Phytochemical Screening, Physicochemical Analysis of Starch from Colocasia Esculenta

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ABSTRACT

Colocasiaesculanta is herbaceous plant with central edible corms, it is widely cultivatedin high rain fall area and it was first cultivated in 'south east Asia'. Now a day, people suffering from a variety of health issues, including new ailments and costly therapies for those disease. As a result, employing the herbal plant is less expensive and has less adverse effects. Taro contains 70-80% starch, which is a fantastic source of energy for the human body. Starch is also beneficial for peptic ulcers, pancreatic ulcers, inflammatory bowel diseases (IBD), chronic liver disease, making it a readily available and nutritious food. The starch can beextractedfromtarocormpowderbysimpleextractionprocess.Thephytochemicalevaluationofextractedstarchrevealsthatitcontains starch, glycosideandprotein.Thephysicochemical evaluation shows the extracted starch powder has poor flow propertiesalsoabsorptionmaximaofextractedstarchismatchwiththestandardstarch.Theextractedstarchshowsthemoderateanti-ulcerogenic activity.

KEYWORDS: Taro, Medicinal uses,Ediblecorms,Starch, Phytochemical screening, UV-Spectrophotometry, IR Spectroscopy.

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INTRODUCTION

History

Colocasiaesculentaplantwasfirstcultivatedinsoutheastasiaandthentransportedtosouthchinaviajapanandindonesia,anarchipelagoofislands.Taromayhavebeencultivatedasearlyas100B.C.inChinaandEgypt.Thewheelwasthen transported to West Africa by an Arab commerce caravan some 2,000 yearsago, then to South America by the slave trade, and lastly to the Caribbean by theslave trade. It is now grown practically everywhere in the tropical and subtropicalworld, and it is a widely distributed plant. The majority of taro is grown in WestAfrica. [1]

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Indigenous medicinal plants have recently grown in relevance on a global scale.Andtherearealotofthesemedicinalplants.Peopleinruralareas,especiallythose withoutaccesstohealthcare,relyonmedicinalherbs.Colocasiaesculenta,sometimesknownasTaro. The plant also contains bioactive phytonutrients like flavonoids,glycosides,andmicronutrients. [1]

Taroisatuberousperennialplantthatistypicallygrownintropicalandsubtropicalregions around the world [15,17]. Taro's botanical name is Colocasia esculenta,and it is from the Arum family (Apiaceae). This herb is grown in more than 60nations throughout the world, making it the sixteenth most popular. It is a widelygrown crop in India. Taro has a modest protein (1.5%) and fat (0.2%) content in its corm, which issimilar to many other tuber crops. It contains a lot of starch (70–80 g/100 g drytaro), fibre (0.8%), and ash (1.2 percent). Taro also contains thiamine, riboflavin,iron,phosphorus,andzinc,aswellasvitaminB6,vitaminC,niacin,potassium copper, and manganese. Taro can be utilized to entrap flavoring chemicals as well. [2,8]

Morphology

Taro is an herbaceous plant with a central corm (just below the soil surface) fromwhich leaves and roots grow upward and cormels, daughter corms, and runners(stolon's)sproutlaterally.Thefibrousrootstructurecanbeseenlargelyintheupperone metre of soil. Dasheen taro has a large, cylindrical corm. It can grow up to30cminlengthand15cmindiameter,andistheplant'sprincipalediblecomponent. [1]

Fig.No.1Leave

Fig.No.2Corm

Leaf: Taro leaves with a high protein content (23%) could be a good complementto the high carbohydrate content (87%) found in the tuber component of the plantas a human dietary source [2,10]. Taro leaves have been shown to be high inmineralssuchascalcium,phosphorus,andiron,aswellasvitamins.Thetaroleaf'shigh dietary fibre content is also beneficial since it helps regulate intestinal transitby boosting dietary volume [2,11].

Root: Roots and tubers have a lots of nutritional potential for providing cheap

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sources of dietary energy in the form of carbs. The protein level of roots and tubers is generally modest, ranging from 1 to2 % dry weight. [2,6] Taro is low in protein and fat, however it is strong in carbs, fibre and minerals. [15,24] Other nutrients such as zinc, vitamin C, thiamine, riboflavin and niacin are higher in it than in order root crops. [2,7]

ChemicalConstituents

Minerals: When compared to other tuber crops including potato, sweet potato,cassava, and rice, tarohas a highernutritional value. Potassium, along withmagnesium, phosphorus,and calcium.is themostprevalentmineral in taro.[21].

Fat: Taro is low in fat and has a low fat content. Raw taro has a fat percentage of0.65%, and cooked taro has a fat content ranging from 0.3 g/50 g to 0.7 g/50 g. [21]

Carbohydrate:Onafreshweightbasis,taro carbohydratesareclaimedtoaccountfor29 %.Accordingtoastudy,inaccessiblecarboh ydratesaccountfor14.7percentof the dry matter in taro, with hemicellulose accounting for about 70% of thefraction,pectinfor17%,andcellulosefo r13%,makingtarocormsagreatalternative flour source. [21]

Dietary fibres: Taro is a good source of dietary fibre when compared to othertubers, particularly potatoes. Polysaccharides, which make up the majority ofdietary fibers. [21]

Starch:Tarocormhas70–80percent(dryweightbasis)starchwithtin yGranules,according to report. Taro starch is easily digestible [2,13]. Pepticulcerpatients,pancreatic disease patients, chronic liver disease patients, inflammatory boweldisease patients, and all benefit from taro starch[2,14].

MedicinalUses

1. Theplant'sleaves, roots,andtubersallhaveseveraltherapeu ticpowers.
2. Tarowasused bytotreat illnessrangingfromconstipationtubercul osis.
3. Studieshavebeenreporteditsp ossiblebeneficialroleinthetreatm entofdiarrhea,gastroenteritis,an dinflammatory boweldisease,cancer.
4. Thejuiceextractedfromthecor moftheplantisusedasanexpector ant,stimulant,horsd,oeuvre,anda stringentforalopecia [22].

EXPERIMENT

ALWORK

CollectionofTubersandIdentification

Tubers were collected locally from Maharashtra. Herbarium was prepared andsubmitted at botany department of Balwant College, Vita. Dist. Sangli (specimenNo.ASK01).Thebotanicalidenti fyoftheplantwasconfirmedbyDr.Shankar. M. Shendage. Tubers were washed and air dried. Dried tubers part of Colocasiaesculantawerecrushedtofinepo wderusinggrinderatAdarshcollegeofPhar macy,Vitaand stored inanairtightcontainerforfurtherstudies.

ExtractionofStarchfromTubers

Taro tubers were harvested and thoroughhly cleaned. The exterior covering layerwas stripped after washing. After that, the tuber was sliced and dried at roomtemperature.Thedriedslicedtuberpi eceswerecrushedinamixergrindertomak

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ethe powder after drying. This powder is alsousedfor starchextraction. Thefollowingprocedures were usedtoextractstarch[22].

Extraction byaSimpleMethod

The taro powder (15 gm) was distributed in 150 ml of hot water and homogenized f or around 30 minutes with a homogenizer. The resulting solution was kept in therefrigerator overnight. The solid and liquid layers split the next day, with the solid mattsettlingatthebottomoftheglassbeaker andtheliquid floatingatthetop.The liquid layer is decanted, and any leftover sediment is rinsed away with morehot water. The water is decanted after washing, and the starch powder is producedbyfilteringitthroughWhattmanf ilterpaper. [22]

TableNo.1PhytochemicalTest

Test	Observation	Inferen ce
1.Testforcarbohydrate **A)Fehling′stest** EqualvolumeofFehlingA&Breagentweremix edand 2mlof crudeextractandgentlyboiled.	A brick red precipitateappearedatbottomofthetes ttube.	Positive
B)Benedict′stest Crude extract mixed with 2ml of benedicts reagent and boiled.	Reddish brown precipitate formed.	Positive
C)Molischstest Crude extracts was mixed with2ml of Molisch agent and themixture was shaken ,2ml of conc. H2SO4waspouredalong theside ofthe testtubes.	Appearanceofavioletringattheinter phase.	Positive
2.Iodinetest Crudeextractwasmixedwith2mlofiodine solution.	Adarkblueorpurplecoloration.	Positive
3. TestforProtein **A)Millonstest** crude extract mixed with 2ml ofMillonsreagent.	Whiteprecipitated appeared which turnedredupongentleheating.	Positive
B)Ninhydrintest Crudeextractboiledwith2mlof solutionofNinhydrin.	Violetcolourappeared.	Positive
4. Test forFlavonoids **A)Alkaline reagenttest**Crude extract was mixed with2mlNaOHandaddedfewdrop		Positive

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ofdiluted acid.	Yellowtocolourlessappeared.	
4. Test forFlavonoids **A)Alkaline reagenttest**Crude extract was mixed with2mlNaOHandaddedfewdrop ofdiluted acid.	Yellowtocolourlessappeared.	Positive
B)Shinodatest Crudeextractswasmixedwith few fragmentsofmagnesiumribbonandconc.HCL	Pinkscarletcolourappeared.	Positive
5.TestforGlycoside **A)Salkowskistest** Crude extract was mixed with 2ml of chloroform then 2ml of conc.H2SO4 and shaken gentl**e.**	Reddishbrowncolourindicated.	Positive
B)Keller-killani test Crude extract was mixed with2ml of glacial acetic acid and 1-2 drops of lead acetate solution,Then mixture was poured intoanothertesttubecontaining2ml ofconc.H_2SO_4.	Abrownringat interphase.	Positive

Physicochemical test[2]

3] **Angle of repose**

Takeameasuredamountofpowder.Powderisweighed andpassedthrougha10meshsieve.Place the funnel assembly on a glass plate and secure it with a clamp or a ringsupport.Transferthepowderintothefunnelwhileblockingthestemaperturewithy

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ourthumb.Changedtheheightofthefunnelsothatthereisroughlya2cmgapbetweenthe bottomofthefunnelstemandthepick/topofthepowderpile.Whenthepowderisevacuatedfromthefunnel,theangleofreposeismeasured.Usingapencil,tracetheouteredgeofthepile on blankpapertodetermineitsdiameter.Usingtworulers,measuredthepile'sheight.Calculatedtheangleofreposebyusingradiusandheight.

Bulkdensity(fluffdensity)

If necessary, filter a portion of the powder sample through an aperture ofgreater than or equal to 1.0 mm to break up any agglomerates that may haveformedduringstorage.Gentlypour1gofthetestsample(m) intoadrygraduatedcylindercontaining10mlofwater.Carefullylevel thepowderwithoutcompactingit,anduseitheunsettledapparentvolume (V)toconverttothe nearestgradedunit.Usingtheformula,calculatethebulkdensityin(g/ml).

Bulkdensity= Weightofsample/Bulkvolume

Tappeddensity

Placethecylinderinthebulkdensityapparatus'sholder.Do100tapsonthesamepowdersampleand takeameasurement.Usingtheformula,determinethetappeddensityin(g/ml).

Tappeddensity=Weightofsample/Tappedvolume

MeasureofPowderCompressibility

1. Carr'sindex(compressibilityindex)

Carr'sindex=TappedDensity-BulkDensity/TappedDensityX100

2.

Hausner'sRatio: AsimilarindexwasdefinedbyHausner's.TheHausner'srationis defined

Hausner'sratio=Tapped Density/BulkDensity

Moisture content

Losson Drying

Preparedaslurrywith1gmofsamplepowder.Weighedtheemptypetridishandthenfilleditwiththesampleslurry. Weighedthepetriplatewiththesample.Maintaineda105^0 chotairover temperaturefor15minutesatatime.Measuredtheloss ondryingafterplacingthepetridishinahotairovenfor15min.Dryinglossiscalculateduntilthesampleweightisequal.

Loss on drying = Wt. of sample before dry – wt. of sample after dry

Wt. of sample before dry X 100

Determinationofglobulesize

Thesamplewasmashedusingapestleinamortar. Tomaketheextract,thecrushedsamplewascombinedwithdistilledwater. Theextractsweregiven2-3 dropsofLugol'siodine. Theslideswerewashedanddried beforebeingused. Thenameofthesamplewaswrittenonthesl ides. Afewdropsofthesampleandlugol'siodinecombinationwereplacedontheglassslide

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andcovered witha coversliptopreventairbubbles. Tissuepaperwasusedtoabsorbanyexcess fluids. Theslidewasexaminedatmagnificationsof 10Xand40.

ParticleSizeDetermination [24]

1. Calibrationofeyepiecemicrometer

Useadrytissuepaper tocleantheeyepieceandstagemicrometer .Thestagemicrometerisplacedonthemicr oscopestageandtheeyepiecemicrometer is placedintheeyepiece.Theeyepieceandsta gemicrometersarematchedinsuchawayt hatthefirstlinesofbothmicrometers coincide.Thenumberofdivisionsoftheeye piecemicrometermustequalthenumbero fdivisionsofthestagemicrometer.

2. Particlesizedetermination

Themicrometerintheeyepiecehasbeencal ibrated.Madeasuspensionwithpowdersa mpleand liquidparaffin. Aportionofithasbeenput onaglassslide.Themountedmaterialisplac edonamicroscopestagesothatitmaybeex aminedunderamicroscope.Foratleast300 components,theparticlediameterinbothd irectionsismeasuredandrecorded.Becaus eanaverageparticlesizeisderived,thedata isdisplayedasasizefrequencydistribution [23].

$$\text{Averageparticle size} = \frac{\sum nd}{\sum n}$$

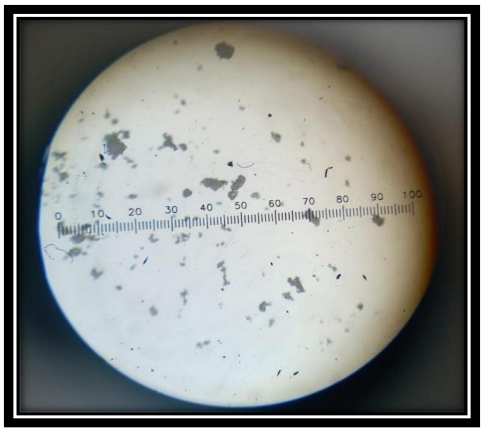

Fig No.3Particlesizedetermination

UV-Spectroscopy

Preparethestocksolutionbydissolving100mgofpurestarchin100mlofdistilledwater tomakeastockof1000ppmstrength.Pipetteout1mL,1.5mL,2mL,2.5mLfromabovestocksolutionandd iluteup to10mlhaving concentration100 ppm,150 ppm,200ppm,and 250 ppm.Scanningtheabovesolutioninbetween200-600nm.

IRSpectroscopy

Obtained IR spectrum by using KBr plates technique Interpretation has been done by using rules of interpretation and also by comparing standard spectrum.

RESULTANDDISCUSSION

Starch has been extracted from taro successfully by the simple process of extraction.

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ThePhytochemicalanalysisofextracted starchcarriedoutandresultare asfollow:

Phytochemicalanalysis

TableNo.2PhytochemicalTest

1.	**Test forCarbohydrates** 1. FehlingTest 2. BenedictsTest 3. MolischTest	Negative Negative Negative
2.	IodineTest	Positive
3.	**TestforProtein** 1. MillonsTest 2. NinhydrinTest	Positive Positive
4.	**Test forFlavonoids** 1.Alkaloids 2..ShinodaTest	Negative Negative
5.	**Test forGlycoside** 1. Salkowskistest 2. Killar-killanitest	Positive Positive

Fig no.4 Phytochemical Test

PhysicochemicalEvaluation

Physicochemical evaluation study was carried outand that gives theidea about theidentification

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of physical appearance, melting point, bulk density, tapped density, carrsindex,hausnersratio,angleofrepose,moisturecontent,particlesizeandtheresultsareasfollows:

TableNo.3PhysicochemicalEvaluation Test

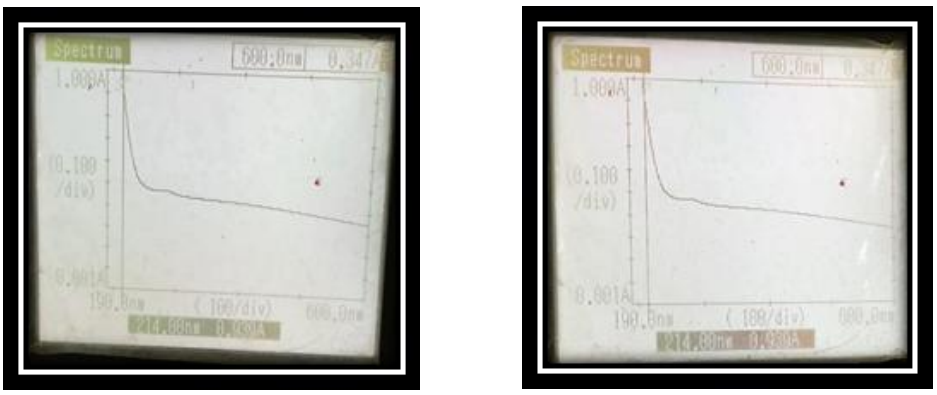
1.	Bulkdensity	0.41gm/cm^3	-
2.	Tappeddensity	0.51gm/cm^3	-
3.	Carr′sindex	19.60	Fair
4.	Hausner′sratio	1.26	Fair
5.	Angle ofrepose	50	Poor
6.	Moisturecontent	10.95%	NMT15%
7.	Particlesize	40.15um	-
8.	Meltingpoint	250-253^{0}C	258^{0}C

UV-Visiblespectrophotometricanalysis

Extracted starch solutions were scanned in between 200-600 nm by using UV-Spectrophotometer.

TableNo.4UV-Visibleabsorption maximumvalues

1.	100ppm	214
2.	150ppm	214
3.	200ppm	214
4.	250ppm	216



FigNo.5UVSpectraofextractedStarch

IR Spectroscopy

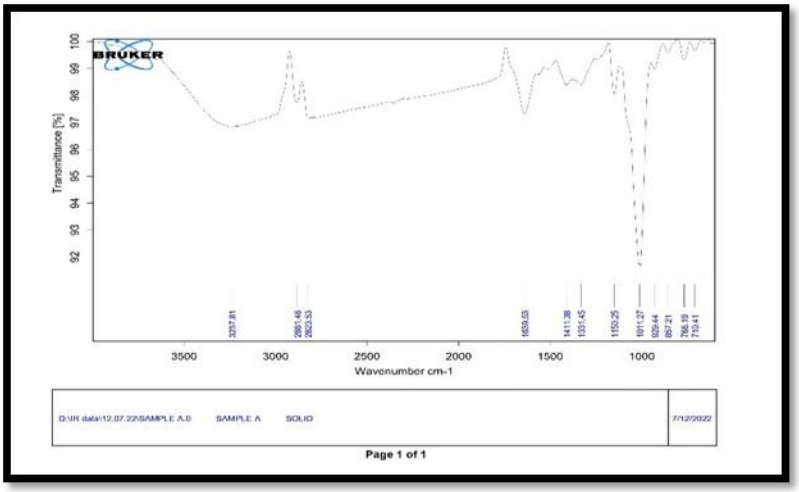


Fig No.6 IR Spectra of Extracted Starch

Interpretation of the sample is as follow:

Table no. 5 Interpretation of sample

1331.43	O-H bending
1411.38	O-H bending
2823.53	C-H stretching
2881.46	C-H stretching
3237.81	0-H stretching –alcohol
1411.38	CH3 bends
1639.53	Water bending vibration due to highly hydrophilic nature of polymer structure
1011.27	Vibration of C-O-H bending
857.21	C1- group vibration
929.44	Ring vibration
768.19	Law frequency vibration
710.41	Law frequency vibration
1150.25	Glycosidic C-O-C asymmetric stretch

SUMMARYANDCONCLUSION

In the present work, phytochemical analysis, physicochemical study and UV-Spectrophotometric analysis of extracted starch is carried out. Phytochemical analysisrevealed that present starch powder contains glycoside, protein and iodine test was alsopositive. Physicochemicalstudygivesbriefideaaboutth eidentificationofphysicalappearance,solubilit ystudies, meltingpoint,bulkdensityandtappeddensity. Sotheangleof repose of extracted starch which is poor. The Hausner's ratio and Carr's index which isfound to bepoor flowability of the powder. Absorbance maxima of extract starch ismatches with the absorbance maxima standard starch Loss on drying of extracted starchpowderobtainedwithinthelimit. (accordingtoIP). The typical assignation of starch include wide bond associated with hydroxyl groups [O-H- bending among 1330-1420 cm^{-1}] [O-H stretching among 3237.81 cm^{-1}] typical signal associated with –CH stretching [2823.53- 2881.46] and intense signal has been associated with vibration of C-O-H bending at 1011.27 cm^{-1}. In particular signal associated to 1639.53 cm^{-1} is usually describe the water bending vibration due to highly hydrophilic nature of polymer are observed in 712.41-768.19 cm^{-1}.

The overall result revealed that presence of medicinally important constituents intheplantwhichisconfirmbythephytochemic alandphysicochemicalcharacterization.Soas per traditional medicinal practices starch extractfrom thisplantis recommendedstrongly as well as it is suggested that further work should carried out to characterizedactive constituent responsible foractivity also addition work is encouragingfor furthergoodresearch.

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