

# PHARMACOGNOSY AND PHYTOCHEMISTRY

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Week 4

Lecture 19

## Distribution of tannins (Part 1)

Hello everyone, and welcome to the NPTEL course on pharmacognosy and phytochemistry. We are learning something about compounds called tannins. In the previous session, we studied compounds belonging to the hydrolyzable tannins. If you recollect, we did a few examples of hydrolyzable tannins. which are nutgall, amla and pomegranate.

In today's session, we will cover a few more examples, such as myrobalan and kino. Going ahead in the subsequent session, we will also deal with condensed tannins, such as pale catechu and black catechu. So, let's understand myrobalan. Myrobalans are a set of roots which, depending upon their sources, are referred to as *Chebolic Myrobalan*, *Baleartic Myrobalan*, and *Emblitic Myrobalan*.

Of these, *Emblitic Myrobalan* is your amla, which you have studied previously. Now, in today's session, we will deal with both *Chebolic* and *Baleartic Myrobalan*. Starting with the *Chebolic Myrobalan*, it is commonly referred to in India as Harda or Harde, often called Hari Takki or also referred to as Black Myrobalan. It is also known as the Ink Fruit.

Because of its ability to stain or dye. This comes from the matured fruits of *Terminalia chebula*, which belongs to the family Combretaceae. Now, this plant *Terminalia chebula* is a deciduous tree which grows to a height of about 25 meters. It bears ellipsoidal leaves towards the apex during the November to March season. It bears spikes, and that is from where you get these hardy fruits.

So, this plant occurs throughout North India, in Madhya Pradesh, in Maharashtra, Gujarat, and going down, you can see it occurring even in countries such as Myanmar as well as Sri Lanka. Now, the fruits of this plant mature somewhere between November to March. That's when you start collecting them. The preferable time of collection is somewhere between January to April. So, when you see the tree is laden with fruits, they are allowed to mature, and on maturation, the tree is shaken.

Once all the fruits have fallen down, they are collected, dried in shade, and then once they turn yellow to deep brown in color, they are used for the market. Now, these fruits, depending upon their species or subspecies, may have a slightly ellipsoidal or ovoid shape and have ribs. So, if you see your chebule myrobalans, they bear somewhere between 2 to 6 ribs, of which the one that has 5 ribs is preferred for its tannin content.

Now, what does this contain? So, if you go to see myrobalans, they are rich in hydrolyzable tannins, the monomer of which you can see here. is a chebulic acid. Now, if you see carefully, chebulic acid is actually very closely allied to ellagic acid. Let me show you how.

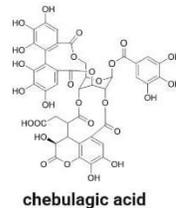
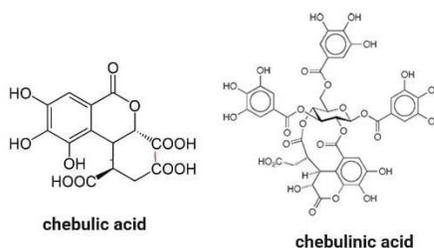


## Myrobalans -Harde

### Chemical composition

**Tannins:** Myrobalan contains about 30% of the hydrolysable tannins- chebulinic acid, chebulagic acid, and D-galloyl glucose Free tannic acid, gallic acid, ellagic acid

**Other compounds:** myrobalanin. Anthraquinone glycosides



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So if you remember your ellagic acid, you had a six-membered ring and then you had a lactonization here. So you get a very similar type of compound. This is almost a coumarin derivative, but what happens in this case is instead of your typical phenyl ring, you have a dicarboxylic acid and the third carboxylic acid, which opens up from here. So chebulic acid is basically an ellagic acid derivative or hexahydroxy diphenic acid

derivative. Now, this chebulic acid, if you attach it out here to a sugar, which is in turn attached to a few more gallic acid moieties, you get what is called chebulinic acid. One occurrence of tannins from chebulic acid is your chebulagic acid. Now, this is also very similar, but what you see here is a monomer of chebulic acid, one gallic acid And one more T of hexahydroxy diphenic acid.

So this, on hydrolysis, will further give you your ellagic acid derivative. Apart from this, it also contains free tannins, that is, free tannic acid, free gallic acid, ellagic acid, D-galoyl glucose, and other free monomeric units. We often refer to them as pseudotannins. So this fruit is laden with tannins, and that is the reason it has very strong astringent properties.

Now, apart from that, it contains a resinous compound referred to as myrobalan, and the seed of this is rich in anthraquinone glycosides. Because of these anthraquinone glycosides, some of the laxative properties of your chebulic myrobalan are seen. So if you see the applications, owing to a huge amount of tannins that are present in this plant, you get a rich antioxidant activity. So this fruit has the ability to scavenge free radicals, bring about anti-inflammatory properties, and therefore it is used in numerous conditions.

Being a tannin, it can definitely help us with infections. Being a tannin, it can definitely help us with ulcers and bleeding. And because of its antioxidant properties, it is known to protect our liver. We refer to it as hepatoprotective. It gives anti-tumor activity, anti-arthrogenic, anti-fibroids.

As well as in some cases it is found to possess anti-diabetic properties as well. Now myrobilin is a common component of a famous Ayurvedic preparation triphala churna. We also discussed this in amla. So this is the second fruit that is your chabulic myrobilin which is present in it. This is because of its antioxidant effect and also its anti-inflammatory effect.

Not only that, it helps in numerous digestive disorders as well. Apart from it, myrobilin has traditionally been used in dying industries. So what is done is the mature fruits of this plants are taken dried till they are crisp and once they are dried what you get is they are pulverized to get a fine powder a hot decoction that is this powder is then boiled with water and once you get the extract out of it

this extract is tannin rich now if you recollect tannins have a very nice ability to bind to proteins. So in fabrics, if you remember proteinaceous fibers such as silk and wool, they are animal origin, they are protein components. So tannins bind to them very strongly to give intense coloration. So your myrobilin, especially halda, the aqueous extract of it is taken and your silk and wool are deeply dyed into it.

In some cases, this dye is also used as a fixative or as a mordant for other coloring agents as well. Now turn to the next myrobalan, and that's your behda. Behda is very similar to your harada, but if you see the fruits, the ridges are comparatively missing, and if you see the shape, they are more oval. Circular in nature as compared to your Harada.

So this is referred to as your Balearic Myrobalan or Baheda, or often in some cases, using vernacular names, it is also referred to as your bibhitak. Now this is also obtained from ripe fruits, but the plant is different. So it is obtained from *Terminalia bellerica*, belonging to the family Combretaceae.

Now this shares the same family and same genus as your Harada. So the same family Combretaceae and same genus Terminalia. So what changes here is your species. In that case, it is *Terminalia chebula*. In this case, it is *Terminalia bellerica*.

Now this is also a plant that is found throughout India. If you see its occurrence, you will see it abundantly growing in Madhya Pradesh, Uttar Pradesh, Punjab, Maharashtra, and again similarly down in Sri Lanka and the Malaya region. Now the fruits of this plant mature somewhere during the rainy season till the end and are collected from November to February. The process and the treatment remain the same; that is, you know the trees are shaken to drop off all these droop-shaped fruits.

These droops are then collected and dried in the shade till they give you a very hard, stony structure. These can be pulverized easily to get your powders. Now, these powders are also tannin-rich, but their composition is relatively simple compared to your *Terminalia chebula*. In this case, they contain simple compounds such as your gallic and ellagic acids, which are your pseudotannins or monomers of tannins.

In addition to it, it contains Phyllembelin. Now, Phyllembelin is nothing but, if you see carefully, the ethyl ester of gallic acid, often referred to as your ethyl gallate. And in addition, you will also have some amount of galloyl glucose occurring. So sugar, sugar esters, and mostly hydrolyzable tannins make up your myrobellum, that is, your baheda. Now, apart from that, if you see the inner stony seed,

this also contains oil, but the oil of this seed is considered to be non-edible. Apart from this, if you give incisions on this plant, this plant is also known to give you a good-quality gum. However, it's not commercialized as yet. Now, coming to the applications. Out of your Terminalia species, your *Terminalia chebula* poses more of a laxative effect,

whereas if you see baheda, that is *Terminalia bellerica*, in Ayurveda and in the Unani system of medicine, you will see that this is something known to address your cough condition. So, people suffering from excessive mucus secretion, cough, and cold, the powder or the decoction of this plant is given, often mixed with honey in Ayurveda, in warm water, and given for the patients to consume. It is said that it has a good kapha balancing property.

It is also reported to show rasayanam that is an ability to enhance one's immunity as well as, you know, give you a good age or increase longevity. This is the third fruit that goes in your Triphala churna. So we have covered all three. The first one is Amla.

The second one is Harada and the third one is Baheda. And it has numerous hydrolyzable tannins. It has a deep coloration. And as a result, this is also used in the dyeing and tanning industry. Now going on to the third drug, this is not a myrobaran but this is something which is referred to as Kino or Malabar Kino.

It is pterocarpus. Now this is a blood red juice which is obtained from making vertical incisions. So if you have a tree, it is called a *pterocarpus marsupium* tree. It's a Leguminosae family member and you will see this tree growing throughout again in India In Gujarat, Madhya Pradesh, Uttar Pradesh, Bihar, Orissa, and also found in numerous forests such as Karnal,

you will see it growing in Kerala, Assam, and West Bengal regions. Now, if you make an incision on this tree, it gives out a reddish, as I said, a blood-red color or typically bright red color juice. Now, this juice is collected and is said to be medicinal. Now, this red juice, if you dry it, is referred to as Kino red. This Kino red is consumed as such by diabetic patients, or in some cases, the wood is also taken.

So, what does it contain? This is also a good source of tannins. Now, this contains chiefly what is called Kino tannic acid. Now again, if you see this carefully, you can conveniently break it into two halves. One half of it has a structure.

Of gallic acid, the second half resembles, do you recollect? This is the ellagic acid structure. So, kinotannic acid is a derivative of gallic plus ellagic acid. Now, this is the monomer. Condense it with glucose molecules and convert it into a polymer.

And that is what is collectively referred to as kinotannic acid. Apart from that, it also contains what is called kinored. I just refer to it as a pigment. Kinored is actually a phlobaphene derivative, which is obtained from kinoin, and kinoin is an oxidation product of kinotannic acid, generally given by an oxidase enzyme.

So, kinotannic acid, you can say, is a glucosidyl tannin, whereas kinored is an oxidative product generally formed by an oxidase enzyme. As a result, this oxidase enzyme converts it into an anhydride. It undergoes further conjugation polymerization to give you an intense red coloration. Now, if you see your kinotannic acid as a polymer per se, it has a much darker color than your kino red.

So, all these polymeric tannin compounds give it a typical red-brown coloration. Now, coming to the therapeutics of it, because of its high tannin content, it is a protein precipitant, and it's used to treat diarrhea and dysentery as an antimicrobial agent. It is used as a styptic in your hemorrhages. So, whenever there's minute bleeding happening.

These tannins can precipitate the proteins, seal the wound, and form a good cover. It is also used to treat infections of teeth and, you know, take care of your toothache. A good utility of this is seen in diabetics. Nowadays, you will see a lot of Khadi and Gram Udyog

exhibitions. If you go across, you would see cups made up of wood where they recommend you drink hot water in it.

Now, these cups are generally made up of Keno wood. they are available in market and what you do is when you put hot water on it they say your tannins get extracted earlier we had studied that tannins have the ability to dissolve and their solubility is further enhanced if you add hot water to it so the moment you pour hot water into this cup all the tannins from that wood especially if you take the stem bark of it and especially the heartwood part of it

You will see more and more tannins in a rich fraction. Eventually your water will turn a little off colored or dull colored where you know the tannins from that would have entered in your solution. Once you drink it, that drink or that decoction is thought to be a very good anti-diabetic preparation. Apart from that, because of its color, it's used in dyeing, printing as well as in tanning industries.

So here are a few examples of what we did with myrobalans as well as kino. So if you want to read any further, you have a few textbooks on pharmacognosy for this. And thank you. Thank you.