e ISSN-0976-7223 | Visit Us - *www.researchjournal.co.in* DOI : 10.15740/HAS/IJAE/7.2/436-441

RESEARCH PAPER **International Journal of Agricultural Engineering | Volume 7 | Issue 2 | October, 2014 | 436–441**

Study on standardization of starch extraction time from rhizomes of tikhur (*Curcuma angustifolia* Roxb.)

DEO SHANKAR, S. PATEL, M.K. SAHU AND S.C. MUKHERJEE

Received : 12.07.2014; **Revised :** 08.09.2014; **Accepted :** 19.09.2014

See end of the Paper for authors' affiliation

Correspondence to :

DEO SHANKAR
AICRP on Tuber Crops, Shaheed Gundadhoor College of Agriculture and Research Station, Jagdalpur, BASTAR (C.G.) INDIA
Email : deo1975ram@gmail.com

ABSTRACT : The investigation was conducted at Shaheed Gundadhoor College of Agriculture and Research Station (IGKV), Kumhrawand, Jagdalpur, Bastar, Chhattisgarh. The experiment was undertaken during 1st December to 30th December 2010 and 1st December to 30th December 2011. The experiment was laid out in Completely Randomized Design (CRD) in which 7 treatments were tested in three replications. High rhizome and starch yielded genotype IGSJT-10-2 of tikhur was selected as an experimental material. The results clearly indicated that the maximum starch yield 167.29 g/kg of rhizome was recovered in treatment T_2 (starch extraction on 5 days after harvest) and lowest starch yield 127.06 g/kg of rhizome was recorded in treatment T_7 (Starch extraction on 30 days after harvest of rhizomes). The highest starch recovery per cent was recorded in treatment T_2 and lowest starch recovery per cent was recorded in treatment T_7. Starch colour observed white in all treatments. In the year 2011-12, highest starch yield 167.73 g/kg of rhizome was recorded in treatment T_2 and lowest starch yield 123.27 g/kg or rhizome was recorded in treatment T_7. The highest average starch recovery per cent (16.75) of rhizome was also recorded in treatment T_2 and lowest starch recovery per cent (12.52) rhizome was recorded in treatment T_7. The low starch yield and starch recovery per cent was recorded when starch extracted one day after harvesting of rhizomes, it may be due to high moisture content of rhizomes and field heat. Gradual reduction of starch yield and starch recovery per cent starch extraction after 5 days may be due to conversion of starch in to sugar due to increasing of temperature.

KEY WORDS : Tikhur, *Curcuma angustifolia* Roxb., Starch extraction, Starch recovery, Tikhur processing

HOW TO CITE THIS PAPER : Shankar, Deo, Patel, S., Sahu, M.K. and Mukherjee, S.C. (2014). Study on standardization of starch extraction time from rhizomes of tikhur (*Curcuma angustifolia* Roxb.). *Internat. J. Agric. Engg.*, **7**(2) : 436-441.

Tikhur (*Curcuma angustifolia*; family Zingiberaceae) is a rhizomatous herb also known as white turmeric or East Indian Arrowroot. It's cultivation has now been undertaken by the farmers of Bastar on a large area. Tikhur cultivated as medicinal crop in many parts of the state under moist deciduous mixed and *sal* forest of Madhya Pradesh, Chhattisgarh and Jharkhand. It is generally propagated by rhizomes and good source of starch and fibre (Misra and Dixit, 1983). Tikhur is also found in central province, Bihar, Maharashtra and Southern part of India. In undivided Madhya Pradesh, it is widely distributed in Bastar, Balaghat, Chhindwara, Surguja, Bilaspur, Raipur and Mandla districts (Kirtikar and Basu, 1918). In Chhattisgarh, it is found abundantly in the hilly tracts and forests of Bastar, Dantewada, Bijapur, Narayanpur, Kanker, Rajnandgaon, Kawardha, Dhamtari, Bilaspur, Raipur, Korba, Korea and Surguja districts. The total collection of tikhur rhizome as a minor forest produce in Chhattisgarh is 190.00 tonnes. Bastar and Bilashpur divisions are the major potential area of the state for tikhur (Anonymous, 2005). Two types of tikhur are found in the Bastar division; one with creamy white flowers and another having light pink coloured flowers (Singh *et al.*, 1999). Tikhur rhizomes are used as appetizer reducing burning sensations and stomach pains, removal of stone from kidney, useful for ulcer patient (Sharma, 2003) and rhizome pulp is used for treatment of headache as well as it gives cooling effect (Nag *et al.*, 2006). The fresh rhizomes of tikhur are used for the preparation of starchy flour, which has medicinal value and aliment for many diseases. The rhizome pulp is a remedy for fever, joint pains and leucorrhoea. The rhizomes are used in inflammation, bone fracture, intestinal diseases, etc. by the tribes of Madhya Pradesh and Chhattisgarh states of India

(Ray *et al.*, 2011). The starch obtained from the rhizomes is highly nutritious and easily digestible, therefore, it is recommended for infants, weak children and invalids. The starch can be consumed by individuals during fast as it is rich in energy. It is used for the preparation of many sweetmeats like halwa, barfi, jalebi etc. (Tiwari *et al.*, 2012). The starch of tikhur is used for the preparation of many sweet meals and herbal dishes like *halwa, barfi, jalebi* etc. It is used specially during fast (*Vrata, Upwas*). Farmers also prepare herbal drink "*sarbat*" through tikhur starch during summer due to its cooling effect (Singh and Palta, 2004). The rhizomes of tikhur contains 69-70 per cent moisture, starch 25-30 per cent, crud protein 1.6 per cent, fat 0.2 per cent, sugar and dextrins 2.1 per cent, crude fibre 3.9 per cent and ash 0.9 per cent (Deshpande, 2008). The essential oil composition of tikhur rhizomes are *ar*-curcumene 27.8 per cent, β- Pinene 17.9 per cent, α – Terpineol 13.4 per cent, camphor 12.1 per cent, zingiberol 9.5 per cent and borneol 7.0 per cent (Banerjee *et al.*, 1980).

The farmers of Chhattisgarh reside vicinity to the forest, collect naturally grown tikhur rhizomes as a minor forest produce and some farmers grown commercially in their kitchen garden and *badi* farming system. Farmers grown unidentified locally available genotypes of tikhur for rhizome production and doing processing of rhizomes through traditional method for starch extraction. Farmers yielded less starch due to unrefined extraction process and proper time of starch extraction after harvesting of tikhur rhizomes. Very little information is available regarding this crop especially production, processing and value addition under agro-climatic condition of Chhattisgarh. These kinds of work would ensure *ex-situ* conservation of medicinal plants, besides the economical up scaling of farmers and the augmentation of supply of raw material to pharmaceutical industries. Looking to the importance of the crop for people of the Chhattisgarh an investigation entitled study on standardization of starch extraction time from rhizomes of tikhur (*Curcuma angustifolia* Roxb.) to find out suitable starch extraction time from rhizome after harvesting.

METHODOLOGY

The investigation was conducted at IGKV, Shaheed Gundadhoor College of Agriculture and Research Station (SG CARS), Kumhrawand, Jagdalpur, Bastar, Chhattisgarh. The experiment was undertaken during 1st December to 30th December 2010 and 1st December to 30th December 2011. The experiment was laid out in Completely Randomized Design (CRD) in which 7 treatments were tested in three replications for analyzing effect of processing time of tikhur rhizome on starch recovery. High rhizome and starch yielded genotype IGSJT-10-2 of tikhur was selected as an experimental material and planted in field during last week of June 2010 and 2011 for rhizome production. The tikhur rhizomes were harvested on 30th November 2010 and 2011. The treatments were decided for starch extraction in 5 days intervals after harvesting of rhizomes to standardized processing time of tikhur rhizomes. The treatments were as follows: T_1 = Starch extraction on 1 day after harvest T_2=Starch extraction on 5 days after harvest T_3=Starch extraction on 10 days after harvest T_4=Starch extraction on 15 days after harvest T_5=Starch extraction on 20 days after harvest T_6=Starch extraction on 25 days after harvest T_7=Starch extraction on 30 days after harvest. 1000 g rhizomes of IGSJT-10-2 were taken for each replication in each treatment for extraction of starch by traditional method (sieve rubbing method) to estimate the starch yield. The flow chart of starch

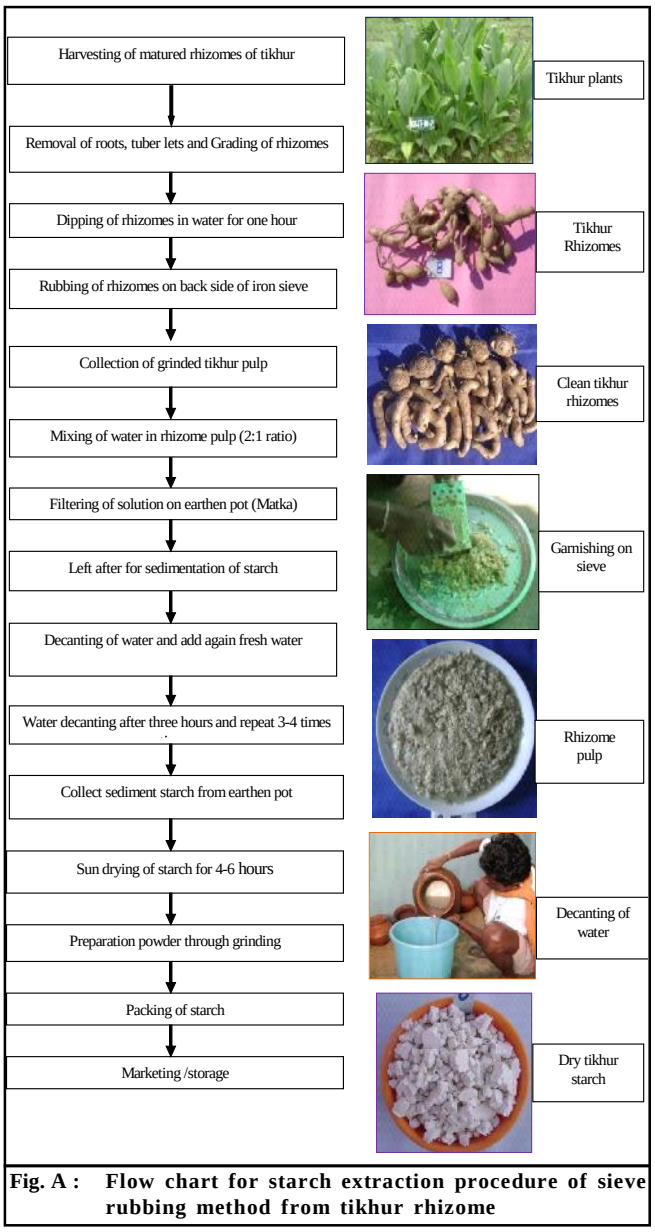


Fig. A : Flow chart for starch extraction procedure of sieve rubbing method from tikhur rhizome

extraction procedure is given in Fig. A with photographs (Photo: 1-7). Tikhur rhizomes were washed thoroughly before starch extraction and used cotton cloth for filtration and used earthen pots (*Mutka*) for fart sedimentation of starch as compared to steel or aluminum pots. Starch recovery of tikhur rhizomes were estimated after extraction of extractable starch from rhizomes. Extracted starch was dried in sun and weighed. Starch recovery was calculated on the basis of following formula: Starch recovery (%) = Wt. of extracted starch / Wt. of rhizomes taken x 100. Colour of starch was recorded on visual basis after the drying of extracted starch.

■ RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect of processing time on starch recovery of tikhur rhizome (2011-12) :

The study was conducted to find out suitable starch extraction time from rhizome after harvesting of tikhur. The experimental results are given in Table 1.

Starch yield (*g*) :

The maximum starch yield 167.29 g/kg of rhizome was recorded in treatment T_2 (starch extraction on 5 days after harvest) followed by 166.94 g/kg of rhizome in treatment T_1 (Starch extraction on one day after harvest) and 165.58 g/kg of rhizome in treatment T_3 (Starch extraction on 10 days after harvest. The lowest starch yield 127.06 g/kg of rhizome was recorded in treatment T_7 (Starch extrication on 30 days after harvest.)

Starch recovery (*%*) :

The highest starch recovery per cent (16.73) was recorded in treatment T_2 (Starch Extraction on 5 days after harvest) followed by 16.70 per cent in treatment T_1 (Starch extraction on one day after harvest), 16.56 per cent in treatment T_3 (Starch extraction on 10 days after harvest). The lowest starch recovery 12.71 per cent was observed in treatment T_7 (Starch extraction on 30 days after harvest). Starch colour was observed white in all treatments during experiment.

Effect of processing time on starch recovery of tikhur rhizome (2011-12) :

Starch yield (*g*) :

Highest starch yield 167.73 g/kg of rhizome was recorded in treatment T_2 (Starch extraction on 5 days after harvest) followed by 163.43 g/kg of rhizome in treatment T_2 (Starch extraction on 1 days after harvest). The lowest starch yield 123.27 g/kg of rhizome was recorded in treatment T_7 (Starch extraction on 30 days after harvest) depicted in Table 1. The starch extraction technique from tikhur rhizome is given in Fig. 1 with photographs (1-6).

Starch recovery (%) :

Maximum starch recovery 16.77 per cent was recovered in treatment T_2 (starch extraction on 5 days after harvest) followed by 16.34 per cent in treatment T_1 (starch extraction on 1 day after harvest) and at par with each other. The minimum starch recovery 12.33 per cent was recorded in treatment T_7 (starch extraction on 30 days after harvest). Starch colour was observed white in all the treatments during experiment given in Table 1.

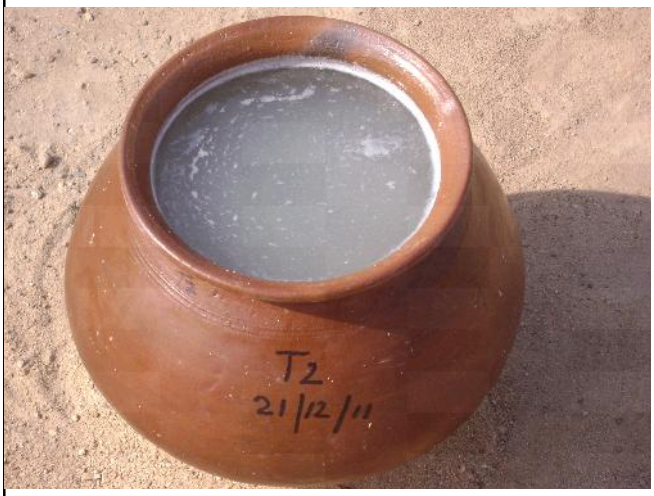
Extraction of starch from tikhur rhizomes in very tedious through traditional method and resultant starch is pure white in colour. Moreover, the extraction of starch from other tuber and root crops is not so simple. The setting of starch germplasm is often slowed down by presence of various components and high temperature. Hence, maximum recovery of starch with good physicochemical and functional qualities coupled with economical extraction of starches from tuber crops other

Table 1 : Effect of processing time on starch recovery of tikhur (*Curcuma angustifolia* Roxb.) rhizome

Sr. No.	Treatments	Year 2010-11		Year 2011-12		Starch colour	Average starch recovery (%) (2010-11 and 2011-12)
		Starch yield (g/kg of rhizome)	Starch recovery (%)	Starch yield (g/kg of rhizome)	Starch recovery (%)		
T_1	Starch extraction on 1 days after harvest	166.94	16.70	163.43	16.34	White	16.52
T_2	Starch extraction on 5 days after harvest	167.29	16.73	167.73	16.77	White	16.75
T_3	Starch extraction on 10 days after harvest	165.58	16.56	158.60	15.86	White	16.21
T_4	Starch extraction on 15 days after harvest	153.03	15.30	147.23	14.72	White	15.01
T_5	Starch extraction on 20 days after harvest	142.06	14.20	139.73	13.97	White	14.085
T_6	Starch extraction on 25 days after harvest	131.64	13.17	132.59	13.26	White	13.215
T_7	Starch extraction on 30 days after harvest	127.06	12.71	123.27	12.33	White	12.52
S.E. ±		2.12	0.21	2.06	0.22	–	–
C.V. (%)		2.44	2.43	2.42	2.60	–	–
C.D. (P=0.05)		6.63	0.66	6.31	0.69	–	–

1. Garnishing of cleaned rhizomes

2. Addition of water and filtration in *Matka*



3. Left for starch sedimentation

4. Decanting of water

5. Sedimented starch ready for drying

6. Dry tikhur starch ready for use

Fig. 1 : Starch extraction technique from thikur rhizomes (Photo 1-6)

than tikhur is thus, relevant. Tuber and root crops are rich sources of starch and hence, are used widely for the extraction of starch. Starch has tremendous application various fields like food, feed and industry.

Tikhur contain starch as the major component and thus, act as important source of starch. Except cassava and to a smaller extent sweet potato, starch from other tuber, root and rhizome crops like tikhur has not been exploited for industrial applications partly because of difficulty in extraction of pure starches and partly because of non- availability of information about properties of these lesser known starches. Similar results were obtained by Vimala and Nair,1988; Vimala *et al*., 2009; Vimala and Hariprakash, 2011 and Huang *et al*., 1999.

Farmers of Chhattisgarh extracting starch from tikhur rhizome through traditional method and yielded less starch due to unrefined starch extraction process and time. Time and method of starch extraction affect the starch yield and starch recovery of Tikhur rhizomes. The experiment conducted for above constraints and results are discussed below for the year 2010-11 and 2011-12. The maximum starch yield 167. 29 g/kg of rhizome was recovered in treatment T_2 (starch extraction on 5 days after harvest) and lowest starch yield 127.06 g/kg of rhizome was recorded in treatment T_7 (Starch extraction on 30 days after harvest of rhizomes). The highest starch recovery per cent was recorded in treatment T_2 and lowest starch recovery per cent was recorded in treatment T_7. Starch colour was observed white in all treatments. In the year 2011-12, highest starch yield 167.73 g/kg of rhizome was recorded in treatment T_2 and lowest starch yield 123.27 g/kg or rhizome was recorded in treatment T_7. The highest average starch recovery per cent (16.75) of rhizome was also recorded in treatment T_2 and lowest starch recovery per cent (12.52) rhizome was recorded in treatment T_7. The low starch yield and starch recovery per cent recorded when starch extracted one day after harvesting of rhizomes it may be due to high moisture content of rhizomes and field heat. Gradual reduction of starch yield and starch recovery per cent starch extraction 5 days may be due to conversion of starch in to sugar due to increasing of temperature. These findings are supported by study curried out by Thamburaj and Singh (2003) in West Indian Arrowroot (*Maranta aurundianaceae*), Vimala and Nambisan (2010); Srinivas *et al.* (2002) and Tiwari and Patel (2013).

Summary and conclusion :

Under the experiment maximum starch yield and starch recovery was recorded by treatment T_2 (Starch extraction on 5 days after harvest) and lowest starch yield and starch recovery was recorded in treatment T_7 (Starch extraction on 30 days after harvest of rhizomes). The starch colour observed white in all the treatments. The maximum starch yield and starch recovery per cent was observed in T_2 when starch extracted 5 days after harvesting and gradually reduced starch recovery due to delay in starch extraction after harvest of rhizomes.

Acknowledgement :

The authors express their sincere gratitude to Dr. S.K. Patil, former Director of Research and present Vice Chancellor, IGKV, Raipur for the facilities provided and encouragement for undertaking this programme. The senior author is indebted to Dr. N. Shukla Sir, Dr. J. Singh Sir, Dr. R. K. Bajpai Sir and Dr. Ravi R. Saxena Sir for their valuable suggestions and guidance during the experiment. They are also grateful to Shri J. L. Nag, Scientist, Horticulture, College of Agriculture, Kanker (C. G.) and Shri R.K. Sori, Ranger, State Forest Deptt. (C.G.) for help during experiment.

Authors' affiliations:

S. PATEL, PI-AICRP on Processing, Faculty of Agricultural Engineering, Indira Gandhi Krishi Vishwavidyalaya, RAIPUR (C.G.) INDIA

M.K. SAHU, Krishi Vigyan Kendra (I.G.K.V.), NARAYANPUR (C.G.) INDIA

S.C. MUKHERJEE, Shaheed Gundadhoor College of Agriculture and Research Station, Kumhrawand, Jagdalpur, BASTAR (C.G.) INDIA

REFERENCES

Anonymous (2005). Chhattisgarh Rajya Laghu Vanopaj, Bajar Sarvekshan Prativedan, CGMFPFED. pp. 16,17 & 42.

Banerjee, A., Kaul, V.K. and Nigam, S.S. (1980). Chemical examination of the essential oil of *Curcuma angustifolia* (Roxb.). *Dalz. Gibs. Riv. Ital. Essenze, Profumi, Piante Offic., Aromi, Saponi, Cosmet. Aerosols*, **62**(2) : 75-76.

Deshpande, D.J. (2008). *A handbook of herbal remedies*. Agribios Pub, Jodhpur, India, pp. 403-404.

Huang, A.S., Tanudjaja, L. and Lum, D. (1999). Content of alpha-beta- and dietary fibre in 18 sweet potato varieties grown in Hawaii. *J. Food Composi. & Anal.*, **12** : 147-150.

Kirtikar, K.R. and Basu, B.D. (1918). *Indian medicine plant*. Second addition, **4** : 241 p.

Misra, S.H. and Dixit, V.K. (1983). Pharmaceutical studies on starches of some Zingiberaceous rhizomes. *Indian J. Pharma. Sci*., **45**(5) : 216-220.

Nag, J.L., Shukla, N., Pararey, P.M., Soni, V.K., Netam, C.R. and Pandey D.K. (2006). Effect of extraction methods on production of edible tikhur (*Curcuma angustifolia* Roxb.). Abstracts book, National Seminar on Medicinal, Aromatic & Spices Plants Perspective and Potential. IGKV, TCB, CARS, Bilaspur, Chhattisgarh. 185 pp.

Ray, S., Sheikh, M. and Mishra, S. (2011). Ethnomedicinal plants used by tribals of East Nimar region, Madhya Pradesh. *Indian J. Pharm. Sci*., **45** (5) : 216-220

Sharma, R. (2003). *Medicinal plants of India- An encyclopedia*. Daya Publishing House, Delhi. 75 pp.

Singh, J., Sharma, R.B. and Singh, R. (1999). Improved cultural practices for cultivation of medicinal herb - Tikhur. In : *Health care and development of medicinal plants.* pp. 319-324.

Singh, R. and Palta, A. (2004). Foods and beverages consumed by Abujhmarias- A primitive tribe of Bastar in Chhattisgarh. *Tribal Health Bulletin.* Regional Medical Research Centre for Tribles (ICMR), Nagpur Road, Jabalpur (M.P.). **10**(1&2): 33-40.

Srinivas, P., Edison, S. and Mithra, S.V.S. (2002). Economic analysis of arrowroot processing and marketing in Thiruvannanthapuram district, Kerala. *J. Root Crops*, **28** : 41-45.

Thamburaj, S. and Singh, Narendra (2003). *Vegetables, tuber crops and spices.* Indian Council of Agricultural Research (ICAR), NEW DELHI, INDIA.

Tiwari, S., Deo, S., Patel, S., Kumar, M., Kumar, Y. and Talukdar, D. (2012). Physico-chemical variation on starch obtained from mother and finger rhizomes. *J. Crop Improv.,* **13**: 25-26.

Tiwari, Soumita and Patel, S. (2013). A comparative study of tikhur traditional and partial mechanical processing and cost economics. *Internat. J. Agric. Engg.*, **6**(1) : 213-215.

Vimala, B., Beenakumari, R. and Nambisan, Bala (2009). Seasonal variations of carotenoids in orange-fleshed sweet potato **(***Ipomoea batatas* (L.) Lam). In: Program and Abstracts of Papers, Presented in session V111. Biofortification and adding value for food and health in root and tuber crops. 15th Triennial Symposium of ISTRC held at Lima, Peru from 02/10/2009-06/10/2009. OP61, 124-125 pp.

Vimala, B. and Hariprakash, Binu (2011). Variability of morphological characters and dry matter content in the hybrid progenies of sweet potato [*Ipomoea batatas* (L.) Lam]. *Gene Conserve.*, **10** (39): 65-86.

Vimala, B. and Nair, R.B. (1988). Segregation pattern of some morphological characters in the hybrid progenies of sweet potato **(***Ipomoea batatas* L.). *J. Root Crops*, **14** : 63-65.

Vimala, B. and Nambisan, Bala (2010). Beta-carotene enriched ice cream from orange-fleshed sweet potato. p.43. In: Sustainable sweet potato production and utilization in ORISSA, INDIA.