International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 03 | Mar 2020 www.irjet.net p-ISSN: 2395-0072

A Review on Post Processing of Turmeric Rhizome

Dhawle Manuraj S.[1], K. S. Gharge[2], A.T. Pise[3]

[1,2,3] *Department of Mechanical Engg, Government College of Engg, Karad 415124, Maharashtra, India*

Abstract - *Turmeric is the most ancient medicinal species found in the world. It is found in most of the Asian countries. The post processing of turmeric rhizome is done 2 or 3 days after the harvesting. In post processing maintaining the curcumin content in turmeric is important and which is depends upon the methods used for processing the turmeric. The study of improving the turmeric processing is been done. For the drying of turmeric rhizome solar dryer is evaluated which reduces the drying time for turmeric. Post processing of turmeric rhizome involves curing (boiling), drying, polishing, grinding and packaging. This paper involve the information about the post processing of turmeric rhizome. Various methods are used to cure the turmeric and it has various effect on it's quality. A various literature is presented in this paper each has independent and dependent parameter having direct impact on final product. In this paper effort has been taken to understood the various methods used for post processing of turmeric rhizome. It is found that solar drying is the most efficient method for the post processing of turmeric rhizome.*

Key Words: Turmeric rhizome, Curcumin, Solar dryer, Curing, post processing.

1. INTRODUCTION

Turmeric has several applications in our daily life. It is used in various sector like cosmetics, cooking, food processing, medical etc. A fresh raw turmeric rhizome is dug out from the field. Before dispatching the turmeric to market, it is processed through some processes which involves boiling of rhizome, drying of rhizome, grinding and polishing of rhizome.

i. Curing (boiling) of turmeric rhizome

It is the process of boiling of raw turmeric rhizome. Traditionally rhizome was boiled in water, but now a days it is boil using steam. As the retention of curcumin in case of steam boiling is more than the boiling in water[5]. Boiling of the rhizome is responsible for the uniform distribution of the color, also it removes the odour. In case of steam cooking of rhizome is carried out till the froth is coming out. Boiling time affect the main curcumin content of rhizome, it is decreases with increase in boiling time. To handle the large quantities of turmeric rhizome a several improvements is made in heating furnace and cooking vessels. One more advantage of boiling is that microbiological activity is significantly reduced.

ii. Drying

After boiling the rhizome is spread over the floor for sun drying around 5-7 cm thick layer. To avoid the contamination from foreign particle it is dried on clean and dry surface. For uniform drying of rhizome, it is turned after some interval of time. Almost 10 to 15 days are required for the proper drying of turmeric rhizome. Drying either carried out under open sun drying or in mechanical dryer. It is found that drying time is less in mechanical dryer as compare to open sun drying[10].

iii. Polishing

The rhizome with rough surface and with poor surface colour is polished to obtain the better surface finish. Polishing can be done either by mechanically or by manually. In case of mechanical polishing the mechanical drum is used, whereas in case of manual polishing rhizome is placed in bags and rubbed with the help of stones.

iv. Grinding and packaging

Before grinding the turmeric rhizome, it is need to clean the rhizome. After cleaning the rhizome is grinded to a fine powder. Packaging can be done by manually or by automatic machine. Packing of turmeric is done in different size depending on the customer requirement.

2. Literature on processing of turmeric

Indu Rani Chandrasekaran et al they studied the effect on bioactive constituent due to the processing of turmeric rhizome. The improved post processing technique like boiling, drying, packaging and storage were compared with conventional operation and its impact is assessed on retention of biochemical constituent like essential oil, oleoresin and curcumin. Two varieties of turmeric PTS 10 and CO 2 were studied over a four different boiling methodviz. Cow dung slurry boiling, water boiling, pressure boiling and steaming. After drying and polishing the rhizome were stored by packaging in different material bag. Pressure boiling found to be most efficient method for maximum quality retention of turmeric. Study conclude that turmeric verity PTS 10 found to be best quality dry turmeric rhizome. The maximum retention of curcumin 5.21 %, oleoresin 14 %, essential oil 5.83 % was observed in pressure boiling which is followed by drying the rhizome in solar dryer for 35 hrs.[1]

Mariana Correa et al the purpose of the study is to assess the effectiveness of radiation (Gamma radiation) on turmeric

processing. Radiation $^{60}C_o$ is used at a doses of 0,5,10,15 and 20 KGy on turmeric rhizomes. Folin-Ciocalteu process is performed to quantify the phenolic compound. The quantification of curcumin is performed by the HPLC (High Performance Liquid Chromatography). Sufficient great losses of phenolic compounds is observed in sample with 15 KGy and 20 KGy irradiated. Antioxidant activity index is assessed by the Rancimat method and which is observed significantly lower for doses of 5 KGy and 15 KGy irradiated. It is concluded that the gamma radiation from synthetic radioactive isotope of cobalt ($^{60}C_o$) is viable for the processing of turmeric. For the safety purpose of antioxidant activity doses up to 10 KGy is applied, as there is higher losses found in doses of 20 KGy and 15 KGy irradiated sample.[2]

Vipul Damale et al they analysed the turmeric drying process experimentally. Traditional method of post processing of turmeric rhizome is studied and the effect of various parameter on production of turmeric is identified. Post processing of turmeric rhizome involves curing (boiling) of rhizome, drying of rhizome, polishing of rhizome, grinding of rhizome and packaging. Experiment performed over a sample of 5 grams. After boiling the turmeric rhizome in water the sample is dried in open sun. As the time passes the decreasing the weight of turmeric sample is obtained. They discussed about the combustion efficiency, fuels with various calorific value were used and its effect on mass flow rate of fuel for boiling, energy required for boiling. Optimum hours for open sun drying is identified so that minimum area of absorber is required. In conducted experiment 40 hrs is the optimum hrs for drying which require absorber area less than 0.0002 sq. m.[3]

Dipsikha Kalita et al in this study curing of turmeric rhizome based on microwave is studied. It is observed that power and time shows great effect on curing when statistical analysis is done. However power had low effect compare to time level. It is also observed that retention of curcumin is high in microwave cooking, due to microwave rhizome heats up quickly which reduces the processing time. Cooking of rhizome based on microwave requires 4 min for cooking which is very less time as compare to conventional cooking. Hence, cooking of rhizome based on microwave is used for best quality turmeric production potentially.[4]

Jayashree Ettannil et al "Prathiba" is the variety of turmeric which is processed by the eight different ways. It is found that slicing is the most efficient method for the processing as the drying time reduces to 9 days, whereas in case of cooking the rhizome in water and steam drying time found to be 11 and 12 days respectively. The main content of turmeric is curcumin which is decreases with increase in curing time. The retention of curcumin in water boiling and in steam cooked rhizome is about 5.91% and 6 % respectively. They found the several advantages of steam curing over water boiling in terms of fuel required and quality of cured rhizome. Also the labour required for the processing is minimum.[5]

J. Gitanjali et al in this investigation to retain the maximum curcumin content efficient combustion system for boiling of turmeric rhizome was developed. Different feed stock viz. Coconut husk, tapioca stalk, wood chips, briquettes and juliflora were used to evaluate the performance of developed system for boiling of turmeric rhizome. 80 lit. Water is translated into steam from 100 lit water tank were tank capacity for holding the water is 100 lit. For the production of steam from water about 18 kg of fuel (biomass) feed stocks is consumed. For boiling of 100 kg turmeric sample the steam generated at 100 ^oC and pressure of 8 kg/cm^2 is sufficient when curing time is 8 min. Curcumin content in developed system of combustion is retained up to 6.9 % which is quite higher than the uncooked rhizomes. Energy and mass closure efficiency of developed system found to be 91.62 and 91.27 respectively. It is found that the thermal output, power rating and energy efficiency of developed system is 24360 kcal/h, 28 kw and 18.26 % respectively.[6]
Dr. Rahul C. Ranveer et al they investigated the effects of drying and curing method on constituent of turmeric such as curcumin, essential oil etc. Different cultivars of turmeric like Krishna, Tekurpeta and Salem was investigated in the study. Physio-chemical analysis of this three cultivars is done and it is found that Krishna cultivars was best from three cultivars. It is observed that Tekurpeta and Salem has higher value of colour. Rhizomes cured by improved method loose the moisture content faster as compare to rhizome cured by traditional method. Recovery of Salem cultivar rhizome is higher when it is cured by improved method followed by drying. It is found that the oil content of this three cultivars is unaffected by drying and curing methods. Drying of rhizomes in shade-net was superior to that of cabinet drying and drying in the sun to retain the curcumin content.[7]
KJ Kamble et al they studied the improvements in the processing of turmeric. The study was conducted in College of Agricultural Engineering and Technology, Parbhani. Study was conducted over a different verity of turmeric rhizome by boiling in traditional and improved boiling pot. The traditional boiling pot is improved to reduce the fuel consumption, to improve the quality of rhizome and to reduce the time required for post processing. In traditional boiling pot the essential oil and curcumin content hold upto 2.93 % and 2.57 % respectively, whereas in case of improved pot the content found to be 3.33 % essential oil and 3.20 % is curcumin. It is also observed that 35 min boiling of turmeric in improved pot gave uniform colour than boiling of rhizome in traditional pot for 25 to 45 min.[9]

Dr. V. B. Tungikar et al they worked to improve the performance of turmeric processing unit. Turmeric processing time, properties of turmeric rhizome, rate of consumption of fuel (energy), labour cost etc is improved in new designed turmeric processing plant. Thermo-structural analysis of developed mobile blancher is made to know the developed thermal stresses, heat flux, deflection within limit or not. The purpose of developing mobile blancher is to uniform cooking of the turmeric rhizome. ANSYS software is used to carry out the thermal analysis of developed processing unit. It is observed that the design is safe under

the temperature limit of 120 ℃ to 210 ℃ along with pressure limit of 3 bar to 9 bar when 50 kg weight of turmeric taken for the experiment. Material used for the blancher is stainless steel 304L. Structural and thermal analysis is performed with this material model. Software gives the satisfactory result, which includes distribution of heat flux uniformly, stresses developed (thermal and structural) are within limits. The stresses and elongation observed in analysis are lower than yield strength of 304L. Hence, developed model of turmeric processing is recommended to fabricate.[8]

J. Jhon Gunasekar et al evaluated the solar dryer for post-harvest curing of turmeric. The important biochemical ingredient of turmeric rhizome like oleoresin, volatile oil and curcumin content was studied by drying the rhizome in direct sunlight and drying in the solar dryer. Erode variety of turmeric rhizome was used for the study. A sample of turmeric rhizome is boiled in mild steel pan. After boiling rhizome were cooled to perform biochemical analysis. The important curcumin content, volatile oil percentage, initial moisture content and protein content is determined. Analysis carried out in the replication and each replication is divided into four part out of which two part dried using solar dryer and two part fried under open sun. Result obtain from this study shows that the curcumin content, volatile oil,, protein is in specified requirement. Results shows the greater protein content in solar dried product. Also, the time require for drying is reduces in case of solar drying, for same moisture content 7.2 % achieved in 64 hrs whereas in case of open sun drying it require almost 96 hrs.[10]

M. Blasco et al there are two important steps in turmeric processing blanching and drying. In traditional processing of turmeric blanching is the general step and other option for solar drying is hot air drying. In this study various air flow rate 0.2, 0.5 0.7 1.2 m/s were taken to know the drying kinetics and its effect on the process. To investigate blanching effect, drying kinetics of blanched and unbalanced turmeric rhizome is carried out. During this temperature is different 60, 70, 80, 90 & 100 ^{o}C. Air velocity affect he mass transfer of turmeric during hot air drying. It is observed that in blanching removal of water tested at all temperature enhances but as the temperature increases its effect reduces.[11]

Maria Lucia et al they studied the effect of post harvest processes on turmeric production and its quality. Rhizomes was peel out, cooked in water, sliced, dried using paper towel and packed in bags of polyethylene and last at room temperature it stored 60 days. It is found that yield ranges from 9.83 to 14.50 gram powder per 100 gram of rhizome as there significant loss of moisture. Removal of peel results 30% loss of mass however, powder obtained is of high intensity red and yellow. It is observed that cooking of rhizome in alkaline media compared with regular cooking results high intensity of yellow and low pigment level. There is no significant change observed in curcumin content of rhizome when it is stored for 60 days.[12]

K. P. Jose et al they made comparative study of turmeric drying. In this investigation sample of turmeric is collected from 30 different places and drying of this sample is done by three different method viz. conventional drying, solar tunnel drying and commercial drying. In conventional drying rhizomes dried under sun whereas commercial drying made at the location where sample of turmeric is collected. In case of solar tunnel drying rhizome is boiled for 30 min in a solution containing hydrochloric acid and sodium bisulphite. Air is heated by solar radiation in solar air heater and it passed over the turmeric rhizome. In conventional drying the retention of curcumin and other constituent like essential oil, oleoresin are less. Solar tunnel drying of turmeric retain maximum curcumin content, oil and oleoresin with lesser drying time when compared to conventional drying.[13]

M. Padma et al they evaluated the quality of turmeric when dried at various floor at different condition. Initial condition of turmeric and different method of processing affects the quality of final powder of turmeric and curcumin content. Study is carried out to find effect of drying of turmeric in polyhouse and sun drying with different floor condition like LDPE sheet, cement concrete, sand floors, tarapaulin. It is found that drying time varies as the floor condition changes. When rhizome dried on LDPE sheet it is observed that time required for drying is less as compare to other floor condition. Followed to LDPE sheet tarapaulin is another good floor material for drying of rhizomes.[14]

Sameer D. Shaikh et al they developed solar dryer for turmeric in which heated air is forced over the turmeric rhizome. Various parameter such as solar intensity, flow rate of air and drying time is been evaluated. Experiment of drying conducted over water boiled rhizome and it is observed that about 48 sunshine hour is required for proper drying which very less than the sun drying. So it is concluded that drying of turmeric is possible in short time with developed dryer along with quality of the product. The developed system is renewable energy based so small scale farmer can use this system economically.[15]

Patil P. M. et al the operation of rhizome cooking based on steam is improved by making the some modification in the cooking system. The pressure vessel is designed for the boiling of the rhizome and pressure cooking of rhizome is done. Pressure cooking operation of rhizome reduces the time required for the boiling from 30 minutes to 17 minutes. During this operation condensate collected is recycled through the system hence efficiency of boiler increases. Heat from the chimney is used for generation of steam so that time required for generation of steam reduces drastically[16].

3. CONCLUSION

Above literature review concludes that there are various conventional and improved methods for the processing of turmeric rhizomes. Conventionally rhizomes was boiled in

water which results less retention of curcumin content and essential oil. Also there is no engineering and thermal background in designing of conventional turmeric boiling system due to this system was very bulky and there is large amount of heat losses. Processing time of turmeric rhizome is also very large in conventional system. Hence modification is done and improved system is developed for processing of turmeric. Improved system are small in size also time required for the processing is less. The essential constituent of turmeric curcumin is retain to higher value as compare to conventional system.

REFERENCES

[1] Indu Rani Chandrasekaran and Chandra Bhan Singh, " Effect of processing of turmeric rhizomes (Curcuma longa L.) on the concentrations of bioactive constituents", CSBE/SCGAB 2018 Annual Conference University of Guelph, Guelph, 22-25 July 2018.

[2] Mariana Correa Almeida, Geni Rodrigues Sampaio, Deborah Helena Marcowicz Bastos, "Effect of gamma radiation processing on turmeric: Antioxidant activity and curcumin content", Radiation Physics and Chemistry 152 (2018) 12–16, ELSEVIER, 2018.

[3] Vipul Damale and Kashinath Patil, "Experimental Analysis of Turmeric Drying Process", ScienceDirect, ICMPC_2018.

[4] Dipsikha Kalita, Brijesh Srivastava and Baby Z. Hmar, "Optimization of microwave power and curing time of turmeric rhizome (Curcuma Longa L.) based on textural degradation", LWT - Food Science and Technology 76 (2017) 48-56.

[5] Jayashree Ettannil and Thondiath John Zachariah, "Processing of turmeric (Curcuma longa) by different curing methods and its effect on quality", Indian Journal of Agricultural Sciences 86 (5): 696–8, May 2016/Short Communication.

[6] J. Gitanjali, P. Venkatachalam and P. Subramanian, "Development Of High Efficient Combustion System For Turmeric Boiling", Journal of Environmental Research And Development, Vol. 9 No. 01, July-September 2014.

[7] Dr. Rahul C. Ranveer, Siddharth Madhukar Lokhande, Ravindra Kale and A. K. Sahoo, "Effect of curing and drying methods on recovery, curcumin and essential oil content of different cultivars of turmeric (Curcuma longa L)", International Food Research Journal 20(2): 745-749 (2013).

[8] Prof.Dr.V.B.Tungikar, Prof.Dr. B.M. Dabade and M.G.Harkare, "Design And Thermostructural Analysis of A Mobile Blancher for Turmeric Processing", International Journal of Mechanical Engineering Research and Development (IJMERD), ISSN 2248 – 9347, May-October (2011).

[9] K. J. Kamble, S. B. Soni, "A study of improving turmeric processing", Karnataka J. Agric. Sci., 22(1) : (137-139) 2009

[10] J. Jhon Gunàsekar, S. Kaleemullah, P. Doraisamy and S. Kamaraj, "Evaluation of Solar Drying for Post Harvest Curing of Turemric (Curvuma longa L.)", Agricultural mechanization in Asia, VOL. 37 NO. 1 2006.

[11] M. Blasco, J.V. Garcia-Perez, J. Bon, J.E. Carreres, A. Mulet, "Effect of Blanching and Air Flow Rate on Turmeric Drying", SAGE Publications, ISSN: 1082-0132, 2005

[12] Maria Lucia A. Bambirra, Roberto G. Junqueira and Maria Beatriz A. Gloria, "Influence of Post Harvest Processing Conditions on Yield and Quality of Ground Turmeric (Curcuma Longa L.)", Brazilian Archives of Biology and Technology, Vol. 45, n. 4, ISSN 1516-8913, December 2002.

[13] K. P. Jose, C. M. Joy, "Solar Tunnel Drying Of Turmeric (Curcuma Longa Linn. Syn. C. Domestica Val.) For Quality Improvement", Journal of Food Processing and Preservation 33 (2009) 121–135.

[14] M. Padma, B. Sreenivasula Reddy, M. Madhava, "Evaluation of the quality parameters of the turmeric rhizomes dried on different floors and conditions", International Journal of Agricultural Sciences, Volume 12, Issue 2, June, 2016.

[15] Mr. Sameer D. Shaikh, Prof. R. H. Yadav, Prof. S. M. Shaikh, "Performance Analysis Of Forced Convection Solar Dryer For Turmeric", International Research Journal of Engineering and Technology (IRJET), ISSN: 2395-0072, Volume: 04, Issue: 11,Nov -2017.

[16] Patil P. M., Chhapkhane N. K., "Improving Design and Operation of Steam Based Turmeric Cooking Process", International Journal of Engineering Research and Applications (IJERA), ISSN: 2248-9622, Vol. 3, Issue 4, Jul-Aug 2013.