.60	Organic Sulphates
6	1300-1400	1327.59	-OH- bend
7.	1000-1100	1050.57	-C-C- stretch, ethers
8.	700-800	771.70	Skeletal –C-C- vibrations
9.	600-700	635.68	Aliphatic Bromo compounds

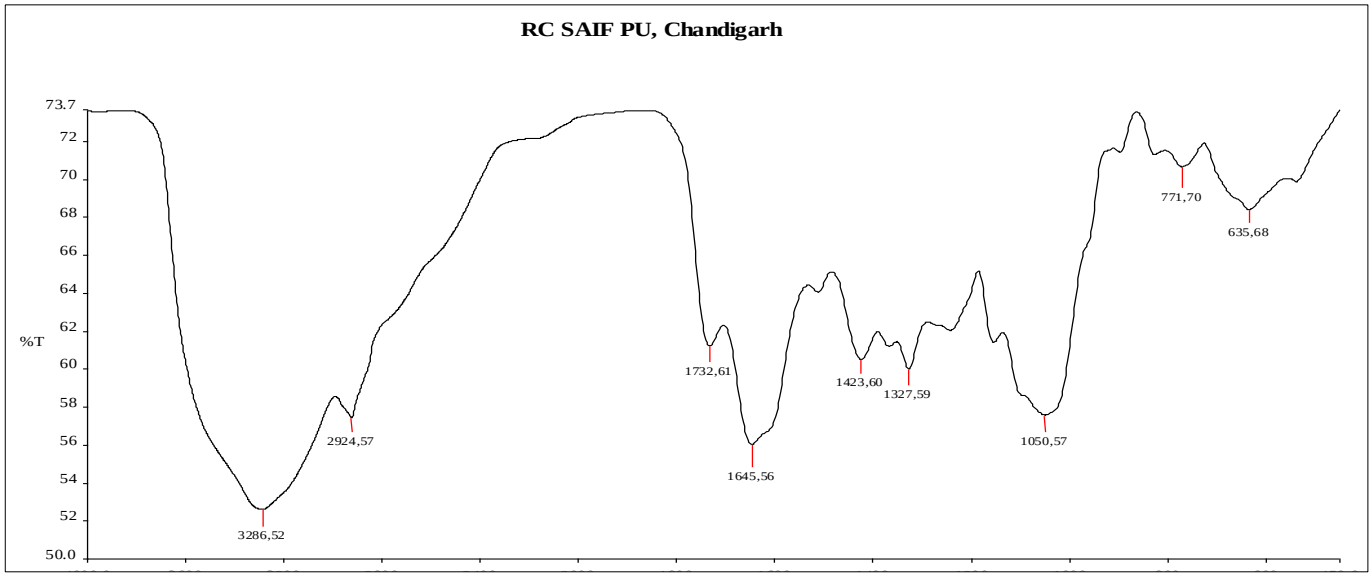

Fig 1: FTIR analysis of onion skin dye powder

FTIR analysis of onion skin dye powder revealed the presence of different functional groups viz. hydroxyl group (H-bonded–OH- stretch), methylene–CH- stretch, carbonyl group (C=O) and aldehyde group, C=C stretch, quinone or conjugated ketone and organic sulphates, OH – bend which showed water absorption characteristics. The presence of quinone was responsible for antibacterial property of onion skin dye whereas presence of >C=O< carbonyl and >C=C< (-C- double bond –C stretch) in onion skin dye powder acted as a chromophore, which were responsible for the colouring of substrate. The hydroxyl (-OH) groups were also present in onion skin dye which acted as auxochromes and were responsible for deepening of colour. The results of study are supported by Vankar (2000) [11] stated that colour of dyed fabrics depend on the nature of the chromophores as well as the substituent functional groups, the auxochromes, of the dye molecular species**.** The skin of onions was inedible however it contains a dyestuff called "Pelargonidin" (3, 5, 7, 4 tetrahydroxy antocyanidol) reported by Zubairu and Mshelia (2015) [6]. The antimicrobial activities of some dyes were reported as potent owing to the existence of phenol, tannin and quinone in their extracts **(**Kanchana *et al.*, 2013) [3]. Gawish *et al.* (2017) [2] found that curcumin dye possessed the best antimicrobial activity against bacteria and fungi as a result of Methoxy and hydroxyl groups' existence, which was believed to improve the antimicrobial activity of curcumin.

4. Conclusion

In conclusion, aqueous, ethanol and methanol extracts of onion skin showed almost comparable phytochemical activity, which might be support their tradition use against bacterial infection, also the presence of most general phytochemicals possibly responsible for their use in colouring of textile material. It further imitates optimism for the advance of much more novel application on textile fabric by providing ultra-violet protection property to the textile material.

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