Int.J.Curr.Microbiol.App.Sci (2020) Special Issue-11: 3830-3839

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-11 pp. 3830-3839**
Journal homepage: http://www.ijcmas.com

Review Article

A Review on Preparation of Natural Dye and Herbal Gulal from *Beta vulgaris* and Study of its Dyeing Properties

Suman Sahu[1]*, Shashikant Tiwari[1] and Trishla Sahu[2]

[1]BRSM College of Agricultural Engineering and Technology and Research Station, Mungeli Indira Gandhi Agricultural University, Raipur, C.G., India
[2]Department of Agricultural Processing and Food Engineering, SV CAET & RS, FAE, IGKV, Raipur-492012, C.G., India
**Corresponding author*

A B S T R A C T

To extract natural dye for fabrics with keeping the eco-friendly extraction procedure. We have chosen the *Beta vulgaris* (beetroot fruit) for extraction of natural dye and making the herbal gulal. Three types of techniques used for extraction of natural dye from beetroot i.e. aqueous technique, acidic technique and alkaline technique and extract total six numbers of samples. Also, analyze the extracted natural dye such as percentage yield, absorbance maxima and wavelength etc. And result shows that the red dye obtained through alkaline extraction has better colour strength i.e. maximum colour intensity at 3M NaOH. We have also studied the dyeing properties in cotton and polyester fabrics by using different solvents such as potassium dichromate, iron sulphate heptahydrate, hydrochloric acid and sodium hydroxide. We have also analysed the effect of potassium dichromate and iron sulphate heptahydrate on dyeing properties of natural dye. The herbal gulal has also made by using beetroot extract with wheat and rice flour.

Keywords

Beta Vulgaris(beetroot), natural dye, gulal, solvents, cotton and polyester fabrics, UV/VIS digital spectrophotometer, distilled water, wheat and rice flour

Introduction

The beetroot is the taproot portion of the beet plant, usually known in North America as the beet, also table beet, garden beet, red beet, or golden beet. It is one of several of the cultivated varieties of *Beta vulgaris* grown for their edible taproots and their leaves called beet greens. These varieties have been classified as *B. vulgaris* sub-species *Vulgaris* Conditiva group (Cultivar group). Beta is the ancient Latin name for beets, possibly of Celtic origin. In 15th century Beets were cultivated for their leaves by Romans, they ate its leaves as food, which called as Roman beet. Roman beets were white or black in colour but today deep red or yellow colour beets are also available.

It is mainly cultivated in Haryana, Uttar Pradesh, Himachal Pradesh, Maharashtra and Tamil Nadu. Beetroot Helps lower blood pressure, may improves muscles power in people with heart failure, may prevent cancer, Good sources of potassium and other minerals, also reduce cholesterol & Provides vitamin C and supports your liver.

Natural dyes

The art of making natural dyes is one of the oldest known to man and dates back to the dawn of civilization. In India, there are more than 450 plants that can yield dyes. In addition to their dye-yielding characteristics, some of these plants also possess medicinal value. Due to lack of availability of precise technical knowledge on the extracting and dying technique, it has not commercially succeeded like the synthetic dyes. We can either use chopped beets, beet juice or beet root powder to dye natural fabric.

Several parts of this plant are used in medicinal system such as anti-oxidant, anti-depressant, anti-microbial, anti-fungal, and anti-inflammatory.

Natural dyes are not harmful to environment. Natural dyes are obtained from renewable sources that can be harnessed without imposing harm to the environment. Some natural dyes, such as carmine found in lipstick, will not cause harm or health problems when ingested. Natural dyes are produced from plant tissues and fungal species.

Natural or organic gulal or a beer

Gulal, also known as Abeer, is the traditional name given to the coloured powders used for the typical Hindu rituals, in particular for the Holi festival.

Organic colours which are made of him consist of natural components like fruits, leaves, stems, and flowers which are skin-friendly. They are also eco-friendly and do not cause harm to the environment. These colors are as easy on clothes as they are on the skin and disappear after a simple washing, and they protect the hair and skin. To prepare the particular natural color dye on the gathered trial, three types of extraction technique had been followed. These techniques are aqueous, acidic, and alkaline technique. The beetroot fruits was collected, then soaked with water over night and then boiled. The liquid material or dyes were used for the experiments. For the dye extraction, organic solvents such as HCL, NaOH, were used.

And to prepare natural gulal or abeer we use wheat flour and rice flour. These flours are added with different concentrations of beetroot juice prepared by aqueous technique. Then this solution is mixed it properly and makes small balls of this flour. These balls are sun dried for 2-3 days and then balls are crushed and fine grind by grind.

Natural dye

Kannanmarikani *et al.,* (2015) studied that according to dye yield and fastness properties the plant was chosen for fabric dyeing. We are chosen the plant *Lawsonia inermis* to color the fabrics in this work. First, the dye was obtained through the extraction methods and studied the physicochemical properties of the dye. The dyeing properties were optimized for colouring the cotton and cotton thread. In this work, we found the red dye obtained through alkaline extraction has better colour strength. During dyeing the fabrics showed brighter color after 24 hours. Still due to its nontoxic and eco-friendly features the henna dye can be an effective natural dye for clothing.

Amlepatil *et al.,* (2015) studied that to extract natural color from various novel techniques of extraction especially ultrasonication and microwave assisted extraction techniques and their efficiency and suitability. Colour is one of the crucial factors for the consumer's acceptability of any processed foods. The potential sources of coloring pigments are

Betalain and Betacyanins are present in Beet root and Amaranth respectively. Extraction of these natural color used various novel techniques like ultrasonic assisted extraction, microwave assisted extraction. Betalain pigment can be used as a natural additive for food, cosmetics and drugs in the form of beet juice as well as beet powder and Amaranth plant can be a good source of antioxidants. Jha *et al.*,(2015) studied that in this study, natural colorants mainly flavonoids and carotenoids present in the Marigold flower (*Tagetes erecta* L.) were extracted using Soxhlet extraction method and other conventional techniques under different operating conditions. Spectrophotometric method based on the Aluminium complex formation was used for the determination of total flavonoids concentration in the extracts of different solvents used. The dye potential of the colorants obtained from the marigold was evaluated by coloring pure cotton fabrics and the yarns of pure cotton and wool. The surface color of the dyed fabrics and yarns was not affected by washing. These study reveal that marigold dye can serve as a potential source of natural colorant which can be used in textile industry for dyeing purpose.

Daberao *et al.,* (2016) studied that there are huge numbers of process to do coloration. Natural and man-made colors are also used. The natural dyes are extracted and fabric dyeing is analyzed by applying dye on 100% pure cotton. At first stage we extract dye from Butea Monosperma. This dye was extracted with the help of boiling method. We find out yellow color from Butea monosperma. The fabric dyed with extracted dye by using alum as a mordant. The dyed fabric tested for rubbing fastness, washing fastness, perspiration fastness etc.

Warsiki *et al.,* (2013) studied that the purpose of this research is to study and develop smart packaging by addition of natural dyes of beet (*B. vulgaris L.var cicla L.)* as well as finding the best drying techniques for label producing. This label was produced from chitosan and chitosan – polyvinyl alcohol (PVA). Two form (chitosan and chitosa-PVA) films were compared to its properties. Three drying techniques were carried out in this experiment, i.e. oven blower, oven vacuum and freeze drying. A result showed that films made from chitosan-PVA has the appearance of a more clear, shiny, and looks more refined than the indicators of chitosan films. The use of beet extract as dyes of color indicator did not allowed for the drying in conjunction with the film solution. Natural dye staining technique that can still be used as an indicator dye in smart packaging was freeze drying in temperature of -10°C. Indicators with natural dyes of beet responded through changes in color of the storage temperature. Color changes that occur in the film made from chitosan had a vulnerable time longer in the retention time than films made from chitosan-PVA.

Yeniocak *et al.,* (2015) developed an eco-friendly wood stained extracted from beetroot *(Beta vulgaris)* and determined the color stability of stain to UV light irradiation. Natural dye stuff were extracted from beetroot by ultrasonic-assisted method and prepared from aqueous solution with ferrous sulphate, aluminium sulphate, copper sulphate and vinegar mordant mixes. Scots spine (*Pinus sylvestris*), oriental beech (*Fagous orientalis*), oak (*Quercus petraea*) and walnut (*Juglans regia*) wood specimens were used for this study. Wood specimens were exposed to UV irradiation for periods of 50,100 and 150 hours. Results showed that the color change values for all wood specimens colored with beetroot extract had better performance compared to synthetic dye. Therefore, alternative to synthetic dyes more economical and eco-friendly, wood paints may be developed.

Siva *et al.,* (2007) studied that in India, there are more than 450 plants that can yield dyes. Indians have been considered as forerunners in the art of natural dying. In addition to their dye-yielding characteristics, some of these plants also possess medicinal value. Though there is a large plant resource base, little has been exploited so far. Due to lack of availability of precise technical knowledge on the extracting and dying technique, it has not commercially succeeded like the synthetic dyes. In this article we reviewed the availability of natural dyes, their extraction, applications, mordant types, advantages and disadvantages.

Ding *et al.,* (2017) studied that cotton fibres can be dyed through the formation of coordinate bonds involving cellulose chains, mordants such as alum, and natural dyes such as alizarin. Similarly, synthetic dyes known as mordant acid dyes can be used to dye wool fibres. In dying method using mordant and natural dyes raise the possibility of using mordant dyes as alternatives to natural dyes in the dyeing of cotton. The results of this study indicate that shades comparable with those produced by natural dyes can be obtained on cotton using select mordant dyes following Fe^{2+} and Al^{3+} pretreatments. The best results were obtained using a two-step/two-bath process and dyes such as Cl Mordant Blue 13 and Cl Mordant Orange 6. The fastness properties of these dyes must be improved in order to produce commercially viable dyeing.

Dogan *et al.,* (2018) studied that natural dyeing has been an avocation performed in the Anatolia region for centuries and can be used for dyeing of different materials. In this study, it is aimed to expose color values, color named, light and rubbing fastness of the colors that were obtained as a result of dyeing three different materials (wool yarn, cotton fabric and paper) with some natural dyes according to traditional method. In line with this aim, the materials were dyed with madder *(Rubia tinctorium L.),* walnut *(Juglans regia L.),* weld *(Reseda luteola)* and indigo. In consequence of the research; color names, color values, light and rubbing fastness of fifteen samples were determined. The results of the research were evaluated statistically using SPSS programme.

Sundrarajan *et al.,* (2011) studied that marigold and turmeric were used for the extraction of the natural dye material. The method appropriate for natural dye dyeing on knitted cotton was found to be premordanting by studying with other methods such as simultaneous and post mordanting method. The colour develop range on dyed materials is evaluated by dye uptake measurement and the improvement of colour strength on fabric using mordants was also examined. Marigold with tannic acid and pomegranate rind produced good dye uptake and fastness properties. All the mordant fabric showed good dye uptake.

Ali *et al.,* (2008) studied that the alkaline conditions for extraction of natural dye from Henna leaves were optimized and the resulting extract was used to further optimize its dyeing conditions on cotton by exhaust method. It was found that dyeing produced with alkaline extracts of Henna leaves have better colour strength than the dye extract obtained in distilled water. Furthermore, dyeing with alkaline extracts have moderate to good fastness properties and that mordanting did not result in any significant improvement in fastness properties. Finally, in comparative studies between synthetic and this natural dye, it was inferred that natural dye has good potential to act as co-partner with synthetic dye. Kumar *et al.,* (2016) studied that nowadays, demand for natural dyes has been developing rapidly due to increased awareness on hazardous, toxic and

allergic reactions associated with artificial dyes. Natural dyes are obtained from natural sources such as plants, insects and minerals. This paper reviews the available floral dye source, application and removal of colorant from flowers and effect of different mordant. Floral dye sources are more important for textile dyeing as it offers both dye as well as smell.

Gokhale *et al.,* (2004) studied that at present total market of herbal dyes is to the tune of US $ 1 billion and is growing tremendously at the rate of 12% per annum. Per capita consumption of dyes is 400g to 15 Kg in developed and underdeveloped countries for their utility in paints, inks, textiles, polymers, etc. Nature has gifted us more than 500 colour yielding plants. The present paper is an aid to a collective enquiry into the Indian dye yielding plants, their parts and chemical constituents. India is a major exporter of herbal dyes mostly due to ban on production of some of the synthetic dyes and intermediates in the developed countries due to pollution problem.

Samanta *et al.,* (2009) This paper reports the studies available on the characterization and chemical/biochemical analysis of natural dyes; extraction of colorants from different natural sources; effects of different mordants and mordanting methods; conventional and non-conventional methods of natural dyeing; physico-chemical studies on dyeing process variables and dyeing kinetics. The chemical modification of textile substrate for improving dye ability, attempts for improvement in overall colour fastness properties and survey of some traditional processes of natural dyeing in different parts of India have also been discussed.

Cristea *et al.,* (2006) studied that the objective of this study were to evaluate the light fastness of selected natural dyes (madder, weld and woad) and the effect of some commonly used antioxidants and UV absorber on the light fastness of these dyes. A poor light fastness of the three natural dyes in comparison with synthetic ones is established beyond question. Never the less, the use of some additives can improve this default of natural dyes. In all the cases, the use of UV absorbers or antioxidants improved the light fastness of dyed fabrics. The most effectives were the vitamin C and the gallic acid.

Wells *et al.,* (2013) studied that historically many dye plants were once regarded to possess “magical properties” with the power to heal and to keep evil away. Today many of these plants that can be used for dye extraction are classified as medicinal and in recent studies have been shown to process remarkable anti-microbial, anti-fungal, anti-viral activity. The cosmetic industry now employs many natural dyes due to the fact they will cause fewer side effects than the employment of synthetic dye stuffs but they can also provide extra properties such as UV protection, skin moisturizing and anti-aging.

Chengaiah *et al.,* (2010) studied that the worldwide demand for natural dyes is nowadays of great interest due to the increased awareness on therapeutic properties of natural dyes in public. Among the all natural dyes, plant-based pigments have wide range of medicinal values. Many of the plants used for dye extraction are classified as medicinal and some of these have recently been shown to possess remarkable antimicrobial activity.

The present review, describes the detail information about basic chemistry of the major pigments and their medicinal importance found in naturally occurring dye yielding plants, which are helpful to further development of pharmaceutical formulations.

Jothi *et al.,* (2008) studied that marigold flowers, which are yellow to orange red in

colour, are a rich source of lutein, a carotenoid pigment. This pigment has acquired greater significance because of its excellent colour value. In this study, an experiment was conducted to study the use of an extract isolated from marigold as a natural dye. The dye potential of the extract was evaluated by dyeing, using the flower, in 100% cotton and silk fabrics under normal dyeing conditions. The surface colour was not affected by washing, and the quality of the flower was maintained even washing at 60°C for 30 minutes. These findings reveal that the extract of marigold flower can be used for coloration of 100% cotton, silk, and wool fabrics.

Abdelrahman *et al.,* (2013) studied that this research was carried out to study the possibility of using the beet dyes as a laser gain medium. The fluorescence quantum yield was determined by the comparative method with rodamine b as an organic dye standard. The increasing of fluorescence quantum yield of dye solution as a result of increasing the viscosity of solvent was observed clearly. The study concluded that the beet dyes are so sensitive to fluorescence and it is very suitable to be used as a laser gain medium. Nowadays the dye lasers play as an important tool and are used in many applications including spectroscopy, medicine and dermatology.

Farag *et al.,* (2013) studied that the aim of this present study is to evaluate the performance and efficiency of dyeing of cotton, wool and polyamide from dry skin *Allium cepa* and henna fabrics with natural dyes obtained as extract leaves. Natural dyes may chemically be classified as vat, direct, acid and\or pigment. This makes onion scale and henna leaves one of the easily available raw materials for natural dyeing industry. Accordingly, efficiency and performance of dyeing were assessed on different natural and synthetic fibers. However, some good fast colors were obtained. Natural dyes have limitations of fastness, and brilliancy of shade. Therefore, in present work, use of metallic mordant was investigated to produce depth of shade, bright and fast colors.

Natural Gulal or a beer

Bhatnagar *et al.,* (2018) studied about festival called Holi and its hazardous ocular effects at tertiary care ophthalmic center in north India. The aim of this study is study the demographic and clinical profile of patients visiting ophthalmologic emergency tertiary care ophthalmic center during Holi in New Delhi. The data were collected by conducting direct interviews with patients and from medical records of the patients visiting the Emergency Department of RPC from March 1 to 5, 2018. These 5 days were chosen so that it could cover the pre-Holi day, Holi day and post-Holi day. Statistical data were analyzed using Microsoft Excel. An increase in awareness among people shows a substantial decline in number of color injury, complications, traumatic eye injuries, and assault cases from the year 2016. Men (20) were more affected than women (9), with most common being among the youth (21 years ±10). Sudden spike in cases of color injury (29) was observed during the study period.

Ghosh *et al.,* (2016) studied that Holi is a festival of colors, traditionally celebrated by mutual application of colors in different forms on a particular day of the year. These colors frequently comprise a range of synthetic dyes which have harmful effect on the skin and mucosae. The objective of this study is to find out the different patterns on Holi- related dermatoses in a group of pediatric patients. Consecutive patients of pediatric age group who attended dermatology outpatient department (OPD)

with different dermatoses following application of Holi color were included in this study. A total of 63 patients were evaluated with a female to male ratio 1.3:1. Itching is the predominant presenting symptom followed by burning sensation, dryness, scaling, and loss of hair. The conclusion of this study shows that a sizable number of patients of pediatric age group may be affected by Holi-related dermatoses necessitating precautionary measures.

Kumar *et al.,* (2015) studied that we have chosen Holi festival as an event to study the effect on aerosol loading in the atmosphere due to extensive burning of biomass especially in the evening hours prior to main festival. We have studied aerosol optical and microphysical parameters by ground based AERONET over the three stations situated in the Indo-Gangetic plain (IGP) during March 5-11, 2012. The Holi was celebrated on 7-8 March across the country in 2012. The aerosol volume size distribution showed a bimodal structure. The coarse modes showed peak maxima ranged from 2.5 to 3.5.

Samariya *et al.,* (2013) studied that sindoor is one of the key cosmetics used by the married women of our countries. The present investigation was done to formulate herbal sindoor using different natural ingredients, as these preparations are one of the key cosmetics to be used by the married women of our country.

The sindoor was formulated using five different natural coloring agents in four batches (F1 to F4) and were evaluated. It was found from the present investigation that F3 has good results as compared to other formulated herbal sindoor, through a detailed clinical efficacy is still needed to establish safety profile of the formulation.

Jain *et al.,* (2015) studied that these Holi colours are synthetic dyes which may have harmful side-effects on the skin and mucocutaneous areas like the conjunctive and oral mucosa. In India, these colours are prepared on a small scale and lack any quality checks. Here we present a case of a 43 years old female who developed angioedema with urticaria progressing into urticarial vasculitis after playing with the colours in the festival of Holi. This case report highlights the need to put manufacturing of Holi colours under the guidelines of the Food and Drug Cosmetic Act and the Bureau of Indian Standards.

Das *et al.,* (2015) studied that during the Holi festival a good quantity of synthetic Holi powder is used every year, which contain heavy metals, sand and soil. Considering the threat of heavy metals to the environment and human health, a simple, low cost method of making eco-friendly Holi powder has been standardized. Tapioca (*Manihot esculanta*) is a high yielding annual crop requiring low agronomic input and it is harvested well before Holi. The process involves the use of tapioca flour and Fruit Products Order, 1955 approved synthetic food colour which does not contain heavy metals. The product is found to be acceptable based on colour brightness, texture, and stickness, low cost involvement and simplicity of procedure.

Gupta *et al.,* (2015) studied that a wide prevalence of socio-religious and cultural practices in the Asian subcontinent often leads to multitude of skin diseases which may be missed by the dermatologists because of a lack of awareness. “Henna” and “Kumkum” application can result in pigmented contact dermatitis. “Sticker bindis” and “alta” induce contact leukoderma. Irritant and allergic contact dermatitis occurs after playing with Holi colors. “Mudichood” represents the comedogenic effect of hair oils combined with occlusion and humidity.

With increasing globalization and migration, the practice of indigenous customs and traditions is no longer limited to regional territories, making it imperative for the dermatologists to be acquainted with the cutaneous side effects they can cause.

Bossmann *et al.,* (2016) studied that by the use of gulal powder the adverse health effect, i.e. skin and ocular irritations as well as respiratory problems may be the consequences. The aim of this study was to uncover some of the underlying mechanisms.

We analysed four different Holi colours regarding particle size using an electric field cell counting system. Two of the analysed Holi powders contained even more than 75% of PM10 particles. In Holi colour 1 we detected a fungal contamination. Some of the observed unwanted health effects of Holi colours might be explained by the high content of PM10 particles in conjunction with the possible induction of a pro-inflammatory response and an oxidative leukocyte burst.

Patel *et al.,* (2014) studied that triphenylmethane dye, any member of a group of extremely brilliant and intensely coloured synthetic organic dyes having molecular structures based upon that of the hydrocarbon triphenylmethane.

They have poor resistance to light and chemical bleaches. Crystal violet, the most important of the group, was introduced in 1883. The range of colours is not complete but includes reds, violets, blues, and greens. They are applied by various techniques, but most belong to the basic class, which are adsorbed from solution by silk or wool, but have little affinity for cotton unless it has been treated with a mordant such as tannin.

Sharma *et al.,* (2013) Holi is celebrated by spreading scanted colors, powders and perfume at each other. The various parts of trees such as flower, leaves, fruits and so on, from Indian coral tree (Parijat), flame of forest (kesu), marigold, turmeric (Haldi), henna (Mahendi), and beetroot etc has been used to prepare colors.

Natural colors seem to maintain good quality in itself. While these chemical colors are extremely dangerous for human beings and also are perilous for environment. The objective of present study is to analyze the conscious awareness among literate and illiterate people either men or women.

The present study showed that natural dye can be successfully extracted from *Beta vulgaris*. The whole process of extraction is eco-friendly. The dark red color dye extracted from *Beta Vulgaris* used with different mordants as natural dyeing for cloths which shows good coloring strength and dyeing potential. In future it can serve as a source of raw material for fabric dyeing.

If natural dyes have to be commercialized, the traditional methods must be substituted by modern. Due to non-toxic properties, less side effects and more medicinal values, natural dyes are suitable for dyeing.

Also, natural gulal prepared by beetroot with different wheat and rice flour provides powder material having soft and supple touch with good sticking capacity to skin. This natural gulal is safe, non-toxic, stain-free, eco-friendly and easily removed by water.

References

Abdelrahman, A. H., Abdelrahman, M. A., and Elbadawy, M. K. 2013. Possibility of using the beet dyes as

a laser gain medium. Natural science, 5(11): 1183-1188.

Ali, S., Hussain, Tanveer, and Nawaz, Rakhshanda. 2008. Optimization of alkaline extraction of natural dye from Henna leaves and it's dyeing on cotton by exhaust method. Journal of cleaner production, xxx (2008): 1-6.

Amlepatil, M. N., Miraje, Y. S., Patil, P. D., Sahoo, A. K. and Mote, G. V. 2015. Natural colour extraction from amaranth and beetroot: a review. Indian J of Applied Research, 5(5):19-20.

B. Chengaiah., Rao, K. M., Kumar, K. Mahesh., M. Alagusundaram., and Chetty, C. M. 2010. Medicinal importance of natural dyes- a review. Int. j of pharmtech research. 2010, 2(1): 144-154.

Bhatnagar, A., Gupta, S. K., Hanumanthappa, V. and Garg, N. 2018. A study on after effects of Holi: color injury, ocular trauma, and assault at a tertiary care ophthalmic center in North India. Int. J Res Foundation Hosp Healthc Adm 2018; 6(1): 31-36.

Bossmann, K., Bach, S., Hoflich, C., Valtanen, K., Heinze, R., Neumann, A., Straff, W., and Suring, K., 2016. Holi colours contain PM10 and can induce pro-inflammatory responses. Journal of occupational medicine and toxicology, 2016; 11(42): 1-11.

Cristea, Daniela., and Vilarem, Gerard. 2006. Improving light fastness of natural dyes on cotton yarn. Dyes and pigments, 71(2006): 39-46.

Daberao, A. M., Kolte, P. P., Turukmane, R. N. 2016. Cotton dying with natural dye. Int. j of research and scientific innovation (IJRSI), 3(8):157-161.

Das, P., Goswami, N., and Borah, P., 2015. Development of low-cost eco-friendly Holi powder. Int. J of agriculture innovations and research, 4(3): 466-468.

Ding, Yi, and Freeman H. S. 2017. Mordant dye application on cotton: optimization and combination with natural dyes. Color technol., 0, 1-7.

Dogan, S. D., and akan, meral. 2018. A research on colours and fastness values of different materials dyed with some natural dyes. Int. j of materials science and applications, 7(3): 69-74.

Farag, R. S., S. Shakra, Adway, H. EL., and Ali, Ali. A. 2013. Physicochemical studies and application of some natural extracts and its metallic mordant complexes as dyes for textile fabrics. Al-Azhar Bull. Sci. 24(2): 17-35.

Ghosh, S. K., Bandyopadhyay, D., Agarwal, M., and Rudra, O. 2016. Dermatoses among children from celebration of "Holi", the spring festival, in India: a cross sectional observational study. Indian J of Dermatology 2016; 61: 525-528.

Gokhale, S. B., Tatiya, A. U., Bakliwal, S. R., and Fursule, R. A. 2004. Natural dye yielding plants in India. Natural product radiance, 3(4): 228-234.

Gupta, D. and Thappa, D. M., 2015. Dermatoses due to Indian cultural practices. Indian J of dermatology 2015; 60(1): 3-12.

Jain, S., Jakhar, P., Pandey, N., and Shivkumar, V. B. 2015. Urticarial vasculitis following exposure to Holi colors: A rarity. Egyptian dermatology online journal, 11(2): 1-8.

Jha, C. K., Kumar, R., Venkat, S. K., Devi Rajeswari V. 2015. Extraction of natural dye from marigold flower

(*Tagetes erecta* L.) and dying of fabric and yarns: A focus on colorimetric analysis and fastness properties. Scholar Research Library (Der Pharmacia Lettre), 7(1):185-195.

Jothi, D. 2008. Extraction of natural dyes from African marigold flower (*Tagetes ereecta* L.) for textile coloration. AUTEX research journal, 8(2): 49-53.

Kannanmarikani, Kannan, U. S., and Kanniappan, R. 2015. Assessment of dyeing properties and quality parameters of natural dye extracted from Lawsonia inermis. European J of experimental biology, 5(7): 62-70.

Kumar, P., Sachan, A. K., and Rawat, Anupam. 2016. Utilization of temple flower waste in Varanasi for the generation of economic resources. Journal of environmental sciences and engineering, 1(3): 1-8.

Kumar, S., Singh, A., and Singh, A. K. 2015. Impact of Holi festival on aerosol optical properties in Indo-Gangetic plain. Int. J of advances in earth sciences, 4(1): 19-28.

Patel, A. K., Chaudhary, H. H., Patel, K. S., and Sen, D. J., 2014. Colour of ecofriendly dyes used in holi rather than triphenyl methane dyes. World J of pharmacy and pharmaceutical sciences, 3(9): 1287-1305.

Samanta, Ashis. K. and Agarwal, Priti. 2009. Application of natural dyes on textiles. Indian j of fibre & textile research, 34(2009): 384-399.

Samariya, S., Dwivedi, S., Patil, S., Panigrahi, D., and Joshi, H. 2013. Formulation and evaluation of herbal sindoor using different natural/herbal ingredients. Int. J of pharmacy teaching & practices. 4(3): 752-754.

Sharma, A. 2013. Analysis of conscious awareness for natural colors. Arch. Appl. Sci. Res., 2013, 5(2): 273-277.

Siva, R. 2014. Status of natural dyes and dye-yielding plants INDIA. Current science, 92(7): 916-925.

Sundrarajan, M., Selvam, S., Rajiv Gandhi, R. and Sujesh, J. 2011. Effectively utilize the natural resources as mordants and dyes for dyeing of cotton. Int. J of current research, 3(11): 363-367.

Warsiki, Endang, and Setiautami, Asih. 2013. Color stability of beet (*Beta vulgaris* L.) dyes label during heating.proc. 2nd Int. conference on adaptive intelligent agro-industry (ICAIA). IPB Int. convention center Bogor, Indonesia. 213-219.

Wells, kate. 2013. Colour, health and wellbeing: The hidden qualities and properties of Natural dyes. Journal of the Int. colour association, (2013):11, 28-36.

Yeniocak, M., Goktas, O., Colak, M., Ozen, E. and Ugurlu, M. 2015. Natural coloration of wood material by red beetroot (*Beta vulgaris*) and determination color stability under UV exposure. Maderas. Ciencia y tecnologia 17(4): 711-722.