

PHARMACOGNOSY AND PHYTOCHEMISTRY

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Week 9

Lecture 43

Oleo-gum-resins containing drugs

Hello everyone, and welcome to week 9 of the NPTEL course in pharmacognosy and phytochemistry. This week, we are studying a beautiful set of compounds called resins. Resins, if you remember, are compounds we defined in our first lecture as oxidation products of terpenes. So, whenever the plant synthesizes terpenes, they get oxidized gradually, metabolized, and converted into very amorphous polymeric substances.

Asafoetida

Biological Source: Asafoetida is exudation obtained from decapitated rhizome or roots of

- *Ferula foetida* Regel,
- *Ferula rubricaulis* L.; and
- some other species of *Ferula*.
- Family: Umbelliferae

Geographical Source: Iran, Pakistan and Afghanistan



Asafoetida
dried oleo-gum-resin

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These substances are often referred to as resins. In this session, we will delve more into resin combinations called oleogum resins. Now, as the name indicates, oleogum resins

contain oil, gum, and resin. So, it's a mixture of three ingredients in varying concentrations. The oils essentially contain volatile oils and are rich in terpenes.

These are responsible for imparting a pleasant aroma to the oleoresin substances. Now, moving to the second ingredient of oleogum resin, which is gum. This is basically the carbohydrate component that comes from the plant. So, in addition to resin, you will also have carbohydrate components. Now, these carbohydrate components impart one more important property to the substances, and

that is emulsifying property. Oleogum resins naturally contain oil in them that is your essential oil and this carbohydrate in presence of water water will emulsify those oils. As a result, when these oleogum resins are triturated with water, they get converted into emulsions. So if your resin forms an emulsion with water, mostly it's a resin combination, which is your oleogum resin. Now, let us see a few examples of oleogum resins.

So today we see examples such as asafoetida, guggul and myrrh. The first one is a very familiar name in our kitchen, and that's your asafoetida. Often referred to as hing, and because of its aroma, it is also referred to as your devil's dung. So asafoetida is nothing but an exudation that comes out from the rhizomes of different *Ferula* species. This includes your *ferula asafoetida*, *ferula foetida*, *ferula rubricaulis*.

Now, apart from that, there are various other *Ferula* species from which your oleogum resin is also procured. Now, this resin is principally procured from your Iran. and Afghanistan. So the chief producers of hing or asafoetida are your Iran, Pakistan, and Afghanistan. In India, it is also grown to a certain extent in the Kashmir region.

So how is this hing made, or how is this asafoetida produced? Now, asafoetida is produced in ducts that are present in the cortical region of your asafoetida rhizome. Now this Asafoetida rhizome in order to get this particular oleogum resin out from that is often decapitated. So what happens is in the cortical region there are numerous what are referred to as your schizolysigenous and schizogenous cavities.

Eventually they kind of merge to get what is called as schizolysigenous cavities. So your Asafoetida rhizome is secreted in the schizolysigenous cavities it is already there you just

have to cut and get it out what is done is the plant is grown sometimes even taken from the wild sources sometimes cultivated so if when the plant is about three to four years old the rhizomes of it become as big as your carrots so

they are very big and thick and so is the stem So if you just see like a Asafoetida plant, you might have a rhizome like your carrot and then you have a stem. So what is made is a cut is made above the ground just above the rhizome in the stem and all your oleogum resin starts oozing out like a milky white liquid. Now once it oozes out like a milky white liquid, what happens is

it is prone to getting you know contaminated with dirt or grime because it's very close to the ground so as a result what is done is this is often covered With plastic or sometimes even the leaves of the same plant, a dome shaped structure is created and this resin, whatever is secreted is protected from the wind and dust. Once when the resin oozes out and it's kind of literally dried up, that time this dome is lifted and the resin is scraped.

Now this process doesn't stop there. So the next time what is done is now once this resin or oleogum resin is kind of scraped off, our next cut is given slightly lower. Now what happens is again your schizolytogenous cavities, the resinous ducts are exposed and more of this oleogum resin starts exuding out.

So it keeps on exuding and this process is repeated till my rhizome gets completely exhausted and the drug is no longer coming out of it. So in some cases, it is not only rhizomes; in some cases, even stems are cut off to get whatever little resin you can obtain from the stem part. So it's obtained from the little stem, but it's mostly obtained from the roots and rhizomes as well.

Once that is done, all the scrapings are dried in the sun. What happens here is the moisture content decreases, and a little white-colored emulsion turns into a dull buff-yellowish-brown resinous substance, which becomes what is called asafoetida of commerce. So you can see here.

This is what it dries up to, and this is what your asafoetida of commerce looks like. Now you will see that, in addition to that, you also get what is called compound asafoetida.

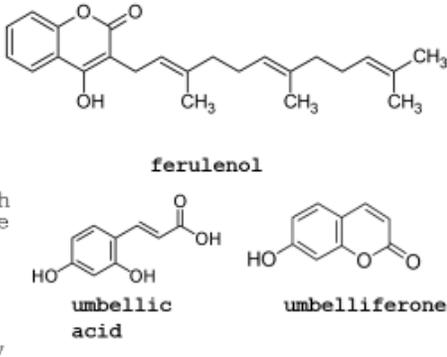
Compound asafoetida is the asafoetida that we use in our culinary practices. So in your kitchen, if you see the hing container, that is what is referred to as compound asafoetida. So what is done thereafter is after drying this asafoetida oleogum resin is triturated

either with grains, starch, or sometimes even gum arabic, so much so that it contains 50% asafoetida and 50% starch, gum arabic, or other substances. In that case, it is referred to as compound asafoetida. The reason for doing this is that pure asafoetida has a very nasty, strong, and alliaceous odor. But the moment you dilute it, it gives you a pleasant culinary odor.

One more additional advantage of compounding asafoetida or preparing compound asafoetida is you get to prepare or obtain a free-flowing powder, which is much more manageable. So what compounds present in this? Now Asafoetida being oleogum resin contains essential oils that is volatile oils approximately 8 to 16%, gum 25% and resin which is the major part about 40 to 60%.

Chemical Composition

- **Asafoetida is oleo-gum-resin** and contains volatile oil (8-16°C) gum (25%) and resin (40-60%).
- The flavour is largely due to sulphites such as R-2-butyl-1-propenyl disulphide (a mixture of E and Z isomers), 1-(1-methylthiopropenyl)-1-propenyl disulphide and 2-butyl-3-methylthioallyl disulphide
- **resin alcohols:** resinotannol, asaresinotannol, ferulenol are present partly free and partly combined form with **ferulic acid**.
- It also contains **umbellic acid** and **umbelliferone**; the latter is found combined with ferulic acid, but it gets generated on being treated with dilute HCl.
- Sesquiterpene umbelliferyl ethers mostly with a monocyclic or bicyclic terpenoid moiety



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Now, if you see Hing or Asafoetida, it has that strong alliaceous odor and that is attributed to lot of disulfide and trisulfide containing compounds. So, you will see that the flavor of Asafoetida, the alliaceous odor of Asafoetida is attributed to presence of bisulfides and trisulfides. These major compounds which attribute or which contribute to the flavor of

Asafoetida are 2-butyl-1-propenyl disulfide, isomers of it, 1-1-methyl-thiopropenyl-1-propenyl disulfide and 2-butyl-3-methyl-thioly disulfide. So all of the sulfurous compounds are even a kind of essential so when you heat asafoetida you get the aroma of it and that is the sulfurous compound contribute both to the flavor as well as to the aroma of asafoetida in addition to that it contains resin alcohols this includes your resinotannol ,asaresinotannol ,feruniol so you can see your ferulenole is chiefly your terpene derivative So if you remember your terpenes they are methyl that is dimethyl allyl derivatives and you can clearly understand the isoprene groups which are contributing to it.

Now when it comes to this part from your previous session you know that this part is contributed by your phenyl propanoid moiety chiefly originating from your phenylalanine. So, you have your resin. In addition to that, you have other phenyl propanoid compounds like your umbilic acid, ferulic acid. Now, this umbilic acid, ferulic acid are present and sometimes you have your umbelliferone which is a byproduct of

What you call it as cyclization of umbellic acid. So umbelliferone is a coumarin derivative which is formed when umbellic acid cyclizes. Now, this often occurs naturally, as it is present in combination as esters with ferulic acid. But once it is hydrolyzed, ferulic acid is separated from umbellic acid, and you can obtain umbelliferone. Now, this is also used in the detection and identification of Asafoetida.

Apart from that, there are numerous other compounds: sesquiterpenes, umbelliferol ethers, and many of them contain or mostly form ethers with monocyclic or bicyclic terpenoidal moieties. Now, let's move on to the chemical evaluation. First, being an oleo-gum resin, it forms an emulsion when water is added due to the carbohydrate component as well as the oil naturally present in the plant.

The next thing is because it is a resinous in nature you treat the freshly opened or fractured surface of asafoetida drug or even asafoetida powder with a drop of concentrated sulfuric acid, it will immediately turn reddish-brown, and later, the sulfuric acid will char it to an almost blackish coloration. But before that, you will observe an intermediate violet coloration.

So, you will see a gradual change from reddish to purplish and eventually black until all the Asafoetida is charred. Now, in the third case, we observe what is called a fluorescence test. You can see here that the fluorescence is due to the presence of coumarin. We just saw that it is umbelliferone. So, umbelliferone is often

found in association or is sometimes esterified and as a result it is important to free it or hydrolyze it first what is done is you take asafoetida powder and hydrolyze it. To facilitate hydrolysis, you take asafoetida powder, add acid, and triturate it in the presence of sand, which provides enough surface area for complete hydrolysis. that gives you enough surface area and the hydrolysis is complete

Now, once that is done, you filter it and heat it. Now, the filtrate also contains the acid, and as a result, when you heat it, the process of hydrolysis still continues. Now, once that is done, you make the pH alkaline because the coumarin shows a very nice fluorescence in the presence of a basic pH. So, you initially neutralize the acid, and as the pH moves toward the basic side, you will get the formation of umbelliferone.

This umbelliferone can be seen under UV as a bluish-colored fluorescence. So, you have to view it under UV at 365 nanometers to observe this kind of fluorescence. Now, moving to the applications, the most common application of asafoetida is in the food industry as a condiment and flavoring agent. Compounds of asafoetida vary in their

composition, and you might find them containing anywhere between 10% to 50% of asafoetida oleogum resin. Now, it is also an important ingredient in numerous spice mixes, masalas, and sauces, such as Worcestershire sauce. Now one interesting application of Asafoetida is it is seen that animals resent, resent—they don't like the aroma of asafoetida—and especially in veterinary cases, whenever there is a bandage to be tied to pets due to injuries, they tend to often lick it and tear it off.

So, what is done is they apply an asafoetida spray on the bandage. So, pets do not chew those bandages; they repel them, and in this way, the bandage is kept safe. So, not only as an insect repellent but also to prevent animals from licking their own wounds and bandages, this is also used. Now, in Ayurveda, asafoetida or hing powder is recommended for applications such as a digestive aid, antispasmodic, and a very good carminative.

Now, moving to the next drug. The next drug is Guggul. Guggul is also oleogum resin which is obtained by making incisions. In this case, the bark of a plant called Commiphora mukul. Now, it belongs to the family Burseraceae.

Now, this plant is distributed throughout India but is mainly grown in Rajasthan, Gujarat, Assam, and Karnataka. now this occurs wild but it's cultivated cultivated. This plant grows to a height of somewhere between 4 to 10 feet, but it can be remarkably observed because of one feature. If you see this plant carefully, you will barely see any leaves on it. Mostly, you will see the stem, which is green and performs the photosynthetic function. As a result, these barks are

kind of grayish papery and if you remove the bark the inner part of stem is often seen as green it's only during the monsoons monsoons or a few seasons that you will see tiny leaves on it. Otherwise, most of the time, you will see this plant not bearing any leaves. Now, when the incision is made, you get a yellowish-colored, milky, resinous compound coming out,

coming out often referred to as your guggul resin which on drying appears something like this which is hard, slightly sticky, and has a balsamic odor. It is generally collected in the winter seasons. So, what does this Guggul contain? Now, this gugul is also an oleogum resin, so it contains mostly gum and a resins and a small quantity of your essential oil the important compounds of Guggul are referred to as Guggul lipids

now Guggul lipids is obtained from Guggul resin so we just saw the resin that resin is taken crushed solvents such as hexane or petroleum ether Now once you extract it with organic solvents you will get the lipid soluble ingredients of guggul and this is referred to as your guggul lipid. Guggul lipid is very medicinal and contains compounds such as guggulsterols.

Now, these sterols range from guggulsterol 1 to 6. And you will also see cetosterol, especially your beta-cetosterol and E and Z-guggulsterols. So what you see here is E-guggulsterol. Just convert this and move it to this form. You get what is called Z-guggulsterol.

So they are just cis-trans isomers of each other. In addition to guggul lipids, the oleogum resin also has flavonoids. Quercetin and its glycosides, small quantities of ellagic acid, and myricyl alcohol. When you examine the oleaginous or oil composition, it is very beautifully fragrant. So, guggul resin is even used in incense because of this oleaginous,

fragrant, or volatile oil composition, contributed by myrcene, alpha-pinene, 1,8-cineole, and numerous other monoterpenes and sesquiterpene derivatives. Now, because of its guggulsterone composition, guggul has numerous therapeutic attributes. It has been used traditionally in the Ayurvedic system of medicine and has numerous current-day applications.

So, it is observed that consumption of guggul significantly lowers serum triglycerides. This includes your cholesterol, LDLs, VLDL cholesterol which are often referred to as the bad cholesterol enhances high-density lipoprotein lipids or HDLs, also referred to as good cholesterol. which are also referred to as your good cholesterol. Now, in addition to that, it is known to inhibit platelet aggregation.

And one reason why Guggul has become famous or sought after again is that it is known to stimulate what is called thermogenesis. That is your heat production by stimulating your T3, T4, or thyroid system as such. Now, because of this thermogenesis, a lot of energy is spent, and as a result, because the energy is spent, there is a burning of lipids, and simultaneously, there is a slimming action.

So people nowadays take Guggul tablets or capsules for slimming purposes, to take care of their lipomas or to take care of their hyperlipidemia as well. Now, in addition to the basic action on the lipids it is also known to possess astringent antiseptic expectorant even aphrodisiac demulcent and immunagogue activities. Not only that, the Guggul resin is reported to

be useful in tonsillitis and pharyngitis. It is also recommended for rheumatoid arthritis in Ayurveda. This resin is often boiled in a specific apparatus called as dolayantra where it is dissolved in milk and ghee after boiling, and you get what is called purified or soft guggul, often referred to as shodit guggul, which is devoid of other impurities and much

more potent compared to your native guggul resin. Now, let's move on to the third example of oleogum resin, and that's your myrrh. Now, myrrh is also referred to as Arabian or Somali myrrh because the place it is brought from is mostly the Arabian subcontinent, also referred to as Myrrha. It's an oleogum resin again obtained from *Commiphora* species,

but it's obtained from *Commiphora molmol* or *Commiphora abyssinica*. Now this belongs to the same family as your Guggul and that is your *Burseraceae*. Now, this is a plant that is more native to the Arabian Peninsula, and often myrrh of commerce comes from countries like Ethiopia and Somalia. So, this myrrh plant is again a short plant, and it has a

stem, and in the stem, you will see the phloem parenchyma and resin ducts are closely associated. Now, what happens is, as the plant matures, they kind of become lysigenous, fuse, and this myrrh resin fills all these ducts. The moment you make an incision, a yellow liquid oozes out of it very spontaneously, and that is what is referred to as your myrrh. So myrrh on drying forms what is called as a reddish brown mass which is often collected by natives from the wild plants

but nowadays again that has been cultivated for commercial purposes. Now once you have this myrrh you will see that the outer surface is little powdery brown but it has a beautiful essence that is aroma and it's acrid in nature. Now going to the chemical composition, in terms of its chemical composition the major part is your gum and you will have your resins almost 25 to 40 percent alcohol soluble resins and

a minor component 7 to 17 percent of your essences or volatile oil. Now this contains numerous compounds which belong to the category of furanosesquiterpenes. Now furanosesquiterpenes in addition to the sesquiterpenoidal part have furans associated with them. So the main furans which are associated with m myrrh include your furanoudesma-1,3-diene. Then you have your landestrine and you have your cozerine.

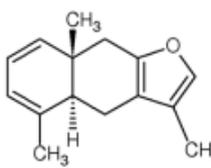
Now, if you see carefully, they are very much analogs of each other. The only difference between furano and eudesmodine is this. So you will see that in lindestrine what has happened is the aromatization is changed and you get a double bond out here. Whereas

what happens in casarin is you will see that the bond has been broken from here. So it's essentially the same compound but has rearranged to form different derivatives.

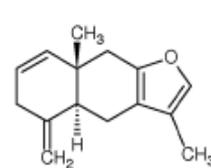
In addition to that, you have your eudesmines, elemenes, germacrane, cardiananes and you have your other compounds also present belonging to your furanosesquiterpenoidal class. In addition to that, the essential component of it includes your alpha, beta as well as gamma bisabolin. It also contains phenolics. These phenolics are also responsible for the color of your myrrh, and this includes your pyrocatechin and pyrocatechuic acid.

Chemical Composition

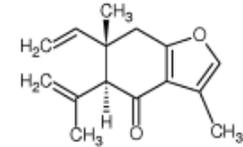
- 7-17% volatile oils, 25-40% alcohol soluble resins, and 57-61% water soluble gum
- Furanosesquiterpenes: eudesmanes, elemanes, germacrane, and cadinane, with furanoedesma-1,3-diene, curzerene, and lindestrene
- Monoterpenes: α -, β -, and γ -bisabolene, Phenolics : pyrocatechin and protocatechuic acid.
- Resins include commiphoric acids, commiphoric acids, commiferin, and heerabomyrrhols



furanoedesma-1,3-diene



lindestrene



curzerene

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Now other components of resin include your commiphoric acids and your commiferin and heerabomyrrhols. Now, coming to the test of it, you can assess whether the drug of commerce given to you is myrrh or not. The first thing is, it is an oleogum resin. So, the moment you triturate it with water, you should get an emulsion. But, as compared to your asafoetida or as compared to your galbanum, myrrh, being more reddish-brown in nature, gradually

fades in color, and as you emulsify, you should get a yellow-brown emulsion. Not only that, if you extract myrrh with ether and take this ether and treat it with bromine—especially the bromine vapors—you will see that initially it turns red, and subsequently,

this color changes to purple when you add your nitric acid to it. In terms of applications, myrrh because it contains tannins in addition to your resinous compounds,

it is given for a lot of wound healing, antiseptic and antibacterial effect. So it's carminative, it's local stimulant, it is antiseptic, it can heal wounds such as your mouth ulcers, and as a result, it is often given as a topical astringent and used in your tooth powders and mouthwashes. It is also used as an immunostimulant. Now, it is also used as a tincture due to its disinfectant properties.

Like I said, this is one of the resins which is rich in tannins, and as a result, it is a very good disinfectant. Extracts of this have been used as fixatives. Now, since it's an oleogum resin, the resinous parts of it are often solubilized in alcohol. These alcoholic resin extracts increase the viscosity, and as a result, they can be used as fixatives in your perfumery industry. So here are a few more references if you wish to read more about these three drugs, and

thank you, everyone, for your patient listening.