

A Review of the Natural Resources Used to Hair Color and Hair Care Products

Z. Shahi, M. Khajeh Mehrizi*, M. Hadizadeh

¹Assistant Professor, Textile Engineering Department, Yazd University, Yazd, Iran

Abstract:

Hair color is one of the oldest and most well-known cosmetics that have been used by many ancient cultures in different parts of the world for not only women but also for men. Synthetic oxidative hair dyes available in the market contain combination of peroxide and ammonia which damage hair and causes allergic reactions. Also, Further the people using synthetic dyes are exposed the risk of breast cancer, urinary bladder cancer and non-Hodgkin's lymphoma. Hair dyes derived from plants to solve these problems and are safe to use. A few of these natural herbals are henna, chamomile, madder, beets, turmeric, walnuts, etc. The developed oil hair color may provide multifunctional effects such as softening, conditioning effect, promotion of growth and density of hair, etc. In this article, the types of used plants for hair color and hair care products are discussed.

Keywords: Hair color, Henna, Chamomile, Madder, Vegetable oils.

INTRODUCTION

The art of hair dyeing was known as early as 5000 years BC among the Egyptians [1]. Hair dye has been used since ancient Egyptian times when Rameses II reinforced red hair color using henna [2]. Since ancient times plants have been used for dyeing targets and even now they play a key role in food, textile and cosmetic. Among them, henna leaf and walnut husk were the most efficient natural hair dyes [3]. Natural colors are divided into several categories, vegetable origin: From root, stem, bark, wood leaf, flower and seed of plants as annatto, turmeric, henna, etc, animal origin as cochineal, etc and mineral origin [4]. Natural dyes are environmental friendly, low toxic and less allergenic. Natural dyes in the structure consist of catechins, flavonoids, ascorbic acid, etc, which show natural anti-oxidant property [5]. Herbal hair color is used in various disorders such as dandruff, premature graying and head lice etc [1]. Natural hair dyes solve the problem of the destruction of the scalp and hair cuticle, which are safe for use [6]. Natural colors include many pigments such as carotene (Golden), lutein (yellow), anthocyanins (red), etc. In this article, an overview of the types of used natural pigments for coloring hair and oils for hair tonic are discussed [7].

VEGETABLE DYES

HENNA

The principle coloring compound of Henna is "Lawson," a red-orange colored compound present in dried leaves in a concentration of 1-1.5% w/w [8].

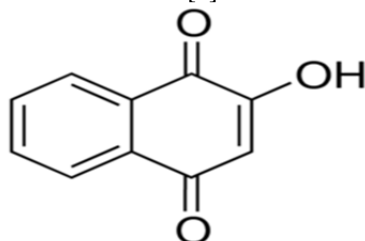


Figure1: The structure of Lawsonone

Lawsonone is proposed to be used as a non-oxidizing hair coloring agent at a maximum concentration of 1.5% in the

cosmetic product [8]. Other components in henna such as flavonoids and gallic acid contribute as organic mordants to the coloring process. Carbohydrates give the henna paste a suitable consistency to hair attachment [9]. Henna has affinity to the keratin in the mildly acidic environment (pH=5.5) [2]. Natural henna is usually hypoallergenic but allergic reactions occurred in mixed types including black henna. This was caused by chemical compounds consisting of para-phenylenediamine, 2-nitro-4-phenylenediamine, 4-aminophenol and 3-aminophenol [10]. Henna has also antifungal activity against *Malassezia* species (causative organism of dandruff) [8]. Henna balances the pH of the scalp for preventing premature hair fall and graying of hair [11]. Henna leaf paste used for alleviating jaundice, skin diseases, smallpox, etc. Extract of Henna leaves with ethanol (70 %) showed significant hypoglycaemic and hypolipidaemic activities in diabetic mice [12].

MADDER

The madders have been exploited as the source of a red dye since ancient times. Anthraquinone structure of madder in various regions is different. For example, the major pigments obtained from European madder are the alizarin anthraquinones and Indian madder mainly yields purpurin [13].

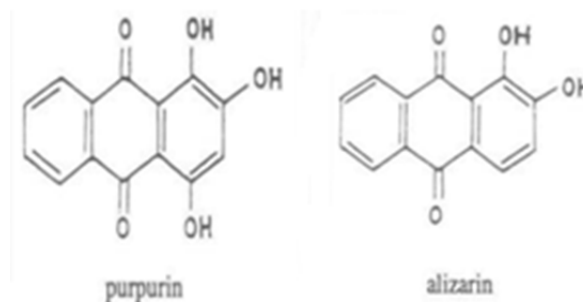


Figure 2: Some of anthraquinone structures in the madder This plant has also been used as natural food colourants and as natural hair dyes. Also, this plant has anticancer, antimicrobial, antifungal, hypotensive and antipain

properties [14]. Moreover, madder is antiseptic, blood purifier and antirheumatic [15].

CHAMOMILE

Another vegetable dye commonly used to obtain yellow shades is chamomile that promotes greater light reflection. The active ingredient of the flower is 1,3,4-trihydroxyflavone, also known as apigenin [2].

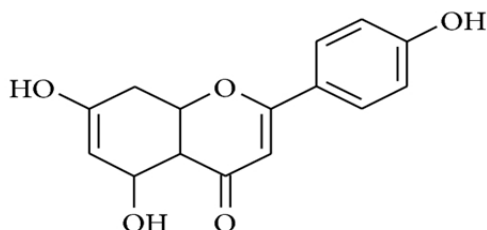


Figure 3: The structure of apigenin

This plant has softening, moisturizing and skin soothing properties [16]. Chamomile is used for indigestion, diarrhea, sleeplessness and sciatica [17].

WALNUT

Juglone (5-hydroxy-1,4-naphthoquinone) can be extracted from different parts of Walnut tree. Juglone is an isomer of the more known lawsone (2-Hydroxy-1,4-naphthoquinone), the coloring agent of Henna and both are some of the oldest dyes used throughout history for dyeing hair [3].

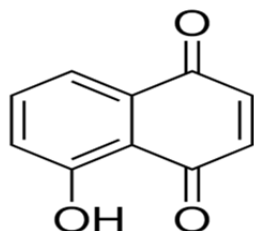
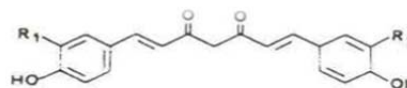


Figure 4: The structure of Juglone

Leaves and hull of walnut fruits is used for hair dyeing. Walnuts contain compounds: Oleic acid, macadamia, linoleic acid, linolenic acid, methionine, cysteine, tryptophan, threonine [18]. 1,4-Benzoquinone is a small organic compound and, in principle, its low molecular weight makes it suitable for semipermanent hair dye formulations. It can be considered a natural brown-dyeing source being it found in young shoots of the pear (genus *Pyrus* L.), where it exhibits strong antibacterial activity [3]. Walnut leaves are used in traditional medicine for external applications such as eczema, loss of hair, scalp itching, peeling and dandruff and treat sun burns [19].

TURMERIC

Turmeric is a small perennial herbaceous plant, bearing many rhizomes which are aromatic and pigment yellow orange-red. Three principal pigments are present in the rhizomes: curcumin, desmethoxy curcumin and bisdesmethoxy curcumin, which are collectively known as curcuminoids [13].



R1	R2
OCH ₃	OCH ₃ ... curcumin
OCH ₃	H ... desmethoxycurcumin
H	H ... bis-desmethoxycurcumin

Figure 5: The structure of the pigment in turmeric

Turmeric has played a traditional role as a crude dyestuff and cosmetic [13]. The paste of turmeric powder has been used as antiseptic and for skin nourishment since centuries [20]. Curcumin is effective in the treatment of inflammatory bowel disease, pancreatitis, arthritis and certain types of cancers [21].

ONION SKIN

Quercetin (3-hydroxy flavone) is the structure of the natural yellow color [3]. Onion skin is rich source of quercetin. Two major flavonoids of onion skin are quercetin glycone and quercetin-4'-glucoside [22].

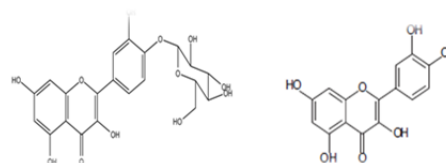


Figure 6: The structure of flavonoids in onion skins

(Right: quercetin glycone, left: quercetin-4'-glucoside)

Quercetin is a strong antioxidant with ability to scavenge free radicals and has been demonstrated to have anti-inflammatory properties. Also, it can inhibit platelet aggregation [23].

ECLIPTA ALBA

The presence of flavones apigenin and luteolin, as the flavone-7-O-glycoside and the flavone-C-glucosides are the main colorant. Two major compounds in the herb of plant are wedelolactone and demethylwedelolactone [24].

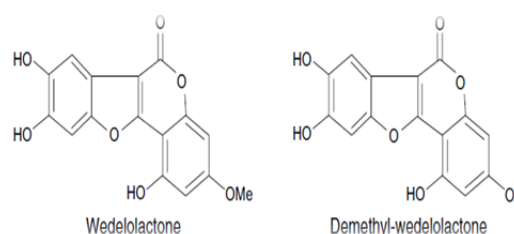


Figure 7: The structure of the compounds in Eclipta alba

The presence such as alkaloids, flavonoids, polyacetylenes, triterpenes and their glycosides in *Eclipta alba* qualifies it as a good source of dye [11]. The juice of the fresh plant is used in a traditional Indian recipe to not only darken the hair, but to improve hair growth and reduce

hair loss [25]. The fresh juice of leaves is used for jaundice, increasing appetite, improving digestion, stopping bleeding, burns, and enhance memory [26].

GUAIAC WOOD

Another blue azulene derivative is guaiazulene (1,4-dimethyl-7-isopropylazulene), present in the essential oil of guaiac wood.

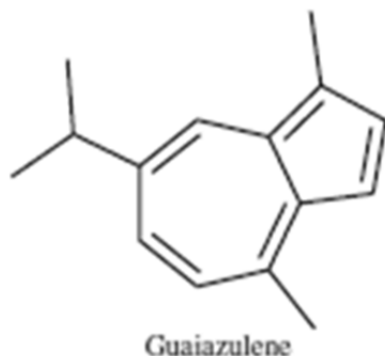


Figure 8: The structure of the pigment in the oil guaiac wood

Recently, it has become a popular ingredient in body care products (lotions, toothpastes, eye drops) owing to its application as a skin conditioning agent in cosmetic formulations (including hair dyes). The absence of polar functional groups in these compounds suggests that only very weak interactions with hair might occur [3].

BRAZILWOOD

Brazilwood was used as natural source for red colors in ancient Asian civilizations. For dyeing, only the colored heartwood of the trunk and larger branches of the tree was used. In contact with oxygen in the air and light brazilin is readily converted to brazilein due to the oxidation of one hydroxyl group to a carbonyl. The Compound creates a red color with much stronger coloring power [27].

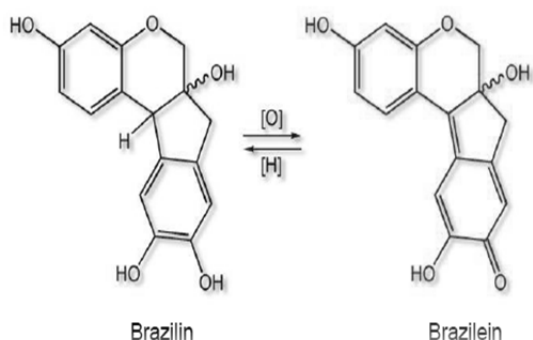


Figure 9: The chemical structure of Brazilin (reduced form) and brazilein (oxidised form).

Brazilin and brazilein from brazilwood species are very similar in structure to haematoxylin and haematin, respectively, from logwood. Brazilwood molecules differ from those of logwood in only one phenolic hydroxyl group [27].

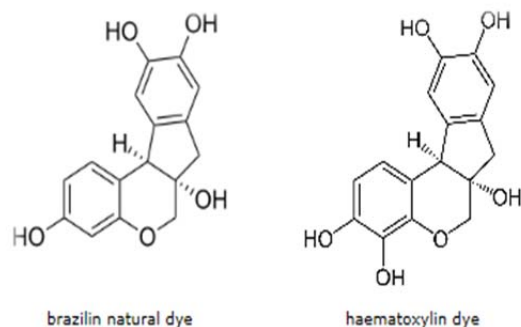
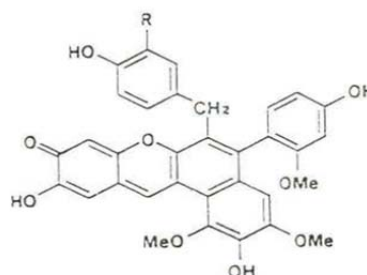


Figure 10: The chemical structure of the pigment in logwood and wood Brazil

The Wood from the Brazilwood tree has been used for brown hair dyes [28]. Brazilwood has been traditionally used as food and beverage colorant in Indonesia [29]. The fruits are rich in tannins and may be used for treatment of leather. Wood and bark are used in traditional medicine for the treatment of diarrhea and a variety of other ailments [13].

RED SANDALWOOD

The principal red pigments in red sandal heartwood are santalin A and B [13].



RH = OH ... santalin A
R = OMe ... santalin B

Figure 11: The structure of the pigment in the red sandalwood

Red sandalwood was employed in the past for wool, cotton and leather dyeing. Red sandal has been traditionally used the coloring of seafood sauces, breadcrumbs and alcoholic drinks [13]. In the traditional system of medicine, the decoction prepared from the heartwood has been used in inducing vomiting and treating eye diseases, mental aberrations, and ulcers. The wood in combination with other drugs is also prescribed for snake bites and scorpion stings [30].

ANNATTO

Annatto is obtained from the outer layer of the seeds of the tropical tree Bixaorellana L. The principle pigment in annatto, namely bixin, is a carotenoid, which is contained in the resinous coating surrounding the seed itself. The major pigment present is cis-bixin; also present, as minor constituents, are trans-bixin, cis-norbixin and trans-norbixin [31].

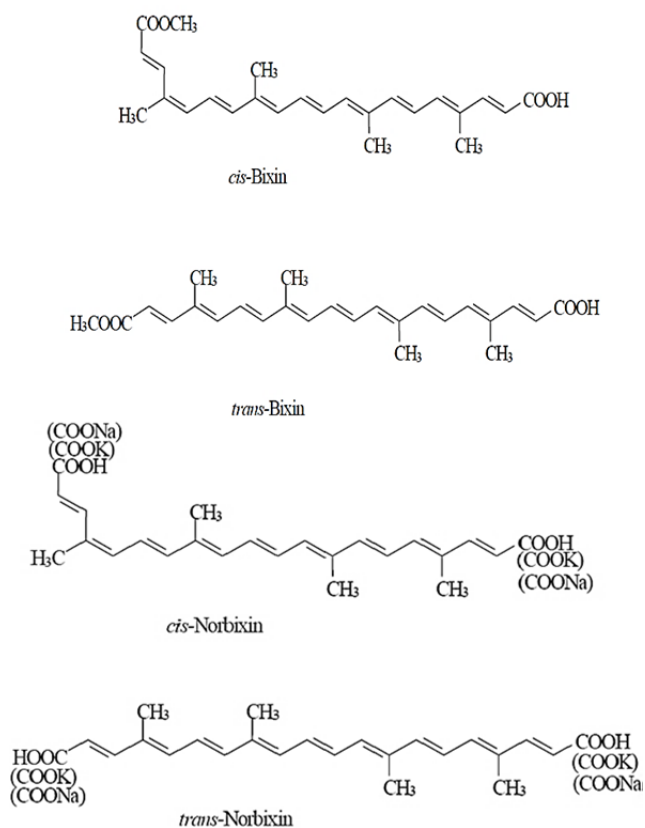


Figure 12: The structure of the pigment in the annatto

The seed is valued as a source of pigments which impart a red or orange hue dependent upon the form of usage [13]. Annatto seeds and extracts have been used for over 200 years in Europe and North America to impart a yellow to red color to foods, especially dairy products such as cheese [31]. Annatto leaves, roots, and seed extracts are popular to treat fevers, inflammatory conditions, and parasitic diseases. A decoction of the leaves is used to stop vomiting and nausea, to treat heartburn, prostate and urinary difficulties [32].

VEGETABLE OILS USED FOR HAIR

ALOE VERA

Anthraquinones, resins, tannins and polysaccharides are the major chemical constituents in Aloe vera [33]. The gel also contains vitamins A, B, C, E, B12, enzymes and amino acid [16]. Aloe vera gel is effective for scalp and can be used not only to treat hair loss, but to promote hair growth as well. Aloe vera contains aloe emodin which promotes hair growth by stimulating hair follicle. It is used as a natural mordant [11]. One of the most valuable cosmetic properties of aloe gel is its ability to stimulate the circulation of the skin and remove the dead skin cells so giving a fresher and younger appearance to the skin. It is recommended for sunburn, insect bites and etc [20].

FENUGREEK

It is used as a conditioner for the hair [11]. The fenugreek contain significant amount of protein content which may help in hair growth and contain rich amount of flavanoid,

which has the antioxidant activity by scavenging free radicals and preventing hair fall [34]. Also, seeds extract is used as hair cleanser [4].

COCONUT OIL

Coconut oil used as such or as a basic raw material for preparing hair oils and tonics [4]. Coconut oil enhances strength of hair and also prevents dryness of hair [35]. Vitamins, Minerals Amino acids, Promote hair growth and moisturize scalp [16].

OLIVE OIL

Olive oil contains Triolein, Tripalmitin, Trilinolein, Squalene and Tocopherol, that gives softening and moisturizing properties to the hair [16]. It is used as skin and hair conditioner in cosmetics like lotions, shampoos and etc [36].

AMLA

This fruit contains vitamin C, tannins, minerals such as (Ca, P, Fe) and amino acid. The fruit extract is useful for hair growth and reduce hair loss [16]. Amla has antibacterial and antioxidant properties that can help promote the growth of healthy and lustrous hair [11].

SHIKAKAI

Shikakai is Lupeol, spinasterol, lactone, hexacosanol, spinasterone, calyctomine, racimase-A oleanolic acid, lupenone, betulin, betulinic acid, betulonic acid and Pods extract is used as hair cleanser and for control of dandruff [18].

SAPINDUS (REETHA)

Sapindus encloses vitamin A, D, E, K Saponin, Sugars, Fatty acid and Mucilage. Reetha extract is useful for promote hair growth and reduce dandruff [16]. Extract of fruit coat works as natural shampoo: used in herbal shampoo as hair cleanser [18].

HIBISCUS

Hibiscus consists of calcium phosphorus, iron, vitamin B1, vitamin C, riboflavin and niacin used to stimulate thicker hair growth and prevents premature graying of hair [37]. This flower is used for controlling dandruff. Hibiscus antioxidant properties by producing flavonoids anthocyanins and other phenolic compounds and are immune-modulating reducing the harmful effects of UV radiation. It can be used to rejuvenate the hair by conditioning [11].

SESAME OIL

Sesame oil involves natural antioxidants such as sesamin and sesamol. It is used in human diet and cosmetics [38]. Seed oil is one of the major sources of hair oils which are used as a base for preparing of specific hair oils [4].

JOJOBA

Jojoba consists of Esters, Acids, Alcohol Tocopherol and Phytosterols that cause reduce hair loss, Moisturize hair and Maintain pH [16]. It is often used in cosmetics as a moisturizer and as a carrier oil for exotic fragrances [36].

CONCLUSION

The world is changing towards the use of safer, nontoxic and natural products with traditional usage. Plants play a key role in food, textile and cosmetic fields and are safe to use. A few of these natural herbs are henna, chamomile, Eclipta alba, Annatto etc. Also, the herbal hair coloring are used in various disorders such as dandruff, premature greying and head lice and etc. Used vegetable oils for hair may provide multifunctional effects such as softening, reduce dandruff and promotion of growth of hair.

REFERENCES

- [1] Naser Zaid, A., et al, Int J Pharm Pharm Sci. 2013, 5, 2, 485-488.
- [2] Aparecida, S., Ferrera, M., Brigatto, V., Rolim, A., Cosmetics. 2015, 2, 2, 110-126.
- [3] Boga, C., et al., Dyes and Pigments. 2013, 97, 9-18.
- [4] Kapoor, V. P., Natural Product Radiance. 2005, 4, 4, 306-314.
- [5] Kilinca, M., Canbolata, S., Merdana, N., Dayioglu, H., Akinb, F., Procedia - Social and Behavioral Sciences. 2015, 195, 2152 – 2159.
- [6] Iqbal, Z., Liaqat, L., Waheed, A., Mahmood, Kh., World Journal of Pharmaceutical Research. 2016, 5,1, 1598-1602.
- [7] Bechtold, Th., Mussak, R. (Eds.), Handbook of natural colorants, John Wiley & Sons, 2009.
- [8] Patel, M., et al., J Adv Pharm Tech Res. 2013, 4, 3, 160-165.
- [9] Nigha, M., Zafar, M. H., Ghaffar, A., Imperial Journal of Interdisciplinary Research. 2016, 2, 2, 190-197.
- [10] Saif, F. A., Journal of Pakistan Association of Dermatologists. 2016, 26, 1, 58-65.
- [11] Naishadham, P., S. P.R., Dasika, R., Tangirala, S., Tangirala, S., International Journal of Pharmaceutical Sciences Review and Research. 2013, 21, 2, 152-157.
- [12] Chaudhary, G., Goyall, S., Poonia, P., International Journal of Pharmaceutical Sciences and Drug Research. 2010, 2, 2, 91-98.
- [13] Green, C.L., Food and agricultural organization of the united nations.1995, 1-116.
- [14] Ramsingh, Geetanjali, Journal of the Serbian Chemical Society. 2005, 70, 7, 937-942.
- [15] Khodke, A.S., Potale, L.V., Patole, S.M., Damle, M.C., International Journal of PharmTech Research. 2010, 2, 4, 2256-2260.
- [16] Anjali, J., Nardev, S., world journal of pharmacy and pharmaceutical sciences. 2016, 5,6, 630-648.
- [17] Aggag, M. E., Yousef, R.T., Planta medica. 1972, 22, 140-144.
- [18] Fatima, A., Alok, Sh., Agarwal, P., Singh, P. P., Verma, A., International Journal of Pharmaceutical Sciences and Research. 2013, 4, 10, 3746-3760.
- [19] Aburjai, T., Natsheh, F. M., Phytotherapy research. 2003,17, 987-1000.
- [20] Amit, J., Subodh, D., Alka, G., Pushpendra, K., Vivek, T., International Journal of Research in Ayurveda & Pharmacy. 2010, 1, 1, 71-77.
- [21] Jurenka, J. S., M.T., Alternative Medicine Review. 2009, 14, 2, 141-153.
- [22] Németh, K., Takácsóva, M., Pisku, M. K., polish journal of food and nutrition sciences. 2003, 12, 53, 170-174.
- [23] Wiczowski, W., Németh, K., Bucinski, A., Piskula, M. K., polish journal of food and nutrition sciences. 2003, 12, 53, 95-99.
- [24] Vankar, P. S., Shanker, R., Srivastava, J., Dyes and Pigments. 2007, 72, 33-37.
- [25] Dweck, A. C., International Journal of Cosmetic Science. 2002, 24, 287-302.
- [26] Pandey, M. K., Singh, G.N., Sharma, R. K., Lata, S., Journal of Applied Pharmaceutical Science. 2011, 1, 7, 104-107.
- [27] Vitorino, T. M., Diss. Faculdade de Ciências e Tecnologia. 2012.
- [28] Uttara, J., Swapnali, B., Mohini, U., International Journal of Pharma and Bio Sciences. 2010, 1, 2, 1-5.
- [29] L., H.N., A., D.R., A., R., International Food Research Journal. 2012, 19, 2, 537-542.
- [30] Arunakumara, K. K. I. U., et al., Journal of the Korean Society for Applied Biological Chemistry. 2011, 54, 4, 495-500.
- [31] Smith, J., Chemical and Technical Assessment Manual. 2006, 21, 1-21.
- [32] Giorgi, A., Marinis, P. D., Granelli, G., Chiesa, L. M., Panseri, S., Journal of Chemistry. 2013, 1-10.
- [33] Packianathan, N., Karumbayaram, S., Journal of Pharmaceutical Sciences and Research. 2010, 2, 1, 648-656.
- [34] Gupta, P. K., Chauhan, N. S., Pathak, A., Spatula DD-Peer Reviewed Journal on Complementary Medicine and Drug Discovery. 2013, 3, 3, 121-125.
- [35] Suvarna, P., Tanuja, N., Deepak, P., P. R.P., World Journal of Pharmaceutical Research. 2015, 4, 8, 1469-1478.
- [36] Joshi, L. S., Pawar, H. A., Natural Products Chemistry & Research. 2015, 3, 2, 1-8.
- [37] Banerjee, P. S., Sharma, M., Nema, R. K., Journal of Chemical and Pharmaceutical Research. 2009, 1,1, 261-267.
- [38] Alencar, J. S., et al., Journal of thermal analysis and calorimetry. 2009, 98.