The nature and chromogenic plants

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Dependency of human being to the nature has always been inevitable. The spoken relationship is not limited to the basic needs of human such as food and water, but also might be related to the artistic aspects of his life. The present study is aimed to explain the process of natural dyeing using combination of Anemone and some other natural pigments. Numerous plant and forest fruits including: Hibiscus tea (Chinese Rose), Barberry, Sumac, Saffron flower, Hawthorn and Cochineal were used as the main materials of this study. Sulfated compounds such as Ammonium Sulfate, Copper Sulfate, and Ferric Sulfate were used as the supplementary materials in the dyeing process. The Safflower comes in a range of colours from yellow to orange and establishes supplement colours (including yellow-red and green). Sumac established a range of red colour from crimson red to the most bright red and scarlet red. Similar to the Sumac, Hibiscus tea was the other plant producing a range of colours from light red to pink. Hibiscus insect in solution produces violet colour, while it establishes different kinds of violet and pink-violet combined with Anemone. Anemone can be applied as one of the most important components of natural dyeing in today's world, combined with the other natural pigments. The present study introduces chromogenic characteristics of Anemones and developed of red tonalities. However, environmental issues must be taken into account by the researchers, while working on the similar dyeing processes.

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Introduction

There has always been a close connection between the nature and human being since the beginning of his life on the earth. Dependence of people to the nature to nurture the plants as their main foods is among the most striking kinds of the above-mentioned connection. Although with the advent of technology this closeness seems to be decreasing, it should be considered that need to the nature, as the main source of food still exists for us [1]. Despite the spoken circumstances it should be considered that relationship between the human being and nature is not restricted to the food. For instance, the considerable association between nature and the entire components of art are among the other types of dependency.

Anemone, permanent flower that grow from glands or seeds, raise up to two feet height and come in a vast variety of colours including red, blue, purple and white. The blooms are developed from a single stem that has a node of parsley-like leaves. The Flower itself consists of eight to ten rounded petals fanning out nearly parallel to each other. The stems grow up to eight inches height. As a spring flowers Anemone grow best in partial or full sun and are planted in October. In hot climates, the Anemone should be protected from the sun in the warmest part of the day. As one of the species, wild Anemone would live either in sandy or moist soil, while Cut Anemone does not grow well in pot. However, Anemones are known as flowers to keep for years and years. In the past, purple Anemone used to symbolise gentility and possession, and has been associated with love and romance [2].

Figure 1: From the nature to colour.

Numerous natural materials have been used in dying process so far. However, to the best of my knowledge no previous study is developed to evaluate the characteristics of natural Anemone in the above – mentioned process, while combined with the other natural pigments. The present study is aimed to explain the above - mentioned combination to produce numerous natural colours.

Methods and materials

Significant results were obtained by primary experiment on dyeing with Anemone flower. It has properties such as various colour spectrums, establishing of softness and subtlety with colour on wool, stability of colour and production of concentrated distillate. It is shown that many of flowers have red pigments and they are applicable in herbal dyeing. However, individual for mentioned specificities and wide spectrum of colour. Some of flowers and plants even forest fruit could combine with Anemone and established unique colours, during practical assay.

I could produce a range of colours such as red, crimson red, violet and grey, during the 20 years researchers on Anemone with other chromogenic plants, also in this study, I show that Anemones flower in combination can generate range of colours from green to crimson red. Several plant and forest fruits have high quality for production of wide range of colours. Hibiscus tea (Chinese Rose), Barberry, Sumac, Saffron flower, Hawthorn and Cochineal are among the above-mentioned plants.

Sulfated compounds such as Ammonium Sulfate, Copper Sulfate, and Ferric Sulfate used as supplementary material in the dyeing process. These compounds have ionic properties [3]. Ammonium Sulfate is colourless and causes original colour of Anemone. Copper Sulfate changes the spectrum of red colour to green and green to brown. Also ferric Sulfate changes spectrum of red colour to gray. Quantity and application of these compounds were determined according to the defined formula and quality of colour in. 0.2g of Sulfate has used for 2g of colour in 200cc of water. Citric acid

is another supplementary that affects on transparency and stabilisation of the colour. It reveals red colour if it exists in extraction of plant or flower. Mentioned plants have medical and therapeutic application and are found in some of countries.

Results

Hibiscus tea is used as a tea and its pink-violet flower together with Anemone can establish broad spectrum of colours. Hibiscus tea has less stability than Anemone flower and it causes that Anemone remains as a main portion to control of colour. Ammonium Sulfate is used in this process and red-violet colour is established.

Figure 2: Combination of Anemone and hibiscus tea and the obtained colour tonality.

Two mentioned species of Barberry have special colour that it is similar colour of blood. Extraction of Barberry contains Tannic acid that it causes brightness and transparency of wool.

Figure 3: Archived variety of the colours obtained from combination of Anemone and barberry.

Two types of sumac are crushed sumac and red sumac that are used in Asian, European and African Countries. Red sumac is called Arabic sumac or American sumac. It has edible use and its powder form is used in a variety of barbecued meat. Colour of crushed sumac is cream colour and it cannot be combined with Anemone, since its colour stability is less than Anemone. However, one of the important chromogenic plants and fruits in combination with Anemone flower is red sumac. Variation in red colour was observed in combination of Anemone and sumac. Besides, sumac contains tannic acid that it causes stabilisation and more effectiveness of colour of Anemone flower. The most beautiful and broad spectrum of red colour can be obtained by increased or decreased quantity of sumac and Anemone.

Cochineal is colour insect that lay eggs in Spain and south of Iran [4]. Scarlet red colour is achieved by drying and grinding process. Achieved variety of colours from combination of Anemone and cochineal insect is result of several years of research. Combination of Anemone and cochineal establishes variety of violet colours but violet suddenly changes to Scarlet red when acetic acid or citric acid is added to the environment reaction at boiling point. Because of importance of this insect in colour industry, powder of cochineal is not usually available, and Sumac is used instead.

Safflower (Carthamus) is another plant, which has edible use and is expensive, and used as condiments in Iran [5]; its flower has beautiful Violet colour while the aqueous solution is orange. Concentration of safflower in aqueous environment is as high as concentration of Anemone. So more precision is needed and control of quantity of colour is essential. Quantity of safflower colour will not change to brown-green and red colour will not establish when quantity of safflower is more than Anemone. Weight ratio of safflower should be half of the weight of wool, silk and Anemone to control spectrum of red colour. If quantity of colour is controlled, firebrick colour or copper colour will establish which is unique of its kind. Combination of safflower with Anemone is similar to its combination with Sumac.

Hawthorn is a kind of forest fruit and grows as a wild plant. This plant also grows in north of Iran (Mazandaran province with cool and humid areas) and has edible use [6]. Colour of Hawthorn is red but it produces red crimson in solution of colour and establishes dark red (blackish red) in the presence of citric acid and Anemone flower.

Figure 4: Anemone and Hawthorn in combination of Ammonium and Ferric Sulfate.

Colour of plant, colour of plant in solution, and colour stability are summarised in Table 1 and analysis of colour of plant in presence of Sulfates is shown in Table 2.

Name of plant	Colour of plant	Colour of plant in solution	Colour stability
Hibiscus tea	Pink-red	Violet	Intermediate
Barberry	Black-red	Black-red	High
Sumac	Crimson red	Scarlet red	Stable
Safflower	Violet	Orange	Stable
Cochineal	Green	Violet-red	Stable
Hawthorn	Brown-red	Red	Intermediate

Table 1: Colour of plant in solution and colour stability.

Name of plant	change of colour		
	in presence of Ammonium Sulfate	in presence of Copper Sulfate	in presence of Ferric Sulfate
Hibiscus tea with Anemone	pink → pink-violet	violet → brownish violet	violet → greyish violet
Barberry with Anemone	red → crimson red	green	brown
Sumac with Anemone	red crimson → scarlet red	crimson red → crimson red and green	crimson red → violet
Safflower with Anemone	yellow-orange → orange	green	brown-green

Table 2: Analysis of the colour of plants in presence of Sulfates.

Significant results are achieved by triple combination of the above-mentioned chromogenic material. Method of multiple combinations (different amounts of colour and level of saturation) established supplement colour. A colour between light yellow and dark violet would be achieved if safflower (yellow colour) is added to cochineal (violet colour).

Figure 5: Archived Variety of colours Obtained from Combination of Anemone and Ferric Sulfate.

Following results were obtained from the stability analyses:

Stability of colour in exposure to light with the main red scale is five. Colour stability in washing process based on the vector stain, and with a grey scale is 6-3. This measure is 7-3 for organic solvents as well. Stability found to be 7 in exposure to scrubbing. The entire amounts related to the colour stability of Anemone flower in exposure to the light, water, organic solvents and scrubbing found to be 25. The Anemone flower has a high stability in exposure to the washing, organic solvents, and the light. The Results of the colour stability analyses are summarised in Table 3.

Colour composition	Washing stability	Stability in exposure to solvents	Light stability (degree °)
1	3-4	5	15
2	7-5	8-3	25
3	6-5	7	20
4	6-5	6-5	22
5	6-5	7	20
6	3-4	5	15

Table 3: Results of the colour stability analyses.

Discussion

In combination of the Anemone flower with the six above-mentioned pigments, 4 samples had more colour depths, compared to the other two samples. Samples 2, 3, 4 and 5 (Barberry, Sumac, Safflower, and Cochineal) showed to have higher absorbent strength compared with the samples 1 and 6 (Hibiscus, and Hawthorn). Colorimetric analyses and K/S amounts demonstrated that the samples 2 and 3 have more colour absorbent, than rest of the samples. During the process of dyeing with Anemone flower, colour bath temperature should be 75 centigrade, which causes the homogeneity of the colour on wool. It is also suggested that the process should be conducted with a pH between 4 and 5.

Due to the effectiveness of its red colour, Anemone flower is one of the most specific plants in dyeing industry. Level of colour saturation in solution is an important factor, which determines the quality of this flower in dyeing process. This flower produces the variety of colours, which the red colour has been considered in this study.

Significant results were obtained by combination of the above-mentioned plants with Anemone. The Safflower comes in a range of colours from yellow to orange and establishes supplement colours (including: yellow-red, green) because of the high stability and brightness.

Colour analysis of sumac showed that it establishes a range of red colour from crimson red to the most bright red and scarlet red. However, it doesn't produce any coloured shades and grey colour except red colour on wool and its colour has high stability. Hibiscus tea was the other plant producing a range of colours from light red to pink, similar to the obtained colours from sumac.

Hibiscus insect in solution produces violet colour. But it establishes kinds of violet and pink-violet with Anemone, while these colours are very individual. Brownish-red colours are observed in analysis of Hawthorn. It should be noted that its red colour has not transparency and brightness, and after a while is changed to crimson red.

Conclusions

Results of the present study are highly extensive. Hundreds of colours are obtained by combination of a plant or flower to another, but recognition about colour of plants, scale of colours stability and selection of produced colours are important parameters in herbal dyeing. Sometimes two plants have high chromogenic property and stability but do not establish appropriate combination with each other. Even their combination may establish heterogeneous on wool. Occasionally, two plants with intermediate or low properties can produce stable colours. However, we shouldn't forget the effectiveness of Sulfates, acids and supplementary material that are influential parameters on colour obtained from the plants. In conclusion, herbal dyeing is one of the benefits of nature for human being. It should also be considered that one of the main purposes of the researchers of the field is to protect the nature. Herbal dyeing is an economic method for public use and has specific importance because of easy access and direct application of plants.

References

1. Kahn PH Jr, Severson RL and Ruckert JH (2009), The human relation with nature and technological nature, *Current Directions in Psychological Science*, **18** (1), 37-42.

2. Afsfar V (1996), Dyeing of yarn with natural materials, Art University, Tehran (Iran).
3. Zuleh T (2002), *Research in Carpet Iran*, Yasavoli.
4. Farzan N (2004), *Knowledge Colors*, Afshar.
5. Aineh Y (1990), Organic chemistry, medicinal herbs, Tehran University, Tehran (Iran).
6. Zadmard H (1978), Chemical analysis of minerals, Tehran University, Tehran (Iran).
7. Yavari H (2006), *Technical Knowledge of Persian Carpet*, Raja.
8. Rosenberg E (2008), Characterisation of historical organic dyestuffs by liquid chromatography – mass spectrometry, *Analytical and Bioanalytical Chemistry*, **391** (1), 33-57.