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Comparative physico-chemical profiles of *Tugaksheeree* (*Curcuma angustifolia* Roxb. and *Maranta arundinacea* Linn.)

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Abstract

Tugaksheeree is as an ingredient in many Ayurvedic formulations. The starch obtained from the rhizomes of two plants, is used as *Tugaksheeree, Curcuma angustifolia* (CA) Roxb. (Family: Zingiberaceae) and *Maranta arundinacea* (MA) Linn. (Family Marantaceae). In the present study, a comparative physico-analysis of both the drugs has been carried out. The results suggest that the starch from CA and MA has similar organoleptic characters. The percentage of starch content is higher in the rhizome of CA when compared with that of MA and the starch of MA is packed more densely than the starch in CA. The chemical constituents of both the starch and rhizomes are partially similar to each other. Hence, the therapeutic activities may be similar.

Key words: *Curcuma angustifolia*, *Maranta arundinacea*, physico-chemical analysis, *Tugaksheeree*

Introduction

Tugaksheeree is as an important ingredient in many Ayurvedic formulations such as *Chyavana Prasha*,[1] *Bala Ghrita*,[2] *Dadimashtaka Churna*,[3] *Pippalyadi avaleha*,[4] *Talisadya Churna*,[5] *Lavangadi Churna*[6] etc.

Starch obtained from the rhizomes of *Curcuma angustifolia* (CA) Roxb. (East Indian Arrowroot) and *Maranta arundinacea* (MA) Linn. (West Indian Arrowroot) are presently used as botanical source of *Tugaksheeree*[7-9] [Figures 1-6].

Until date no research work has been carried out on comparing physico-chemical profiles of the above two plants. Hence, the study has been taken up to evaluate the test drug samples under organoleptic and physicochemical parameters.

Materials and Methods

The rhizome powders and starches of the drug samples CA and MA were collected in the month of December from Purva Mandala District of Madhya Pradesh and Dakshina Kannada district of Karnataka respectively in the month of December and authenticated in the Pharmacognosy Department of Gujarat Ayurved University, Jamnagar.

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The samples were analyzed by using different organoleptic, qualitative and quantitative analyses of drug samples. A chromatography study and ultraviolet (UV) spectrophotometric analysis were also carried out.

Organoleptic characters

The organoleptic characters in corresponds to the *Pancha Jnanendriya Pariksha* mentioned in Ayurveda were noted such as color, odor, touch and taste of the samples.

Physicochemical parameters

Parameters like loss on drying, total ash, extractive values, determination of pH, volatile oil content, percentage of starch and bulk density study were determined by following the methods described in the standards.[10-12]

Preliminary qualitative tests

The rhizome powders and water extracts (starch) were tested for starch (iodine test), carbohydrates, cyanogenic glycosides, reducing sugar, cardiotonic glycosides, saponins, steroids, resin and flavonoids.[13,14] Along with the estimation of starch was also carried out.[15]

Chromatographic study

Thin layer chromatograpy (TLC) and high performance thin layer chromatograpy (HPTLC) of rhizome powders and starches of both CA and MA were carried out.[16,17]

UV visible spectrophotometric analysis

The UV spectra were recorded on a Comeg TLC scanner III *in situ* mode after HPTLC development.

Figure 1: *Curcuma angustifolia* plant

Figure 2: *Curcuma angustifolia* rhizomes

Figure 3: *Maranta arundinacea* plant

Figure 4: *Maranta arundinacea* rhizomes

Figure 5: Rhizome powders of both plants

Figure 6: Starches of both rhizomes

Plates were developed by the selected solvent system i.e., dichloro methane:benzene:diethyl ether (0.5:4.0:0.5) and dichloro methane only. After the development of the plates, using an air blower, they were observed under UV spectra.

Observations, Results and Discussion

The organoleptic characters of the rhizome powders of CA and MA samples are different. This may be because both belong to different family. However, the starches of both the plants have the similar organoleptic characters [Table 1].

Physicochemical parameters

The study shows higher loss on drying in the CA rhizome, i.e., 25.00% w/w and higher water extractive value, i.e., 4.00% w/w, indicating the presence of a substance with a higher water holding capacity and water soluble compounds having ionic properties. The presence of such types of components increases the microbial growth in the available favorable conditions. Hence, the shelf life period is shorter in comparison with the MA rhizome.

The low CA Ash value shows the presence of low inorganic materials, that is, salts. Moreover, the portion of water-soluble ash part was higher against MA [Table 2].

Table 1: Organoleptic characters

Parameters	CA		MA	
	Rhizome	Starch	Rhizome	Starch
Texture	Fibery powder	Fine smooth	Fibery powder	Fine smooth
Color	Yellowish-brown	White	Creamy-white	White
Taste	Bitter-acrid	Starchy sweetish	Mealy sweetish	Starchy sweetish
Odor	Camphoraceous	Odorless	Characteristic	Odorless

CA: *Curcuma angustifolia* Roxb., MA: *Maranta arundinacea* Linn.

Volatile oil content (0.30% v/w) was found only in the rhizome powder of CA. This may be responsible for its camphoraceous odor and bitter acrid taste [Table 2].

Percentage of starch

Was determined by the traditional and laboratory methods and it was observed that the rhizome of CA contained more starch in comparison with starch from the rhizome of MA.

Bulk density study

It was observed that the bulk density of both the rhizome powders were similar, that is, 0.45 g/cm^3 and 0.50 g/cm^3. The bulk density of the CA starch was 0.56 g/cm^3 while that of MA starch was 0.71 g/cm^3. This indicated that the starch of MA might be packed more densely than that of the CA starch [Table 3].

Phytochemical study

Preliminary qualitative tests

The preliminary phytochemical screening indicated the presence of starch, carbohydrates, saponin, terpinoid/sterols, resin and flavonoids in the rhizome powders of both CA and MA resin, starch and saponin were found in the starches of both CA and MA [Table 4].

Chromatographic study and UV visible spectrophotometric analysis

Plate no. 1

Samples: CA rhizome, CA starch, MA starch (80% methanol extracts).

Solvent system: Dichloro methane: benzene: diethyl ether (0.5:4.0:0.5).

Under short UV, the components at 0.03 were common in CA rhizome, CA starch and MA starch, showing the possibility of being the same compounds. All the components at 0.86 were common in the CA rhizome and CA starch showed the possibility of being the same in all the compounds.

Components at 0.86, 0.86 and 0.85 were observed in the CA rhizome, CA starch and MA starch, which showed the possibility of them being similar types of compounds. Components at 0.75 and 0.76 were observed in CA starch and MA starch showed the possibility of them being similar type of compounds.

Under long UV, the components at 0.03 were common in the CA rhizome and MA starch, showing the possibility of being the same compounds.

Components at 0.94, 0.95 and 0.93 were observed in CA rhizome, CA starch and MA starch, indicating the possibility of them being similar types of compounds. Components at 0.12 and 0.11 were observed in CA starch and MA starch indicating the possibility of them being similar types of compounds [Table 5].

It was observed that the components at 0.86 were common in CA rhizome and CA starch showing the possibility of them being the same compounds. The component 0.85 in MA starch showed the possibility of a similar kind of compound [Table 6].

The component 0.03 is common in CA rhizome and MA starch showing the possibility of it being same compound [Table 6].

Components at 0.94, 0.95 and 0.93 in CA rhizome, CA starch and MA starch showed the possibility of being similar types of compounds [Table 6].

Table 2: Physicochemical parameters

Name of the parameter	Results			
	CA		MA	
	Rhizome	Starch	Rhizome	Starch
Determination of loss on drying at 110°C (% w/w)	25.00	15.00	12.00	13.00
Ash value (% of total ash) (w/w)	8.50	0.50	13.00	1.00
Acid insoluble ash (% w/w)	0.65	-	0.60	-
Water soluble ash (% w/w)	2.00	-	0.50	-
Methanol soluble extractive value (% w/w)	4.00	3.00	9.00	5.00
Water soluble extractive value (% w/w)	14.00	13.00	7.00	3.00
Hexane soluble extractive value (% w/w)	0.30	0.10	0.20	0.10
pH value (5% w/v aqueous solution)	6.80	6.90	6.62	7.15
Volatile oil content	0.30% v/w	Nil	Traces	Nil

CA: *Curcuma angustifolia* Roxb., MA: *Maranta arundinacea* Linn.

Table 3: Bulk density study

Sample	Weight of powder (g)	Volume after 50 tappings	Bulk density (g/cm^3)
CA rhizome	5	11	0.45
CA starch	5	9	0.56
MA rhizome	5	10	0.50
MA starch	5	7	0.71

CA: *Curcuma angustifolia* Roxb., MA: *Maranta arundinacea* Linn.

Table 4: Phytochemical study

Components	Tests	Preliminary qualitative chemical tests: Results			
		CA		MA	
		Rhizome	Starch	Rhizome	Starch
Starch	Iodine test	+	+	+	+
Carbohydrate	Fehling A and B solution test	+	–	+	–
Cynogenic glycoside	With Conc.H2SO4	+	–	+	–
Cardiotonic glycoside	Keller-Kiliani test (for sugar)	+	–	+	–
Saponin	With lead acetate	+	+	+	+
	Froth test	+	+	+	+
Terpenoid/Sterols	Libermann-buchhard test	+	–	+	–
	Salkowski reaction	+	–	+	–
Resin	With acetic anhydride and H2SO4	+	+	+	+
Flavonoids	With neutral lead acetate	+	–	+	–
	With sulfuric acid	+	–	+	–

CA: *Curcuma angustifolia* Roxb., MA: *Maranta arundinacea* Linn.

The components 0.75 and 0.76 in CA starch and MA starch showed the possibility of being similar types of compounds [Table 7].

The components at 0.12 and 0.11 in CA starch and MA starch showed the possibility of being similar types of compounds [Table 7].

Plate no. 2

Samples: MA rhizome, MA starch and CA starch (80% methanol extracts).

Solvent system: Dichloromethane:benzene:diethyl ether (0.5:4.0:0.5).

Under short U.V., it is observed that the components at 0.04 are common in MA Rhizome and MA Starch, indicating the possibility of being the same compounds. Furthermore, components at 0.38 are common in MA starch and CA starch, showing the possibility of being the same compounds.

Components at 0.04, 0.04 and 0.03 are observed in MA rhizome, MA starch and CA Starch indicating the possibility of them being similar type of compounds. Also, the components at 0.53, 0.51 and 0.52 in MA rhizome, MA starch and CA starch showed the possibility of being similar types of compounds.

Under long UV, the components at 0.04 are common in MA rhizome and MA starch showing the possibility of being the same compounds. Components at 0.04, 0.04 and 0.03 are observed in MA rhizome, MA starch and CA starch indicating the possibility of them being similar types of compounds [Table 8].

Two components at 0.38 are common in MA starch and CA starch showing the possibility of being the same compounds [Table 9].

Two components at 0.51 and 0.52 in MA starch and CA starch show the possibility of being similar type of compounds [Table 9].

Discussion

Starches of CA and MA have similar organoleptic characters.

Table 5: Chromatographic study and ultraviolet visible spectrophotometric analysis

No. of spots (track)	254 nm Rf value (no. of peaks)	No. of spots (track)	366 nm Rf value (no. of peaks)
3	0.03; 0.67; 0.86	2	0.03; 0.94
4	0.01; 0.03; 0.75; 0.86	3	0.01; 0.12; 0.95
3	0.03; 0.76; 0.85	3	0.03; 0.11; 0.93

CA: *Curcuma angustifolia* Roxb., MA: *Maranta arundinacea* Linn.

Table 6: Ultraviolet visible spectrophotometric analysis

Tracks	Auto-generated samples	λ max (nm)	Rf	λ max (nm)	Rf	λ max (nm)	Rf
1	CA rhizome	261	0.86	200	0.03	266	0.94
2	CA starch	274	0.86	288	0.01	282	0.95
3	MA starch	282	0.85	291	0.03	282	0.93

CA: *Curcuma angustifolia* Roxb., MA: *Maranta arundinacea* Linn.

Table 7: Ultraviolet visible spectrophotometric analysis

Tracks	Auto-generated samples	λ max (nm)	Rf	λ max (nm)	Rf
2	CA starch	284	0.75	348	0.12
3	MA starch	284	0.76	632	0.11

CA: *Curcuma angustifolia* Roxb., MA: *Maranta arundinacea* Linn.

Physicochemical profiles show the presence of starch, carbohydrates, saponin, terpinoid/sterols, resin and flavonoids in the rhizome powders of both CA and MA resin, starch and saponin were found in the starches of both CA and MA shelf life period of the rhizome of CA is shorter in comparison with that of the MA rhizome due to higher loss on drying and higher water extractive value. Low ash value in CA shows

Table 8: Ultraviolet visible spectrophotometric analysis

No. of spots (track)	254 nm Rf value (no. of peaks)	No. of spots (track)	366 nm Rf value (no. of peaks)
6	0.01; 0.04; 0.13; 0.17; 0.18; 0.53	3	0.01; 0.04; 0.55
4	0.04; 0.38; 0.51; 0.62	2	0.04; 0.63
3	0.03; 0.38; 0.52	1	0.03

CA: *Curcuma angustifolia* Roxb., MA: *Maranta arundinacea* Linn.

Table 9: Ultraviolet visible spectrophotometric analysis

Tracks	Auto-generated samples	λ max (nm)	Rf	λ max (nm)	Rf
2	MA starch	284	0.38	272	0.51
3	CA starch	284	0.38	283	0.52

CA: *Curcuma angustifolia* Roxb., MA: *Maranta arundinacea* Linn.

the presence of low inorganic materials that is salts. Volatile oil content has been found in the rhizome powder of CA, which may be responsible for its camphoraceous odor and bitter acrid taste. The percentage of starch content is higher in the rhizome of CA in comparison with that of MA. The starch in MA is packed more densely than that of the CA starch. The chemical constituents of both the starch and rhizomes are partially similar to each other with the possibility of same components at 0.03 and 0.86 in plate no. 1 and at 0.38 in plate no. 2, based on the chromatographic study and UV spectrophotometric analysis.

Conclusion

The physicochemical profile of both the starches was found to be similar, because of the similar type of components present in CA and MA. Therefore, both the source plants can be used as substitutes for therapeutic purposes.

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हिन्दी सारांश

तुगाक्षीरी का तुलनात्मक एवं विश्लेषणात्मक अध्ययन

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तुगाक्षीरी के नाम से दो वनस्पतियों (कुर्कुमा अंगुस्टिफ़ोलिया और मराण्टा अरुण्डिनेसिया) के कन्दों के सत्त्व का उपयोग होता है । प्रस्तुत अध्ययन मे, इन दोनों द्रव्यों के कन्दों और सत्त्वों का तुलनात्मक एवं विश्लेषणात्मक अध्ययन किया गया । इस अध्ययन से दोनों द्रव्यों के संघटनों में पायी गयी समानता दोनों द्रव्यों के उपयोग होने को सूचित करती हैं ।