



CHARACTERIZATION OF HERBAL DRUGS BY IR: A REVIEW

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ABSTRACT

Infrared spectroscopy is used to check the functional groups which are present in the synthetic compounds, herbal compounds and etc. In herbal drugs many functional groups are present, in this work the authors have collected the the research papers in which the herbal drugs and herbal formulations functional groups are detected using the infrared spectroscopy. The infrared spectroscopy can also be used for herbal drugs.

INTRODUCTION

Spectroscopy involves the study of interaction of electromagnetic radiation with matter, this result in forms of absorption, emission or scattering of electromagnetic radiations. The types of spectroscopy are X-ray spectroscopy, flame spectroscopy, atomic emission spectroscopy, atomic absorption spectroscopy, visible and ultraviolet

Spectroscopy, infrared spectroscopy and nuclear magnetic resonance.^[1] IR spectroscopy is used to determine the functional groups present in the compound and types of the bonds present in the compound. It is based upon selective absorption of IR radiations. Selectively there is a absorption of the radiations by the compound when it is exposed to the radiations produced by the IR.^[1,2]

Table no. 1: List of plants and herbal formulations

S. NO	AUTHOR	YEAR	TITLE	PLANT/FORMULATION NAME	CONSTITUENTS USED FOR CHARACTERIZATION
1	Huan Li <i>et al</i>	2018	Multiple Fingerprint profile and chemometrics analysis of polysaccharides from <i>Sarcandra glabra</i>	<i>Sarcandra glabra</i>	Polysaccharides
2	Manickam Murugan <i>et al</i>	2014	Phytochemical, FT-IR and antibacterial activity of whole plant extract of <i>Aerva lanata</i> (L.) Juss. Ex. Schult.	<i>Aerva lanata</i> (L.) Juss. Ex. Schult.	Plant extract of <i>Aerva lanata</i> (L.) Juss. Ex. Schult.
3	Sufiyan Ahmad <i>et al</i>	2016	Isolation and characterization of β -sitosterol from <i>Tephrosia villosa pers</i>	<i>Tephrosia villosa pers</i>	β -sitosterol
4	Naynika Patel <i>et al</i>	2017	Isolation and characterization of potential bioactive compounds from <i>Piper betle</i> varieties Banarasi and Bengali leaf extract	<i>Piper betle</i> varieties Banarasi and Bengali leaf extract	Potential bioactive compounds from <i>Piper betle</i> varieties Banarasi and Bengali leaf extract
5	R. Kavitha	2017	Fluorescence, ft-ir and gc-ms determination of bioactive constituents of leaf extract of <i>Clitoria ternatea</i>	<i>Clitoria ternatea</i>	Bioactive constituents of leaf extract of <i>Clitoria ternatea</i>
6	Manish kumar <i>et al</i>	2011	Detection of metformin hydrochloride in a traditionally used indian herbal drug for antidiabetic: a case report	Herbal drug for antidiabetic	Metformin hydrochloride
7	V. Saratha <i>et al</i>	2011	Isolation and characterization of lupeol, a triterpenoid from <i>calotropis gigantea latex</i>	<i>Calotropis gigantea latex</i>	Lupeol, a triterpenoid
8	A. Nishanthini <i>et al</i>	2014	Phytochemical, ft-ir, and gc-ms analysis of stem and leaf of <i>tiliacora acuminata</i> (lan.) Hook f & thomas (menispermaceae)	<i>Tiliacora acuminata</i> (lan.) Hook f & thomas (menispermaceae)	Stem and leaf of <i>tiliacora acuminata</i> (lan.) Hook f & thomas (menispermaceae)
9	Abiodun Falodun <i>et al</i>	2009	Phytochemical and biological investigation of chloroform and ethylacetate fractions of <i>Euphorbia heterophylla</i> leaf (Euphorbiaceae)	<i>Euphorbia heterophylla</i> leaf (Euphorbiaceae)	Chloroform and ethylacetate fractions of <i>Euphorbia heterophylla</i> leaf (Euphorbiaceae)
10	Huda Jasim	2015	Biochemical analysis of	<i>Origanum</i>	<i>Origanum</i>

	Al-Tameme <i>et al</i>		<i>Origanum vulgare</i> seeds by fourier-transform infrared (FT-IR) spectroscopy and gas chromatography-mass spectrometry (GC-MS)	<i>vulgare</i> seeds	<i>vulgare</i> seeds
11	Marjan Shahriari <i>et al</i>	2019	Biosynthesis of gold nanoparticles using <i>Allium noeanum Reut.</i> Ex Regel leaves aqueous extract; characterization and analysis of their cytotoxicity, antioxidant, and antibacterial properties	Gold nanoparticles using <i>Allium noeanum Reut.</i> Ex Regel leaves aqueous extract	Nanoparticles using <i>Allium noeanum Reut.</i> Ex Regel leaves aqueous extract
12	Ahmad Ahmeda <i>et al</i>	2019	Characterization and anti- acute T cell leukemia properties of silver nanoparticles synthesized by a green approach for bioremediation applications: Introducing a new chemotherapeutic drug for clinical trial studies	Silver nanoparticles	Silver nanoparticles
13	Xing Hu <i>et al</i>	2019	Chemical characterization and evaluation of antimicrobial and cutaneous wound healing potentials of gold nanoparticles using <i>Allium saralicum</i> R.M. Fritsch	<i>Allium saralicum</i> R.M. Fritsch	Gold nanoparticles using <i>Allium saralicum</i> R.M. Fritsch
14	Simona Strgulc Krajsek <i>et al</i>	2008	Identification of Herbarium Whole-Leaf Samples of <i>Epilobium</i> Species by ATR-IR Spectroscopy	<i>Epilobium</i>	Herbarium Whole-Leaf Samples of <i>Epilobium</i>
15	Xu Yang <i>et al</i>		A novel optimization of water-soluble compound polysaccharides from Chinese herbal medicines by quantitative theory and study on its characterization and antioxidant activities	Chinese herbal medicines	Polysaccharides
16	Fabrício Havy Dantas de Andrade <i>et al</i>	2019	Characterization and compatibility of dry extract from <i>Annona muricata</i> L and pharmaceutical excipients	<i>Annona muricata</i> L	Dry extract from <i>Annona muricata</i> L.
17	Ahmed Nokh	2019	Characterization	<i>Tetracera</i>	<i>Tetracera</i>

	ala et al		of α -glucosidase inhibitory activity of <i>Tetracera scandens</i> leaves by Fourier transform infrared spectroscopy-based metabolomics	<i>scandens</i> leaves	<i>scandens</i> leaves
18	M. Sutovská et al	2013	Characterization and biological activity of <i>Solidago canadensis</i> complex	<i>Solidago canadensis</i> complex	<i>Solidago canadensis</i> complex
19	Jia Li et al	2019	Purification, structural characterization, and immunomodulatory activity of the polysaccharides from <i>Ganoderma lucidum</i>	<i>Ganoderma lucidum</i>	Polysaccharides
20	Pierre-Yves Sacré et al	2010	Comparison and combination of spectroscopic techniques for the detection of counterfeit medicines	Counterfeit medicines	Counterfeit medicines
21	Dongyan Wang et al	2019	Biosynthesis and characterization of zinc oxide nanoparticles from <i>Artemisia annua</i> and investigate their effect on proliferation, osteogenic differentiation and mineralization in human osteoblastlike MG-63 Cells	<i>Artemisia annua</i>	Zinc oxide nanoparticles
22	Samuel Kaiser et al	2019	Chemical differentiation between <i>Uncaria tomentosa</i> and <i>Uncaria guianensis</i> by LC-PDA, FT-IR and UV methods coupled to multivariate analysis: a reliable tool for adulteration recognition	<i>Uncaria tomentosa</i> and <i>Uncaria guianensis</i>	<i>Uncaria tomentosa</i> and <i>Uncaria guianensis</i>
23	Noviany Noviany et al	2020	Structure characterization and biological activity of 2-arylbenzofurans from an Indonesian plant, <i>Sesbania grandiflora</i> (L.) Pers	<i>Sesbania grandiflora</i>	2-arylbenzofurans
24	Ping He et al	2019	Structural Characterization and Immunomodulatory Activity of a Polysaccharide from <i>Eurycoma longifolia</i>	<i>Eurycoma longifolia</i>	Polysaccharide
25	Zakie	2020	Isolation and	<i>Piper longum</i>	Acetylcholinester

	Khatami <i>et al</i>		Characterization of Acetylcholinesterase Inhibitors from <i>Piper longum</i> and Binding Mode Predictions		ase
26	Zou Hua-bin <i>et al</i>	2005	Dual-Index Sequence Analytical Method for IR Fingerprint Spectra of Ethanolic Extract of Various <i>Glycyrrhizae</i> 's Root Species Components	<i>Glycyrrhizae</i> 's Root Species	Ethanolic Extract of Various <i>Glycyrrhizae</i> 's Root Species Components
27	Jini Devi <i>et al</i>	2019	Preparation of herbal curd with <i>Gymnema sylvestre</i> and its characterization for the treatment of liver cancer	<i>Gymnema sylvestre</i>	<i>Gymnema sylvestre</i>
28	Tao Shen <i>et al</i>	2020	Discrimination of <i>Gentiana</i> and Its Related Species Using IR Spectroscopy Combined with Feature Selection and Stacked Generalization	<i>Gentiana</i> and Its Related Species	<i>Gentiana</i>
29	Hossein Danafar <i>et al</i>	2014	Biodegradable m-PEG/PCL Core-Shell Micelles: Preparation and Characterization as a Sustained Release Formulation for Curcumin	M-PEG/PCL Core-Shell Micelles	Curcumin
30	Mahadeva Rao U. S. <i>et al</i>	2019	Isolation and Characterization of Phytochemical Constituents and its Antibacterial Activity of <i>Brassica oleracea</i> var <i>acephala</i>	<i>Brassica oleracea</i> var <i>acephala</i>	Phytochemical Constituents of <i>Brassica oleracea</i> var <i>acephala</i>
31	G. Jagadeesan <i>et al</i>	2005	FT-IR Study of the influence of <i>Tribulus terrestris</i> on Mercury intoxicated mice, <i>Mus musculus</i> liver	<i>Tribulus terrestris</i>	<i>Tribulus terrestris</i>
32	I. R. BUNGHEZ <i>et al</i>	2012	Antioxidant silver nanoparticles green synthesized using ornamental plants	Silver nanoparticles green synthesized using ornamental plants	Silver nanoparticles green synthesized using ornamental plants
33	Sivaperumal Gopalan <i>et al</i>	2014	Evaluation of antibacterial activity, phytochemical screening and characterization of <i>Mimusops elengi</i> seeds	<i>Mimusops elengi</i>	<i>Mimusops elengi</i> seeds
34	Mohamed Hajji <i>et al</i>	2018	Structural characterization, antioxidant and	<i>Periploca laevigata</i> root barks	Polysaccharide

			antibacterial activities of a novel polysaccharide from <i>Periploca laevigata</i> root barks		
35	Gunpreet Kaur <i>et al</i>	2020	Isolation and Characterization of Stigmasterol from <i>Fritillaria roylei</i>	<i>Fritillaria roylei</i>	Stigmasterol
36	Abhishek K. Tripathi <i>et al</i>	2020	Extraction, Isolation, and Characterization of <i>Bauhinia variegata</i> Flower	<i>Bauhinia variegata</i>	<i>Bauhinia variegata</i> Flower
37	J. Kanimozhi <i>et al</i>	2016	Comparative evaluation of un-purified and purified form of <i>nervaalam</i> (croton seeds) by pharmacognostical, physicochemical and ft-ir analysis	<i>Nervaalam</i>	<i>Nervaalam</i> (croton seeds)
38	Hadush Gebrehiwot <i>et al</i>	2016	Characterization of some compounds isolated from Sweet basil (<i>Ocimum basilicum</i> L.) Leaf extract	Sweet basil (<i>Ocimum basilicum</i> L.)	Sweet basil (<i>Ocimum basilicum</i> L.) Leaf extract
39	A.Shanmugapriya <i>et al</i>	2017	FT-IR Spectroscopic Studies on Synergistic Potential of <i>Boerhavia diffusa</i> and <i>Tridax procumbens</i>	<i>Boerhavia diffusa</i> and <i>Tridax procumbens</i>	<i>Boerhavia diffusa</i> and <i>Tridax procumbens</i>
40	Jie Feng <i>et al</i>	2018	Infrared fingerprints-based mathematical modeling for characterization of different regions of <i>Zanthoxylum nitidum</i> (Roxb.) DC and prediction of inhibitory components on liver cells	<i>Zanthoxylum nitidum</i> (Roxb.) DC	Different regions of <i>Zanthoxylum nitidum</i> (Roxb.) DC
41	Helimarcos Nunes Pereira <i>et al</i>	2018	Physicochemical characterization of the vegetal drug and nebulized extract of the roots from <i>Apodanthera congestiflora</i> Cogn. (Cucurbitaceae)	<i>Apodanthera congestiflora</i> Cogn. (Cucurbitaceae)	Extract of the roots from <i>Apodanthera congestiflora</i> Cogn. (Cucurbitaceae)
42	Yung Sing Chng <i>et al</i>	2016	Vasorelaxation Study and Tri-Step Infrared Spectroscopy Analysis of Malaysian Local Herbs	Malaysian Local Herbs	Malaysian Local Herbs
43	Kapil Thakur <i>et al</i>	2017	Preparation and Characterization of <i>Suvarna Bhasma Parada Marit</i>	<i>Suvarna Bhasma</i>	<i>Suvarna Bhasma Parada Marit</i>
44	Ayyakkannu Purushothaman <i>et al</i>	2017	Isolation and Characterization of an Acyclic Isoprenoid from	<i>Semecarpus anacardium</i> Linn	Acyclic Isoprenoid

			Semecarpus anacardium Linn. And its Antibacterial Potential in vitro		
45	Ram Bindurani L G P <i>et al</i>	2019	Extraction, Isolation and Characterization Screening of Coccinia grandis	Coccinia grandis	Coccinia grandis
46	Hammad Alam <i>et al</i>	2018	Synthesis and Characterization of Nano Selenium Using Plant Biomolecules and Their Potential Applications	Guava leaves	Nano Selenium
47	Yokeswari Nithya <i>et al</i>	2015	Isolation, Purification and Characterization of (R)- Petranine from Catharanthus pusillus(Murr.) G.Don(Apocynaceae)	Catharanthus pusillus(Murr.) G.Don(Apocynaceae)	(R)- Petranine
48	Fengyao Wu <i>et al</i>	2011	Structural characterization and antioxidant activity of purified polysaccharide from cultured Cordyceps militaris	Cordyceps militaris	Polysaccharide
49	Khushboo Bhardwaj <i>et al</i>	2016	Antioxidant activity and ft-ir analysis of datura innoxia and datura metel leaf and seed methanolic extracts	Datura innoxia and datura metel leaf and seed	Datura innoxia and datura metel leaf and seed
50	Li-mei Lin <i>et al</i>	2018	Extraction, Characterization, Antioxidant, and Immunostimulatory Activities of Polysaccharides from Hedyotis corymbosa	Polysaccharides	Hedyotis corymbosa
51	Satya Prakash Chaudhary <i>et al</i>	2016	A FT-IR Spectroscopic Study of Phytoconstituents of Prepared Formulation of Arjuna (Terminalia arjuna Lin.) And Shilajatu	Arjuna (Terminalia arjuna Lin.) And Shilajatu	Phytoconstituents of Prepared Formulation of Arjuna (Terminalia arjuna Lin.) And Shilajatu
52	Rosemary Izunwanne Uchegbu <i>et al</i>	2013	Isolation and Characterization of Estra-2ll-en -17-ol, 3yl benzoate from Mucuna pruriens (Utilis)	Mucuna pruriens (Utilis)	Estra-2ll-en -17-ol, 3yl benzoate
53	Farooq Ahmad <i>et al</i>	2020	Flacourtia indica based biogenic nanoparticles: development, characterization, and bioactivity against wound associated pathogens	Flacourtia indica	Flacourtia indica based biogenic nanoparticles

54	Abdalrahim FA Aisha <i>et al</i>	2014	Preparation and characterization of nano liposomes of Orthosiphon stamineus ethanolic extract in soybean phospholipids	Orthosiphon stamineus	Nano liposomes
55	J. D. Amenu <i>et al</i>	2019	Characterization and rp-hplc method development of a biomarker (bergenin) from the roots of Securinega virosa	Securinega virosa	BERGENIN
56	A K M Nasimul Islam <i>et al</i>	2003	An anti-microbial Terpinoid from Caesalpinia pulcherrima Swartz: Its characterization, antimicrobial and cytotoxic activities	Caesalpinia pulcherrima Swartz	Terpinoid
57	Anindya Bagchi <i>et al</i>	2015	Synthesis, Characterization and Antibacterial Activity of a Novel Curcumin Metal Complex	Curcumin Metal Complex	Curcumin Metal Complex
58	Chew Oon Sim <i>et al</i>	2014	Assessment of Herbal Medicines by Chemometrics – Assisted Interpretation of FTIR Spectra	Two varieties of O. Stamineus (white and purple flowers)	Terpenoids and flavanoids
59	Muhammad Azfar Firdaus Azlah <i>et al</i>	2020	A fast and reliable 2D-IR spectroscopic technique for herbal leaves classification	Herbal leaves	Herbal leaves
60	Ioana-raluca bunghez <i>et al</i>	2011	Complex spectral characterization of active principles from marigold (calendula officinalis)	Marigold (calendula officinalis)	Active principles from marigold (calendula officinalis)
61	Stéphane Balayssac <i>et al</i>	2012	Analysis of herbal dietary supplements for sexual performance enhancement: First characterization of propoxyphenyl-thiohydroxyhomosildenafil and identification of sildenafil, thiosildenafil, phentolamine and tetrahydropalmatine as adulterants	Sildenafil, thiosildenafil, phentolamine and tetrahydropalmatine	Propoxyphenyl-thiohydroxyhomosildenafil
62	Abolfazl Bayrami <i>et al</i>	2017	Bio-extract-mediated zno nanoparticles: microwave-assisted synthesis, characterization and antidiabetic activity evaluation	Vaccinium arctostaphylos L, fruits extract	Vaccinium arctostaphylos L, fruits extract

63	Seyedeh Mahsa Hoseiniyan Benvidi <i>et al</i>	2020	A new water-soluble polysaccharide from <i>Echinops pungens</i> Trautv roots. Part I. Isolation, purification, characterization and antioxidant activity	<i>Echinops pungens</i> Trautv roots	Polysaccharide
64	Uzma Azeem Awan <i>et al</i>	2017	Biological activities of <i>Allium sativum</i> and <i>Zingiber officinale</i> extracts on clinically important bacterial pathogens, their phytochemical and FT-IR spectroscopic analysis	<i>Allium sativum</i> and <i>Zingiber officinale</i>	Biological activities of <i>Allium sativum</i> and <i>Zingiber officinale</i>
65	K. Rajamaheswari <i>et al</i>	2014	Novel standardization method and characterization of ayakandha chenduram : efficient herbal medicine for anemia	Ayakandha chenduram	Ayakandha chenduram
66	P. Capek <i>et al</i>	2003	Characterization of immunomodulatory polysaccharides from <i>Salvia officinalis</i> L.	<i>Salvia officinalis</i> L	Immunomodulatory polysaccharides from <i>Salvia officinalis</i> L.
67	Nathália Alexandra de Oliveira Cartaxo-Furtado <i>et al</i>	2016	Physicochemical characterization of a new raw material obtained from leaves of <i>Syzygium cumini</i> (L.) Skeel (Myrtaceae)	<i>Syzygium cumini</i> (L.) Skeel	Leaves of <i>Syzygium cumini</i> (L.) Skeel
68	Yangyang Chai <i>et al</i>		Purification, characterization and anti-proliferation activities of polysaccharides extracted from <i>Viscum coloratum</i> (Kom.) Nakai	<i>Viscum coloratum</i> (Kom.) Nakai	Polysaccharides
69	Zhi Chai <i>et al</i>	2018	Preparation, characterization, antioxidant activity and protective effect against cellular oxidative stress of polysaccharide from <i>Cynanchum auriculatum</i> Royle ex Wight	<i>Cynanchum auriculatum</i> Royle ex Wight	Polysaccharide
70	Julius Oloke <i>et al</i>	2017	Characterization and antimicrobial analysis of flavonoids in <i>vernonia amygdalina</i> : a common chewing stick in south-western nigeria	<i>Vernonia amygdalina</i>	Flavonoids
71	Siu-Leung Chau <i>et al</i>	2016	Gold nanoparticles bridging infra-red	Gold nanoparticles	Gold nanoparticles

			spectroscopy and laser desorption/ionization mass spectrometry for direct analysis of over-the-counter drug and botanical medicines		
72	Ahamefula. A. Ahuchaogu <i>et al</i>	2020	Chemical Constituents of Methanol Fruit Extract of <i>Xylopiya aethiopyca</i> by GC-MS and FT-IR Spectroscopy	<i>Xylopiya aethiopyca</i>	Chemical Constituents of Methanol Fruit Extract of <i>Xylopiya aethiopyca</i>
73	Zhen-Feng Chen <i>et al</i>	2012	Synthesis, characterization, and in vitro antitumor properties of gold(III) compounds with the traditional Chinese medicine (TCM) active ingredient liriodenine	Traditional Chinese medicine	Active ingredient liriodenine
74	Wen Chen <i>et al</i>	2011	Crassicauline A/ β -cyclodextrin host-guest system: Preparation, characterization, inclusion mode, solubilization and stability	<i>Aconitum macrorhynchum</i>	Crassicauline A/ β -cyclodextrin
75	Ingjing Chen <i>et al</i>	2012	Characterization and antioxidant activity of <i>Ginkgo biloba</i> exocarp polysaccharides	<i>Ginkgo biloba</i> exocarp	Polysaccharides
76	Fang-Fang Chen <i>et al</i>	2013	Magnetic molecularly imprinted polymer for the selective extraction of sildenafil, vardenafil and their analogues from herbal medicines	Sildenafil, vardenafil analogues from herbal medicines	Sildenafil, vardenafil
77	Qingqing Chen <i>et al</i>	2014	Structural Characterization and Antioxidant Activities of Polysaccharides Extracted from the Pulp of <i>Elaeagnus angustifolia</i> L.	<i>Elaeagnus angustifolia</i> L.	Polysaccharides
78	Rui-Zhan Chen <i>et al</i>	2015	Extraction, isolation, characterization and antioxidant activity of polysaccharides from <i>Astragalus membranaceus</i>	<i>Astragalus membranaceus</i>	Polysaccharides
79	Tianle Chen <i>et al</i>	2016	Structural characterization and hypoglycemic activity of <i>Trichosanthes</i> peel polysaccharide	<i>Trichosanthes</i> peel	Polysaccharides
80	Jian-bo Chen <i>et al</i>	2016	Direct chemical characterization of natural wood resins by	Natural wood resins	Natural wood resins

			temperature-resolved and space-resolved Fourier transform infrared spectroscopy		
81	Haoran Cheng <i>et al</i>	2013	Structural characterization and antioxidant activities of polysaccharides extracted from <i>Epimedium acuminatum</i>	<i>Epimedium acuminatum</i>	Polysaccharides
82	Zhenyu Cheng <i>et al</i>	2016	Extraction optimization, characterization and antioxidant activity of polysaccharide from <i>Gentiana scabra bge</i>	<i>Gentiana scabra bge</i>	Polysaccharides
83	R. Paul Choudhury <i>et al</i>	2007	Elemental Characterization of Trifala Powders and Tablets by Instrumental Neutron Activation Analysis, Thermal Analysis and Spectral Studies of Gallic Acid	Trifala Powders Gallic Acid	Trifala Powders Gallic Acid
84	Wafa Terouzi <i>et al</i>	2013	Classification of olives from Moroccan regions by using direct FT-IR analysis: Application of support vector machines (SVM)	Olives	Olives
85	Vijaya Ravinayagam <i>et al</i>	2012	Cytotoxic effect of tridham (TD) against human hepg2 Cell line: Isolation and characterization of 3,4,5-trihydroxybenzoic acid from aqueous extract of TD	Tridham	3,4,5-trihydroxybenzoic acid
86	E. Deconinck C.A <i>et al</i>	2017	Detection of regulated herbs and plants in plant food supplements and traditional medicines using infrared spectroscopy	<i>Rhamnus purshiana</i> , <i>Passiflora incarnata</i> L., <i>Valeriane Officinalis</i> , <i>Crataegus monogyna</i> , <i>Epimedium</i> spp. Leaves, <i>Pausinystalia yohimbe</i> bark, <i>Tribulus terrestris</i> fruit, <i>Ilex Paraguariensis</i> and <i>Aristolochia Fanghi</i>	<i>Rhamnus purshiana</i> , <i>Passiflora incarnata</i> L., <i>Valeriane Officinalis</i> , <i>Crataegus monogyna</i> , <i>Epimedium</i> spp. Leaves, <i>Pausinystalia yohimbe</i> bark, <i>Tribulus terrestris</i> fruit, <i>Ilex Paraguariensis</i> and <i>Aristolochia Fanghi</i>
87	Raju P.	2017	Determination of silicon	Herbal tablets of	Silicon

	Suryawanshi <i>et al</i>		from medicinal herbal product by atomic absorption spectrophotometer (aas), x-ray powder diffraction (xrpd) and fourier transform infrared spectrometry (ftir)	Sarpagandha, Cardiol Vati and Medomine Vati	
88	O. E. Famobuwa <i>et al</i>	2020	Isolation and Characterization of an Amide, (2S)2- Hydroxy-N-((3R,4R)-1,3,4-Trihydroxytridecan-2-YL)Undecamide, from the Root Bark of <i>Ficus exasperata</i> (Vahl)	<i>Ficus exasperata</i> (Vahl)	Amide, (2S)2-Hydroxy-N-((3R,4R)-1,3,4-Trihydroxytridecan-2-YL)Undecamide
89	Jian-Wei Dong, Le Cai <i>et al</i>	2015	Improving the antioxidant and antibacterial activities of fermented <i>Bletilla striata</i> with <i>Fusarium avenaceum</i> and <i>Fusarium oxysporum</i>	<i>Bletilla striata</i> , <i>Fusarium avenaceum</i> , <i>Fusarium oxysporum</i>	<i>Bletilla striata</i> , <i>Fusarium avenaceum</i> , <i>Fusarium oxysporum</i>
90	Niloufar Dorosti <i>et al</i>	2016	Plant-mediated gold nanoparticles by <i>Dracocephalum kotschyi</i> as anticholinesterase agent: Synthesis, characterization, and evaluation of anticancer and antibacterial activity	<i>Dracocephalum kotschyi</i>	Gold nanoparticles
91	Halil Durak <i>et al</i>	2019	Pyrolysis of black cumin seed: Significance of catalyst and temperature product yields and chromatographic characterization	Black cumin seed	Black cumin seed
92	N. Dutta <i>et al</i>	2004	Synthesis and characterization of polyester resins based on Nahar seed oil	Nahar seed oil	Polyester resins
93	Dr. P. S. Tresina <i>et al</i>	2014	Preliminary phytochemical, ft- ir and antibacterial evaluation of leaf of <i>eugenia floccosa</i> bedd (myrtaceae)	<i>Eugenia floccosa</i> bedd (myrtaceae)	<i>Eugenia floccosa</i> bedd (myrtaceae)
94	Eltayeb E.M. Eid <i>et al</i>	2011	Characterization of the inclusion complex of zerumbone with hydroxypropyl--cyclodextrin	<i>Zingiber zerumbet</i> Smith	Zerumbone, hydroxypropyl--cyclodextrin
95	Amira E. El-Nahas <i>et al</i>	2017	Silymarin-Loaded Eudragit Nanoparticles: Formulation, Characterization, and	Silymarin-Loaded Eudragit Nanoparticles	Silymarin-Loaded Eudragit Nanoparticles

			Hepatoprotective and Toxicity Evaluation		
96	Abhijit V. Dinde <i>et al</i>	2018	Essential Oil Extraction, Characterization and Antimicrobial Study of <i>Blumea laciniata</i> DC from Konkan Region	<i>Blumea laciniata</i> DC	<i>Blumea laciniata</i> DC
97	Abhishek K. Tripathi <i>et al</i>	2020	Extraction, Isolation, and Characterization of <i>Bauhinia variegata</i> Flower	<i>Bauhinia variegata</i> Flower	<i>Bauhinia variegata</i> Flower
98	Yean Chun Loh <i>et al</i>	2018	Mechanisms of action of <i>Panax notoginseng</i> ethanolic extract for its vasodilatory effects and partial characterization of vasoactive compounds	<i>Panax notoginseng</i>	Vasoactive compounds
99	Felipe H. A. Fernandes <i>et al</i>	2013	Thermal characterization of dried extract of medicinal plant by DSC and analytical techniques	<i>X. Americana</i> L, <i>S. Brasiliensis</i> Engl	<i>X. Americana</i> L, <i>S. Brasiliensis</i> Engl
100	Felipe Hugo Alencar Fernandes <i>et al</i>	2018	Quality standardization of herbal medicines of <i>Spondias dulcis</i> Parkinson using analytical and microbiological analysis	<i>Spondias dulcis</i>	Herbal medicines of <i>Spondias dulcis</i>
101	Agnese Brangule <i>et al</i>	2020	Herbal Medicine Characterization Perspectives using advanced FTIR sample techniques- Diffuse reflectance (DRIFT) and photoacoustic spectroscopy (PAS)	Chamomile (<i>Matricaria recutita</i>), Silver birch (<i>Betula pendula</i> Roth), Hibiscus (<i>Hibiscus sabdariffa</i>), Peppermint (<i>Mentha piperita</i>), Cornflower (<i>Centaurea cyanus</i>), Meadowsweet (<i>Filipendula ulmaria</i>), Tansy (<i>Tanacetum vulgare</i>)	Chamomile (<i>Matricaria recutita</i>), Silver birch (<i>Betula pendula</i> Roth), Hibiscus (<i>Hibiscus sabdariffa</i>), Peppermint (<i>Mentha piperita</i>), Cornflower (<i>Centaurea cyanus</i>), Meadowsweet (<i>Filipendula ulmaria</i>), Tansy (<i>Tanacetum vulgare</i>)
102	Sijo Francis <i>et al</i>	2017	Green synthesis and characterization of gold and silver nanoparticles using <i>Mussaenda glabrata</i> leaf extract and their environmental applications to dye degradation	<i>Mussaenda glabrata</i>	Gold and silver nanoparticles
103	Arunachalam K <i>et al</i>	2017	Functional groups identification through FTIR Characterization of	Muppirandai chooranam	Muppirandai chooranam

			siddha poly herbal formulation “Muppirandai chooranam”		
104	Jian-Hong Gan <i>et al</i>	2015	Analysis and discrimination of ten different sponges by multi-step infrared spectroscopy	Sponges	Ten different sponges
105	Jianhua gao <i>et al</i>	2008	Characterization and antioxidant activity of flavonoid-rich extracts from leaves of ampelopsis grossedentata	Ampelopsis grossedentata	Ampelopsis grossedentata
106	Yahaya Gava mukulya <i>et al</i>	2019	Green Synthesis and Characterization of Highly Stable Silver Nanoparticles from Ethanolic Extracts of Fruits of Annona muricata	Annona muricata	Silver Nanoparticles
107	K. Nivetha <i>et al</i>	2016	GC-MS and FT-IR Analysis of Nigella sativa L. Seeds	Nigella sativa L.	Nigella sativa L. Seeds
108	Qing Ge <i>et al</i>	2013	Purification, Chemical Characterization, and Antioxidant Activity of a Polysaccharide from the Fruiting Bodies of Sanghuang Mushroom (Phellinus Baumii Pilát)	Sanghuang Mushroom (Phellinus Baumii Pilát)	Sanghuang Mushroom (Phellinus Baumii Pilát)
109	V. Gnanavel <i>et al</i>	2017	Biosynthesis and characterization of copper oxide nanoparticles and its anticancer activity on human colon cancer cell lines (HCT-116)	O. Cochinchinense	O. Cochinchinense
110	S.Hepzibah <i>et al</i>	2014	Green synthesis characterization & susceptibility of cu2o/pva nano composites	Aegle marmelos	Cu2o/pva nano composites
111	Xiaoli Gu <i>et al</i>	2017	Efficient discovery and capture of new neuronal nitric oxide synthase–postsynaptic density protein-95 uncouplers from herbal medicines using magnetic molecularly imprinted polymers as artificial antibodies	Psoraleae fructus, Trifolium pratense, Astragali radix, Chick	Psoraleae fructus, Trifolium pratense, Astragali radix, Chick
112	Yong-zhi He <i>et al</i>	2014	Isolation and Identification of Bioactive Constituents from Stem Barks of Illicium difengpi	Illicium difengpi	Stem Barks of Illicium difengpi

113	Tao-Bin He <i>et al</i>	2016	Structural characterization and immunomodulating activity of polysaccharide from <i>Dendrobium officinale</i>	<i>Dendrobium officinale</i>	Polysaccharide
114	Giang Thanh Thi Ho <i>et al</i>	2016	Structural characterization of bioactive pectic polysaccharides from elderflowers (<i>Sambuci flos</i>)	<i>Sambuci flos</i>	Pectic polysaccharides
115	Wei Hu <i>et al</i>	2015	Rapid Discrimination of Different Grades of White Croaker Surimi by Tri-Step Infrared Spectroscopy Combined with Soft Independent Modeling of Class Analogy (SIMCA)	White Croaker Surimi	White Croaker Surimi
116	Yuanxiang Huang <i>et al</i>	2018	Biphasic extraction of different polysaccharides from <i>Radix Sophorae Tonkinensis</i> by microwave-assisted aqueous two-phase extraction: Process optimization, structural characterization and mechanism exploration	<i>Radix Sophorae Tonkinensis</i>	Polysaccharides
117	V. A. Huck-Pezzei <i>et al</i>	2013	A chromatographic and spectroscopic analytical platform for the characterization of St John's wort extract adulterations	St John's wort	St John's wort
118	Patrick Chi-Leung Hui <i>et al</i>	2013	Preparation and characterization of chitosan/sodium alginate (CSA) microcapsule containing Cortex Moutan	Cortex Moutan	Cortex Moutan
119	Meibian Hu <i>et al</i>	2019	Purification, Characterization of Two Polysaccharides from <i>Pinelliae Rhizoma Praeparatum Cum Alumine</i> and Their Anti-Inflammatory Effects on Mucus Secretion of Airway Epithelium	<i>Pinelliae Rhizoma Praeparatum Cum Alumine</i>	Polysaccharides
120	Dhananjay Pandey <i>et al</i>	2019	Bioactive compound in <i>Curcuma caesia</i> (roxb.) From bastar and its spectral analysis by hplc, uv-visible, ft-ir, nmr, and esi-ms	<i>Curcuma caesia</i>	<i>Curcuma caesia</i>

121	Biresh K Sarkar <i>et al</i>	2011	Isolation, characterization and antibacterial activity of leaves extract of bael (Aegle Marmelos)	Bael (Aegle Marmelos)	Leaves extract
122	Donatus Ebere Okwu <i>et al</i>	2012	Isolation, characterization and antibacterial activity of alkaloid from Datura metel Linn leaves	Datura metel Linn leaves	Alkaloid
123	Upendra B Gandagule <i>et al</i>	2018	Isolation and Characterization of Lupeol a Triterpenoid from Stem Bark of Ziziphus xylopyrus (Retz) Willd	Stem Bark of Ziziphus xylopyrus (Retz) Willd	Lupeol
124	Marzieh Jahandar <i>et al</i>	2015	Synthesis, characterization and application of polyglycerol coated Fe ₃ O ₄ nanoparticles as a nano-theranostics agent	Polyglycerol coated Fe ₃ O ₄ nanoparticles	Glycidol curcumin
125	Suresh Janadri <i>et al</i>	2015	Preparation and characterization of mercury-based traditional herbomineral formulation: Shwas kuthar rasa	Mercury-based traditional herbomineral formulation	Shwas kuthar rasa
126	S. Nandha Kumar <i>et al</i>	2015	Phytochemical screening and characterization of the bioactive compounds from the leaves of Hyptis suaveolens and Spathodea campanulata	Hyptis suaveolens and Spathodea campanulata	Bioactive compounds from the leaves of Hyptis suaveolens and Spathodea campanulata
127	Peng Ji, Yanming Wei <i>et al</i>	2014	Characterization and antioxidative activities of polysaccharide in Chinese angelica and its processed products	Chinese angelica	Polysaccharide
128	Wenhua Ji <i>et al</i>	2017	Selective extraction and determination of chlorogenic acids as combined quality markers in herbal medicines using molecularly imprinted polymers based on a mimic template	Lonicera japonica Thunb	Chlorogenic acids
129	Xiaolong Ji <i>et al</i>	2017	Purification, structural characterization, and hypolipidemic effects of a neutral polysaccharide from Ziziphus Jujuba cv. Muzao	Ziziphus Jujuba cv. Muzao	Polysaccharide
130	J. X. Jiang <i>et al</i>	2007	Characterization of Galactomannan Gum from Fenugreek (Trigonella)	Fenugreek (Trigonella foenumgraecum)	Galactomannan Gum

			foenumgraecum) Seeds and Its Rheological Properties		
131	N. John Sushma <i>et al</i>	2015	Facile approach to synthesize magnesium oxide nanoparticles by using Clitoria ternatea— characterization and in vitro antioxidant studies	Magnesium oxide nanoparticles	Clitoria ternatea
132	Mohanad Jawad Kadhim <i>et al</i>	2016	Evaluation of anti-bacterial activity and bioactive chemical analysis of Ocimum basilicum using Fourier transform infrared (FT-IR) and gas chromatography mass spectrometry (GC-MS) techniques	Ocimum basilicum	Ocimum basilicum
133	Mangathayaru Kalachaveedu <i>et al</i>	2020	Fabrication and characterization of herbal drug enriched Guar galactomannan based nanofibrous mats seeded with GMSC's for wound healing applications	Acalypha indica, Aristolochia bracteolata, Lawsonia inermis and Thespesia populnea	Guar galactomannan
134	Mayuree Kanlayavattanakul <i>et al</i>	2019	Dendrobium orchid polysaccharide extract: Preparation, characterization and in vivo skin hydrating efficacy	Dendrobium orchid	Polysaccharide
135	Manjusha Karve <i>et al</i>	2015	Determination of cadmium in water and herbal medicine by Penicillium chrysogenum immobilized on silica gel for flame atomic absorption spectroscopy	Penicillium chrysogenum	Cadmium
136	Lingshan Kong <i>et al</i>	2015	Physicochemical characterization of the polysaccharide from Bletilla striata: Effect of drying method	Bletilla striata	Polysaccharide
137	S. Prabakaran <i>et al</i>	2014	Phytochemical investigation and functional group screening of cardiospermum halicacabum and pisonia alba by ft-ir spectroscopic analysis	Cardiospermum halicacabum Pisonia alba	Cardiospermum halicacabum Pisonia alba
138	Zuliang Lai <i>et al</i>	2009	Multi-steps infrared spectroscopic	Cistanche tubulosa	Cistanche tubulosa

			characterization of the effect of flowering on medicinal value of <i>Cistanche tubulosa</i>		
139	Dong-Hai Lai <i>et al</i>	2013	Isolation, characterization and acetylcholinesterase inhibitory activity of alkaloids from roots of <i>Stemona sessilifolia</i>	<i>Stemona sessilifolia</i>	Alkaloids
140	Li Rui <i>et al</i>	2009	Extraction, characterization of <i>Astragalus</i> polysaccharides and its immune modulating activities in rats with gastric cancer	<i>Astragalus</i>	Polysaccharides
141	Jinwei Li <i>et al</i>	2013	Isolation and structural characterization of a polysaccharide from fruits of <i>Zizyphus jujuba</i> cv. Junzao	<i>Zizyphus jujuba</i> cv. Junzao	Polysaccharide
142	Jinyu Li <i>et al</i>	2017	Purification, characterization and bioactivities of polysaccharides from <i>Pleurotus ferulae</i>	<i>Pleurotus ferulae</i>	Polysaccharides
143	Tiantao Li <i>et al</i>	2018	Characterization of herb residue and high ash-containing paper sludge blends from fixed bed pyrolysis	Paper sludge blends	Paper sludge blends
144	Ke Li <i>et al</i>	2019	Extraction, Characterization, Antitumor and Immunological Activities of Hemicellulose Polysaccharide from <i>Astragalus radix</i> Herb Residue	<i>Astragalus radix</i>	Hemicellulose Polysaccharide
145	Hongyi Li <i>et al</i>	2020	Multiple fingerprint profiling for quality evaluation of polysaccharides and related biological activity analysis of Chinese patent drugs: Zishen Yutai Pills as a case study	Zishen Yutai Pills	Polysaccharides
146	Wei Liu <i>et al</i>	2016	Structure characterization, chemical and enzymatic degradation, and chain conformation of an acidic polysaccharide from <i>Lycium barbarum</i> L	<i>Lycium barbarum</i> L	Polysaccharide
147	Yu-Jie Liu <i>et</i>	2017	Extraction Optimization,	<i>Pinelliae Rhizoma</i>	Polysaccharides

	<i>al</i>		Characterization, and Bioactivities of Polysaccharides from Pinelliae Rhizoma Praeparatum Cum Alumine Employing Ultrasound-Assisted Extraction	Praeparatum Cum Alumine	
148	Mengli Liu <i>et al</i>	2020	A facile luminescence resonance energy transfer method for detecting cyano-containing pesticides in herbal medicines	Lanceolata, Angelica dahurica and Astragalus	Cyano-containing pesticides
149	Lu Shao-Ping <i>et al</i>	2010	Chemical characterization of Lycium barbarum polysaccharides and their reducing myocardial injury in ischemia/reperfusion of rat heart	Lycium barbarum	Polysaccharides
150	Shui-Xian Ma <i>et al</i>	2012	Alpinetin/hydroxypropyl- β -cyclodextrin host-guest system: Preparation, characterization, inclusion mode, solubilization and stability	Alpinetin	Alpinetin
151	Fang Ma <i>et al</i>	2016	Rapid discrimination of Panax notoginseng of different grades by FT-IR and 2DCOS-IR	Panax notoginseng	Panax notoginseng
152	S. Singha Mahapatra <i>et al</i>	2004	Synthesis and characterization of polyesteramide resins from Nahar seed oil for surface coating applications	Nahar seed oil	Polyesteramide resins
153	R. Manjula <i>et al</i>	2019	Green synthesis and characterization of manganese oxide nanoparticles from Gardenia resinifera leaves	Gardenia resinifera leaves	Manganese oxide nanoparticles
154	Iraj Mesgarzadeh <i>et al</i>	2017	Novel Design, Preparation, Characterization and Antimicrobial Activity of Silver Nanoparticles during Oak Acorns Bark Retrograde	Oak Acorns Bark	Silver Nanoparticles
155	Fwu-long Mi <i>et al</i>	2000	Synthesis and Characterization of a Novel Chitosan-Based Network Prepared Using Naturally Occurring	Chitosan	Genipin

			Crosslinker		
156	Fwu-Long Mi <i>et al</i>	2003	Synthesis and characterization of biodegradable TPP/genipin cocrosslinked chitosan ge	Chitosan gel beads	Genipin
157	Azar Ullah Mirza <i>et al</i>	2018	Biogenic synthesis of iron oxide nanoparticles using <i>Agrewia optiva</i> and <i>Prunus persica</i> phyto species: Characterization, antibacterial and antioxidant activity	<i>Agrewia optiva</i> and <i>Prunus persica</i> phyto species	Iron oxide nanoparticles
158	P.C. Nagajyothei <i>et al</i>	2013	Green route biosynthesis: Characterization and catalytic activity of zno nanoparticles	P. Trifoliata	Zno nanoparticles
159	Donatus ebere okwu <i>et al</i>	2009	Isolation, Characterization and Antibacterial Activity Screening of Anthocyanidine Glycosides from <i>Alchornea Cordifolia</i> (Schumach. And Thonn.) Mull. Arg. Leaves	<i>Alchornea Cordifolia</i> (Schumach. And Thonn.) Mull. Arg. Leaves	Anthocyanidine Glycosides
160	M.U. Muhammad <i>et al</i>	2015	Isolation and characterization of steroids in the root back of <i>Balanite egyptiaca</i>	<i>Balanite egyptiaca</i>	STEROIDS
161	Xin-xin Pan <i>et al</i>	2017	Characterization and immunomodulatory activity of polysaccharides from the stems and leaves of <i>Abelmoschus manihot</i> and a sulfated derivative	<i>Abelmoschus manihot</i> and a sulfated derivative	Polysaccharides
162	Rahila Ahmad Pathan <i>et al</i>	2011	Preparation & characterization of embelin-phospholipid complex as effective drug delivery tool	Embelin	Embelin-phospholipid complex
163	Ashwini G. Patil <i>et al</i>	2015	Rutin-Chitosan Nanoparticles: Fabrication, Characterization and Application in Dental Disorders	Rutin-Chitosan	Rutin-Chitosan Nanoparticles
164	Izabela Pawlaczyk <i>et al</i>	2009	Polyphenolic-polysaccharide compounds from selected medicinal plants of Asteraceae and Rosaceae families: Chemical characterization and blood	Medicinal plants of Asteraceae and Rosaceae families	Polyphenolic-polysaccharide

			anticoagulant activity		
165	Tiziana M.G. Pecora <i>et al</i>	2016	Preparation, characterization and photostability assessment of curcumin microencapsulated within methacrylic copolymers	Methacrylic copolymers	Curcumin
166	Eleftherios a. Petrakis <i>et al</i>	2009	Quantitative Determination of Pulegone in Pennyroyal Oil by FT-IR Spectroscopy	Pennyroyal Oil	Pulegone
167	Muthukumaran Pakkirisamy <i>et al</i>	2017	Phytochemical Screening, GC-MS, FT-IR Analysis of Methanolic Extract of <i>Curcuma caesia</i> Roxb (Black Turmeric)	<i>Curcuma caesia</i> Roxb (Black Turmeric)	<i>Curcuma caesia</i> Roxb (Black Turmeric)
168	B.Sathya <i>et al</i>	2014	Physicochemical characterization and instrumental analysis of the polyherbal siddha contraceptive formulation maavilingathy mathirai	Polyherbal siddha contraceptive formulation maavilingathy mathirai	Polyherbal siddha contraceptive formulation maavilingathy mathirai
169	S. Kumaravel <i>et al</i>	2019	Phytochemical, GC-MS and FT-IR Analysis of <i>Papaver somniferum</i> L	<i>Papaver somniferum</i> L	<i>Papaver somniferum</i> L
170	Gopukumar S T <i>et al</i>	2016	Phytochemical Screening and FT-IR Analysis of <i>Ficus benghalensis</i> Fruits	<i>Ficus benghalensis</i>	<i>Ficus benghalensis</i> Fruits
171	E. Mugomeri <i>et al</i>	2014	Phytochemical Characterisation of Selected herbal Products in Lesotho	<i>Euclea coriacea</i> , <i>Hypoxis hemerocallidea</i> , <i>Xysmalobium undulatum</i> , <i>Senecio asperulus</i> and <i>Pelargonium sidoides</i>	Diterpenes, phytosterols, flavonoids, glycosides
172	Mahesha M. Poojary <i>et al</i>	2015	Extraction, characterization and biological studies of phytochemicals from <i>Mammea suriga</i>	<i>Mammea suriga</i>	<i>Mammea suriga</i>
173	P.S.Tresina <i>et al</i>	2014	Preliminary phytochemical, FT- IR and antibacterial assessment of leaf of <i>Eugenia singampattiana</i> Bedd (Myrtaceae)	<i>Eugenia singampattiana</i> Bedd (Myrtaceae)	<i>Eugenia singampattiana</i> Bedd
174	Paramasivam premasudha <i>et al</i>	2015	Biological synthesis and characterization of silver nanoparticles using <i>Eclipta alba</i> leaf extract and evaluation of its cytotoxic and	<i>Eclipta alba</i>	Silver nanoparticles

			antimicrobial potential		
175	S. Sharmila <i>et al</i>	2020	Microchemistic, phytochemical, uv-vis and ft-ir analysis as a herbal standardization tool – a trial with psilotrichum nudum (moq.)	Psilotrichum nudum (moq.)	Psilotrichum nudum
176	Xiuying Pu <i>et al</i>	2016	Structural characterization and antioxidant activity in vitro of polysaccharides from angelica and astragalus	Angelica and astragalus	Polysaccharides
177	Roma ghai <i>et al</i>	2014	Isolation and characterization of a novel chemical compound from eugenia caryophyllus flower bud extract	Eugenia caryophyllus	Eugenia caryophyllus flower bud extract
178	Xue Qiao <i>et al</i>	2015	Global profiling and novel structure discovery using multiple neutral loss / precursor ion scanning combined with substructure recognition and statistical analysis (MNPSS): Characterization of terpene-conjugated curcuminoids in Curcuma longa as a case	Curcuma longa	Terpene, curcuminoids
179	Jing Qin <i>et al</i>	2019	Structural characterization and immunoregulatory activity of two polysaccharides from the rhizomes of Atractylodes lancea (Thunb.) DC	Atractylodes lancea (Thunb.) DC	Polysaccharides
180	R.Bharathirajan <i>et al</i>	2015	Analysis of IR, NMR and invitro antibacterial Potency of Pistacia integerrima against 6 Clinically Isolated Multidrug Resistant Bacteria	Pistacia integerrima	Pistacia integerrima
181	Yuan-Feng Zou <i>et al</i>	2017	Purification and Partial Structural Characterization of a Complement Fixating Polysaccharide from Rhizomes of Ligusticum chuanxiong	Ligusticum chuanxiong	Polysaccharide

CONCLUSION:

From the above information authors have concluded that infrared spectroscopy is also can be used to detect the functional group present in the extracted compounds, in the herbal markers, in the herbal formulation and in many other herbal related compounds. It is one of the processes used to identify the structures of the extracted compounds.

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