

PHYTOCHEMICAL, PHYSIOCHEMICAL SCREENING AND ANTIOXIDANT ACTIVITY OF THE FRUIT OF SOLANUM NIGRUM

Student's Journal of Chemistry

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November 3, 2012

This article reveals the qualitative analysis of different metabolites, seven heavy metals concentration and antioxidant activity of the fruit of *Solanum nigrum* (L). Qualitative analysis is very essential for identifying the various classes of compounds present in the medicinal plants. *Solanum nigrum* (L) is an important herbaceous medicinal plant belongs to Solanaceae family. Phytochemical screening of the crude extracts revealed the presence of secondary compounds such as alkaloids, flavonoids, steroids and tannins. Also the concentration of seven heavy metals Zinc (Zn), Cobalt (Co), Lead (Pb), Nickel (Ni), Cadmium (Cd), Iron (Fe) and Copper (Cu) were determined. On comparison the concentration of all metals were high in *Solanum nigrum*. The iron was in high amount 46.46 mg/L, while cobalt was in less amount 0.082 mg/L in *Solanum nigrum*. The fruit extract show a good antioxidant activity at low concentration at 20 and 40 ppm.

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Abstract: This article reveals the qualitative analysis of different metabolites, seven heavy metals concentration and anti oxidant activity of the fruit of *Solanum nigrum* (L). Qualitative analysis is very essential for identifying the various classes of compounds present in the medicinal plants. *Solanum nigrum* (L) is an important herbaceous medicinal plant belongs to Solanaceae family. Phytochemical screening of the crude extracts revealed the presence of secondary compounds such as alkaloids, flavonoids, steroids and tainns. Also the concentration of seven heavy metals Zinc (Zn), Cobalt (Co), Lead (Pb), Nickle (Ni), Cadmium (Cd), Iron (Fe) and Copper (Cu) were determined. On comparison the concentration of all metals were high in *Solanum nigram*. The iron was in high amount 46.46 mg/L, while cobalt was in less amount 0.082 mg/L in *Solanum nigram*. The fruit extract show a good antioxidant activity at low concentration at 20 and 40 ppm.

Key Words: *Solanum nigrum* (L.), phytochemicals, physiochemicals.

Introduction:

Medicinal plants provides new therapeutics unlimited opportunities for discovering new medicines and drugs. In this respect it may be that local treatments may have a wider

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application for certain treatments, however, extensive research prevail for a potential drugs [1].

Plants also have been used in ethno pharmacy for various diseases such as hypertension, cholesterol, eczema and diarrhea for centuries, today their scientific validation was provided by identification and isolation of bioactive phytochemicals [2]. Phytochemicals are the secondary metabolites that have several subgroups possessing various bioactivities such as antioxidant, antimicrobial, antiviral, anticancer, etc [3].

In developing countries, a report of WHO survey indicates that 80% of the populations rely on mostly traditional medicine for their primary health care needs [4].

In addition some synthetic medicines have been derived from medicinal herbs are digoxin, aspirin, reserpine, ephedrine, quinine, vincristine, vinblastine, taxol, artemisinin, hypericin and silymarin [5].

Therefore scientists have tried to discover new antimicrobial substances from various sources including plants. It is known that, now natural products and their derivatives hold more than 50% of all the drugs in clinical usage with one quarter originating from higher plants [6].

Pakistan has one of the greatest floras in Asia due to its various numbers of plants. In this study the purpose was to determine the relative metabolites, metal contents and antioxidant activity of medicinal *Solanum nigrum* species from Swat. Swat has a rich flora which has not been studied by scientific means before. This study also provides an identification of potential, bioactive species that can be used as raw materials for plant derived products in several industries.

MATERIALS AND METHODS

Plant Material

The plant was obtained identified by Professor Sirtaj Botany department Jahanzaib collage and authenticated from the voucher specimen NPGS/Cal 1 and submitted to chemistry department of Jahanzaib Collage Swat. The plant were dried in shade, crushed to coarse powder and used for further studies for the determination of heavy metals and

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qualitative analysis of natural products. Also antioxidant activity of the extract was determined by DPPH method.

Extraction and Isolation

Simple extraction procedure was adopted for Medicinal plants. Plant material dried under shade was chopped and pulverized into fine powder. 100 g of dried powder of each plant were macerated with 80 % methanol three times at room temperature. Resulting methanolic extract (2.5 g, 1.7 g) was evaporated under vacuum by rotary evaporator at 45 °C, afforded a gummy residue. The extracts were subjected to preliminary qualitative tests to identify the various phytochemicals present in it.

Phytochemical Analysis

The crude methanolic extract of the plant material was tested for various classes of natural products using standard qualitative methods [7-10]. Following protocols were used for phytochemical tests, while results are summarized in table 1.

Tannins

The test for tannins was performed by subjecting 1 g plant extract in 2 ml distilled water, filtered and ferric chloride reagent was added to the filtrate [7-10].

Alkaloids

For alkaloids, the test was carried out by subjecting 1 g methanolic extract in 10 ml 1% HCl, boiled, filtered and Mayer's reagent was applied [7-10].

Saponins

The extract was subjected to frothing test for the identification of saponins [7-9].

Flavonoids

The presence of flavonoids was determined by using 1% aluminum chloride solution in methanol concentrated HCl, magnesium turnings, and potassium hydroxide solution [7-10].

Steroids

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Steroids were screened by adding 1 ml of acetic anhydride to 0.25 g methanolic extract of each sample with 1 ml H₂SO₄. The color changed from violet to blue or green in some samples indicating the presence of steroids [7-10].

Anthraquinones

The test for anthraquinones was performed by adding 1 g of extract to 2ml benzene, filtered and ammonia solution added [7-10].

Terpenes

The detection of sterols and terpenes in the extract involved treatment of the extract with petroleum ether followed by extraction with CHCl₃. The subsequently acquired CHCl₃ layer was treated with acetic anhydride and concentrated HCl. The change of pink to purple and green to pink colors was indication of the presence of terpenes or sterols, respectively [7-10].

Extracted elements analysis

The elements Ni, Zn, Cd, Cu, Co, Fe, Pb were analyzed by mean of atomic absorption Spectrophotometer, their standard range and standard deviation from mean values were recorded [Table-4].

Antioxidant Activity

Preparation of Stock Solution

The stock solution was prepared by dissolving 20mg extract in 1 ml of methanol. Then the stock solution was consecutively diluted to get 20, 40, 60, 80 and 100 µg/ml.

Result and Discussion

Phytochemical investigation

The ethanolic extract of *Solanum nigrum* were subjected for phytochemical analysis, the results were positive for tests of alkaloids, phenols, tannis, and steriods but shows negative results for anthraquinones, saponone and terpenoids [Table 2]. The plant collection date and place is shown in table 1. The heavy metals concentration was determined by Atomic absorption spectrometer, the running condition of instruments and

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obtained data has tabulated in table 3 and 4.

Table 1. Information about medicinal plants investigated.

Name	Place of Collection	Parts under investigation	Date
<i>Solanum nigrum</i>	Mountainous areas of Swat	Fruit	30/09/2011

Table 2.

Phytochemical indication test of extracts of *Solanum nigrum*.

S. no	Test parameters						
	AK	AN	TR	PH	SP	TN	ST
1	+	-	-	+	-	+	+

AN-antraquinones, PH-phenols, SP-Saponins, TN-Tannins, TR-trephines, AK-Alkaloids, ST-steroids.

+ Indicates positive test result, - Indicates negative test result.

Table 3. Atomic absorption spectrometer conditions.

Elements	Wavelength (nm)	Slit Width (nm)	Lamp Current (mA)	Flame

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Zinc (Zn)	232	0.7	25	Air-Acetylene
Cobalt (Co)	232	0.2	25	Air-Acetylene
Iron (Fe)	232	0.2	25	Air-Acetylene
Nickel (Ni)	232	0.2	25	Air-Acetylene
Cadmium (Cd)	232	0.7	25	Air-Acetylene
Copper (Cu)	232	0.7	25	Air-Acetylene
Lead (Pb)	232	0.7	25	Air-Acetylene

Table 4. Concentration of specific metals of the plant extracts.

Name of element	Mean atomic reading (mg/L)	SD(+)
Nickel(Ni)	0.160	0.004
Zinc(Zn)	3.291	0.004
Cadmium(Cd)	ND	-
Copper (Cu)	0.197	0.003
Cobalt (Co)	0.082	0.004
Iron (Fe)	46.46	0.005
Lead (Pb)	0.987	0.002

ND- Not Determined

SD- Standard Deviation

Antioxidant activity

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The antioxidant activity of 1, 1-diphenyl-2-picrylhydrazyl (DPPH) free radical scavenging activity of the crude extract and standard ascorbic acid was performed [11]. The test solution was diluted in methanol, DPPH (0.002%) was prepared in methanol. Test solution was mixed with 1 ml of DPPH. The standard ascorbic acid was assessed as that of the test solution. The mixture was then incubated for 30 minutes in the dark. The experiment was performed in triplicate at standard laboratory conditions. The optical density of the crude methanolic extract and standard were measured at 517 nm by using photo spectrometry (Shemdzio UV, 1700). The control used in the experiment contained 1 ml methanol and 1 ml 0.002% DPPH. The % inhibition data were presented [Table 6] by using the following formula.

$$\text{Percent (\%)} \text{ inhibition of DPPH activity} = \frac{\text{Control} - \text{Sample}}{\text{Control}} \times 100$$

Table 6. Total antioxidant capacity of the plant extracts.

Plants	Concentration (ppm)				
	20	40	60	80	100
S. nigram	22.07 ± 0.66	24.63 ± 1.68	28.31 ± 1.02	31.66 ± 1.26	35.89 ± 1.90
Ascorbic acid	20.62 ± 1.26	23.29 ± 1.66	64.50 ± 1.56	70.41 ± 1.50	78.91 ± 1.12

The plant show good anti oxidant activity at low concentration, while moderate activity at higher concentration compared to standard ascorbic acid.

Conclusion

In conclusion *Solanum nigrum* crude extracts possess various secondary metabolites and important heavy metals. The phytochemical study opens the possibility of finding new compounds and activities. It also shows good antioxidant activity. However, the present study of phytochemical, physiochemical and antioxidant activity of *Solanum nigrum* forms a primary platform for further phytochemical and pharmacological investigation for the development of new potential compounds to be useful for various activities.

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ACKNOWLEDGEMENT

The authors are gratefully acknowledged to Principal and The Head, Department of Chemistry Govt. Post Graduate Jahanzaib Collage Swat Pakistan whom are encouragement and given their valuable suggestion during the study period.

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