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Research Article

Influence of Drying on the quality of Ashwagandha (*Withania somnifera*)

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ABSTRACT

An experiment was carried out to adjudge the effect of different drying techniques on colour and withanolides content of *Withania somnifera*. *Withania somnifera* (Ashwagandha) is a plant used in medicine from the time of Ayurveda, the ancient system of Indian medicine and belong to the family Solanacae. The dried roots of the plant are used in the treatment of nervous and sexual disorders. From chemistry point of view, the drug contains group of biologically active constituents known as withanolides. Today there is much interest in natural products. The fresh Ashwagandha roots were dried in shade, sun and cabinet dryer. It was found that in cabinet drying about 49 to 52% moisture loss was observed in only 3.15 hours of drying. The drying condition does not affect much on colour but the effect of temperature plays an important role in withanolides content due to which maximum withanolides was observed in shade drying and minimum in case of cabinet drying (air velocity 1.8 - 2.0 ms^{-1}).

Key words: *Withania somnifera,* withanolides, drying, Ashwagandha.

1. Introduction

Withania somnifera Dunal (family Solanaceae), highly reputed as "Indian ginseng" in Ayurvedic medicine (Schliebs et al., 1997). It is found as a weed in waste places and in hedges throughout the drier regions of India. It is an erect, evergreen shrub with whitish – brown root. Fruits (berries) are smooth, globose, orange- red when mature and enclosed in papery calyx. Seeds are numerous, yellow, discoid or reniform. The roots are alterative, germicidal, aphrodisiac and diuretic and used in Ayurveda to treat ulcers, fever, cough, consumption, dropsy, rheumatism and leucoderma. They are the chief constituent of Ayurvedic drugs such as Ashwagandha churan, Ashwagandharista, etc. Fruit and seeds are diuretic (Parrotta, 2001). It is noted for its beneficial effects on the nervous system. To understand this benefit, a MeOH extract of the roots of *W. somnifera* was investigated as reported previously and showed appreciable activity in the bioassay using a human neuroblastoma SK-N-SH cell line (Tohda et al, 2000).

W. somnifera is well known as a folk medicine and to afford withanolides, which are steroidal derivatives having a characteristic partial structure in the A, B-ring part and the side chain of d -lactone. To date more than 40 withanolides have been isolated from *W. somnifera* (Kirson et al., 1971; Nittala et al., 1981; Bessalle and Lavie., 1992). The chemistry of *Withania somnifera* has been extensively studied and over 35 chemical constituents have been identified, extracted and isolated. The biologically active chemical constituents are alkaloids (isopelletierine, anaferine), steroidal lactones (withanolides, withaferins), saponins containing an additional acyl group (sitoindoside VII and VIII), and withanolides with a glucose at carbon 27 (sitoindoside IX and X). WS is also rich in iron. (Mishra et al, 2000). Withanolides, are a group of naturally occurring C28-steroidal lactone triterpenoids built on an

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intact or rearranged ergostane framework, in which C-22 and C-26 are appropriately oxidized to form a six-membered lactone ring (Mirjalili et al, 2009 & M. Elsakka et al, 1990). These include Withanone, Withaferin A, Withanolides I, II, III, A, C, D, E, F, G, H, I, J, K, L, M, WS- I, P & S , Withamsomidienone, alkaloids like Cuscohygrine, Anahygrine, Tropine, Pseudotropine, Anaferine, Isopellaterine, 3-trophyltigloate and 18 Fatty Acids (Indian Herbal Pharmacopoeia, 2002). Ashwagandha possess anti-inflammatory, antitumour (Devi et al 1992; Dale Kiefer 2006, Widodo et al, 2007); antibacterial (Owais et al, 2005; Murthy et al, 2009; Dhuley, 1998) , antistress (Archana & Navasivayam, 1999; Murthy et al, 2009), antioxidative (Mishra et al, 2000]) , immunomodulatory (Ziauddin et al, 1996; Dhuley, 1997) properties. Withanolides possess remarkable antiarthritic and immunosuppressive properties and protective effect against carbon tetrachloride induced toxicity (Sudhir et al., 1986).

Medicinal plants industrial growth is cultailed by a distinct lack of understanding of the specific post harvest handling and packaging needs of the broad range of species and varieties. Therefore lack of proper cultivation protocol, commercialization techniques, package of practice and limited market opportunities. In particular, poor temperature, humidity management during handling, distribution and marketing were identified as key issues which need to be addressed. *Withania somnifera,* being an herbal raw material for the isolation of active principles for many of the commercially important drugs, conventional methods of drying and improper storage leads to deterioration of produce by contamination and reduction in the alkaloid content. Under these circumstances, it is inevitable to standardize the post harvest drying technique in Ashwagandha for increased active principles recovery through improved post harvest processing.

2. Materials and Methods

2.1. Experiment

An experiment was conducted to standardize the post harvest technology for Ashwagandha during the year 2008-09 at Department of Plant Physiology Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur during. The drying studies were conducted with three replications. The harvested roots were cut into small pieces for the specific treatment and dried by three methods viz., shade drying, sun drying and cabinet drying. Different dryers had variation in configuration; hence they were used to evaluate their suitability for Ashwagandha drying and bio-chemical changes viz, withanolide content in the sample dried in different condition.

2.2. Plant Materials

The fresh Ashwagandha root procured from Department of Plant Physiology JNKVV, Jabalpur. It was then washed thoroughly with running water so that all dirt is removed. Then it was wiped by muslin cloth to remove surface water. After washing the roots was manually peeled with the help of knife and the peeled root was then dried. Grinding of the Ashwagandha was done in the hammer mill to get the powder in the form of fine particle. In shade drying and sun drying methods, the roots were spread uniformly in the aluminium trays and kept in the shade and open to the sun from 8.00am to 5.00pm respectively. The temperature during sun drying ranged from 30 to 32^{o}C and during the night hours, samples were kept in plastic covers to prevent re-absorption of moisture. Likewise, in cabinet drying method, the roots were spread uniformly in the hot air oven at temperature 55 – 61^{o}C. Samples kept for drying were taken at definite intervals and their weight as percentage to original weight was determined.

2.2.1 Moisture

Moisture content of fresh samples and after drying for all the samples was determined by using the standard method (AOAC, 2000).

2.2.2. Colour

The colour of the dried Ashwagandha powder were determined by Hunter lab colour (Flex spectro colorimeter model 45^{o} Hunter Association Laboratory) and the L, a, b values were recorded.

2.2.3. Withanolides content

Withanolides content of Ashwagandha dried under different conditions was determined by HPTLC method (Rajpal, 2002).

2.2.4. Sample Preparation for HPTLC analysis

One gm of each finely powdered sample was extracted three times with 3.0 ml methanol by sonication for 10 minute. Centrifuged the extract for 5 minute at 3000 rev/min. and reduced under vacuum. The extracts were combined in a 10 ml volumetric flask and adjusted to the final volume with methanol. Now samples were diluted with 1:1 methanol. Prior to use, all the samples were filtered through a 0.45µm filter paper.

2.3. Sample analyzed by HPTLC

Apply 10µl of the reference and sample solutions on the different tracks on the silica gel plate (10cm ×10cm) of uniform thickness (0.2mm thickness).The mobile phase was Toluene: Ethyl acetate: Formic acid (5:5:1). Develop the plate in the solvent system upto a distance of 8cm. The plate scanning was done by using a Camag TLC Scanner at 254nm for both reference and samples tracks. Peak purity tests were carried out by comparing their peak areas and Rf values of withanolide A and B (0.40 and 0.50) respectively with those present in the reference and samples tracks. Freshly prepared p-anisaldehyde reagent is used. After drying, the plate was heated at 110^{o}C for 10 min to develop the colour of the spots.

Table 1: Moisture depletion pattern of Ashwagandha root dried in shade and Sun.

Dried in Shade (30 – 32°C)		Dried in Sun (33 – 37°C)	
Time (min)	Loss of moisture (%)	Time (min)	Loss of moisture (%)
30	2.20	30	3.38
60	4.33	60	5.38
90	5.86	90	8.25
120	7.55	120	11.25
150	9.16	150	13.00
180	9.75	180	15.00
560	14.88	210	17.50
590	15.88	240	19.88
650	16.74	270	21.50
710	18.66	330	23.25
770	21.00	360	25.00
840	22.81		

Table 2: Moisture depletion pattern of Ashwagandha root dried in Cabinet dryer at different air velocity and temperature.

Time	Air velocity 1.4-1.6 ms^{-1} and temperature 52 – 61° C		Air velocity 1.8-2.0 ms^{-1} and temperature 55 – 61°C	
(min)	RH	Loss of Moisture (%)	RH	Loss of Moisture (%)
15	51.5	15.25	39	11.63
30	45	22.75	37	19.00
45	41	26.75	35	23.50
60	37.5	30.38	33	30.63
90	36.5	38.50	31	41.00
120	30	41.75	30	45.75
150	28	46.50	27	49.38
195	26.5	49.13	26	52.25

Table 3: Hunter colour value of Ashwagandha powder dried in different condition.

Different drying technique	Lightness	Yellow to Red	Green to Blue
Shade	63.73	2.93	12.27
Sun dried	62.99	3.15	14.05
Cabinet 1, air velocity 1.4 – 1.6 ms^{-1}	67.34	3.87	13.92
Cabinet 1, air velocity 1.8 – 2.0 ms^{-1}	62.95	3.06	12.27
Cabinet 2, air velocity 1.4 – 1.6 ms^{-1}	69.19	3.55	13.64
Cabinet 2, air velocity 1.8 – 2.0 ms^{-1}	61.42	3.33	12.79

2.4. Statistical analysis

All the results were statistically analyzed to estimate the significant difference between different drying conditions on the basis of color, moisture and withanolide content.

3. Results and Discussion

Inappropriate drying of the produce due to microbial activities and biochemical changes result in deterioration of raw material. Effective drying techniques retain a desired moisture level would therefore improve the keeping quality for a longer period of storage.

Effect of different drying condition on moisture content of Ashwagandha:

The moisture content of about 23% was removed in just 14 hours and the temperature lies in the range of 30-32°C during this period when fresh Ashwagandha root was dried in shade. Whereas when the sample was dried in sun 25% moisture was removed just in 6 hours and the temperature range was 33-37°C. The time taken for 22-24% moisture depletion in shade takes about 10-11 hours (30-32°C) and in sun drying 6:30-7.00 hours (33-37°C) which is more as compare to shade drying temperature due to which the moisture is removed faster in sun drying than in the shade drying. Sun drying is the

Table 4. Withanolides content in Ashwagandha dried in different drying condition.

Different drying technique	Withanolide A (%)	Withanolide B (%)
Shade	0.049	0.0137
Sun dried	0.032	0.0119
Cabinet 1, air velocity 1.4 – 1.6 ms^{-1}	0.026	0.0109
Cabinet 1, air velocity 1.8 – 2.0 ms^{-1}	0.027	0.0107
Cabinet 2, air velocity 1.4 – 1.6 ms^{-1}	0.029	0.0113
Cabinet 2, air velocity 1.8 – 2.0 ms^{-1}	0.022	0.0105

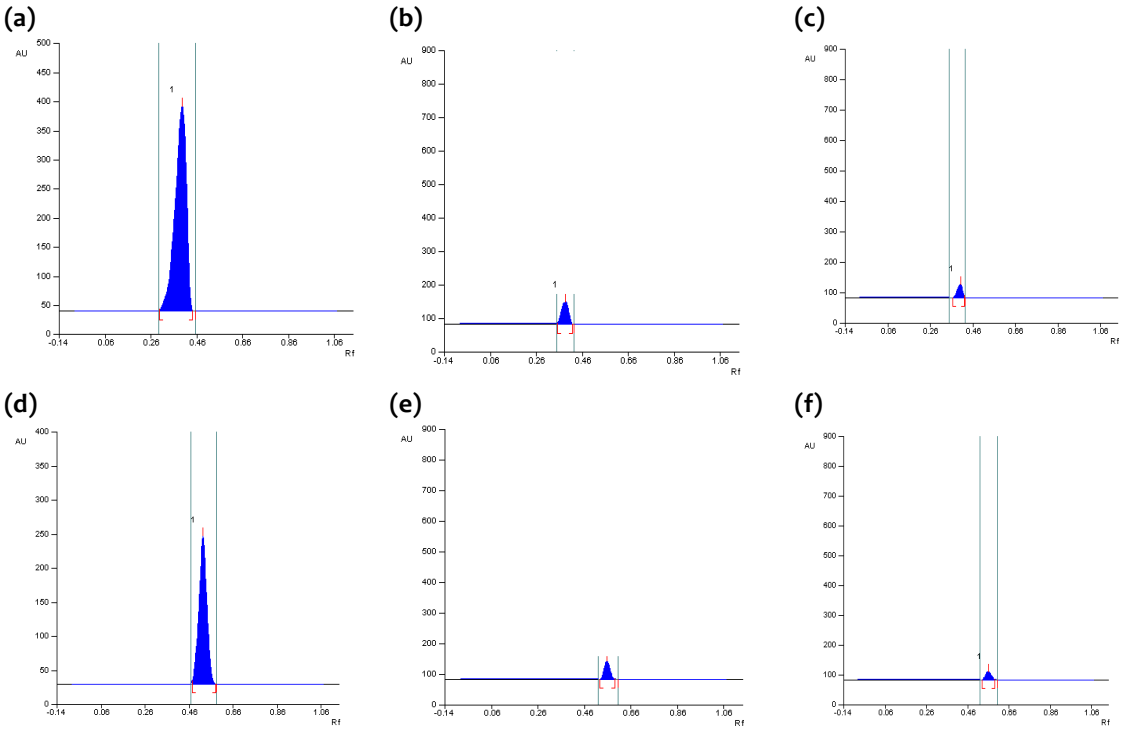

Fig 1. HPTLC chromatogram of (a) Withanolide A Standard (b) Shade drying (c) Cabinet drying (d) Withanolide B Standard (e) Shade drying (f) Cabinet drying.

conventional method of drying. It is the simplest one but weather dependent, time consuming and labour intensive. It is the widely adopted drying technique by most of the cultivators and traders of medicinal herbs. Further in case of cabinet drying the moisture of about 49% is removed in just 3.25 hours and the air velocity is 1.4-1.6 ms^{-1}. Whereas about 52% of moisture is removed from the sample in cabinet drying when the air velocity is 1.8-2.0 ms^{-1} in the same time. Here in cabinet drying the temperature ranges from 52-61^{o}C which is further more as compared to the shade and sun drying (Table- 1 & 2).

Effect of different drying condition on colour of Ashwagandha:

The value of lightness is more or less same in shade, sun and cabinet dried sample as given in the Table-3. The Colour of dried Ashwagandha powder as hunter lab values as lightness varied from 61.42 to 69.19 and Green to blue varied from 12.27-14.05.

3.3. Effect of different drying condition on Withanolides content of Ashwagandha:

The variation in withanolides content of dried powder of Ashwagandha was due to the difference of drying technique. The maximum withanolide A content was observed in the sample when dried in shade (0.049%) and minimum (0.022%) in cabinet dryer with air velocity of 1.88 ms^{-1} and temperature range 55-61^{o}C. Similarly the withanolide B content was found to be maximum in shade drying (0.0137%) and minimum (0.0105%) in cabinet dryer with air velocity of 1.88 ms^{-1} and temperature range 55-61^{o}C (Table 4 and fig.1). The shade drier hinders direct sunlight and gave the best results. This showed that the drying systems affected the withanolides content. This observation if further substantiated by the findings as reported by Kumar et al. (2000) that due to size reduction of turmeric and drying system with covering materials gave better results. Second best results i.e. 0.032% and 0.0119% of

withanolide A and B respectively were observed when the sample was dried in sun. This may be due to the reason that in cabinet drying the temperature inside the cabinet is more i.e. 55-61^{o}C whereas in case of shade drying the temperature lies in the range of 15-18^{o}C. This indicates that the loss of withanolides content take place at higher temperatures.

4. Conclusion

Fresh Ashwagandha when dried in shade and sun for about 13 hours and 6 hours moisture depletion of 21% and 25% was notice respectively. Whereas when dried in cabinet dryer about 49-52% moisture loss is observed in only 3.15 hours of drying. The colour of the dried products does not vary in different drying conditions. Also the effect of temperature plays an important role in withanolides content due to which maximum withanolides was observed in shade drying and minimum in case of cabinet drying with an air velocity of 1.8 - 2.0 ms^{-1}.

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