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Review Article

The use of bay leaf (*Eugenia polyantha Wight*) in dentistry

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ABSTRACT

Background*: Bay leaf or Eugenia polyantha Wight is a species that has several chemical properties. Bay leaf consists of tanine, flavonoid, essensial oil, including citric acid and eugenol. However, only few reports were published about the use of bay leaf in dentistry.* ***Purpose****: The aim of this article is to describe the chemical properties of Eugenia polyantha Wight that are widely used in dentistry.* ***Reviews****: The chemical properties of Eugenia polyantha Wight have analgesic, antibacterial, and anti-inflammatory effect, so they can be used as an alternative dental therapy. These properties can be used as a basic of therapy or as a basic ingredients of treatment.* ***Conclusion****: Eugenia polyantha Wight has some useful pharmacologic activities that are useful in dentistry. We suggest this article can be used as a basic knowledge for dental researchers.*

Key words*: Eugenia polyantha Wight, essensial oil, tanine, flavonoid, dental therapy*

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INTRODUCTION

Bay leaf or *Eugenia polyantha Wight* has been known since long time ago as a species that can be used for therapy. The use of bay leaf has been developed medically, as an alternative medical plant.[1] Bay leaf has a lot of chemical properties that is useful in medical, even as basic materials in dentistry. Empirically, *Eugenia polyantha Wight* can be used for hypertension, diabetic, diarrhea, gastritis, drunks, and skin diseases. The plant also has other benefits such as diuretic and analgesic effect.[2]

Eugenia polyantha Wight has many chemical properties. The chemical properties of *Eugenia polyantha Wight* are basic matters that are used in almost every section in dentistry, as basic matters for therapy and treatment.[2]

The aim of this article is to describe the chemical properties of bay leaf and the benefits of its chemical properties in dentistry. We suggest this article can be used by dentists, as a basic knowledge for future researches about bay leaf in dentistry.

Figure 1. Bay leaf.[5]

The morphology of bay leaf

Bay trees mostly grown in the forest, but they may be planted in the garden. Bay trees can be found in lowlands until 1.400 meters above sea level.[3] Bay trees may height about 25 meters, have large straight root, round trunk and smooth surface.[4] Bay trees have small, white, and fragrant flowers. Bay leaf (Figure 1) has 2.5–8 centimeters long leaf

with flat margins, the tip is blunt and the base of the leaf stretch along length and thight.[2] Chinese therapy books describe that bay leaf has fragrant smell and has astringent to the taste.[1]

Taxonomy of bay leaf

Scientifically, bay leaf is named *Eugenia polyantha Wight* and the synonyms are *Eugenia lucidula miq* and *Syzyqium polyanthum Wight*.[6] The taxonomical chart put this plant in the *Spermatophyte* division, *Pinophyta* subdivision, *Coniferopsida* class, *Eugenia* family, *Myricales* genus, and *Eugenia polyanthum* (Wight) walp species.[7]

In some region or provinces in Indonesia, bay leaf is known as meselangan (Sumatra), ubar serai (Malay), salam (Java, Sunda, Madura), gowok (Sunda), manting (Java) or kastolam (Kangean).[2]

Benefit of bay leaf

Bay leaf can be used not only as spices for cooking purposes, but it can also be used as medicine. Its roots and fruits extract have the ability to neutralize hang over caused by too much alcohol consumption. Beside those two utilities, bay leaf extract is usually used to stop diarrhea, gastritis, diabetes mellitus, itchy, astringent, and scabies.[8] It is also stated that bay leaf has lower side effect compared to synthetic drugs. To be consumed as drugs, we extract bay leaf by boiling it, while as ointment, bay leaf is crashed and applied on the affected skin.[3] Bay leaf can also be used to treat patients with high uric acid. New researches describe that infuse of bay leaf in 0.5 mg doze can increase the excretion of uric acid in urine of Wistar male rat.[9]

Recurrent Apthous Stomatitis (RAS) is an ulcer cause by oral mucous membrane inflammation that is often found. RAS causes pain and difficulties in eating, speaking, and tooth cleaning. The common treatment is giving topical antibacterial, antiseptic, and anti-inflammatory medicines,[9] but the infuse of *Eugenia polyantha Wight* can be used to treat that disease.

Chemical contents of bay leaf

In some study, *Eugenia polyantha Wight* has a lot of chemical properties. The chemical properties consist of tanines, flavonoid and essential oils (0.05%), including citric acid and eugenol.[1]

Tanine is a liquid glycoside derived from polypeptide and ester polymer which can be hydrolyzed by the secretion of bile (3, 4, 5–trinidrokside benzoic acid) and glucose.[10] Tanine or tanat acid isolated from some part of plants can be found in market. It is cream colored powder, amorf, astringent taste and aromatic.[11] Tanine is used as astringent for gastrointestinal tract or skin. Tanine as an astrigent that can make precipitation of the cell membrane protein and also have a little penetration activity, so it can influence the permeability of cell membrane.[12] Tanine can also be used as anti diarrhea. Tanine can inhibit topoisomerase enzyme I and II, viral transcriptase in 0.01µg/ ml concentration.[11]

Pharmacologic and physiologic effects of tanine are derived from its activity to form complex compound.

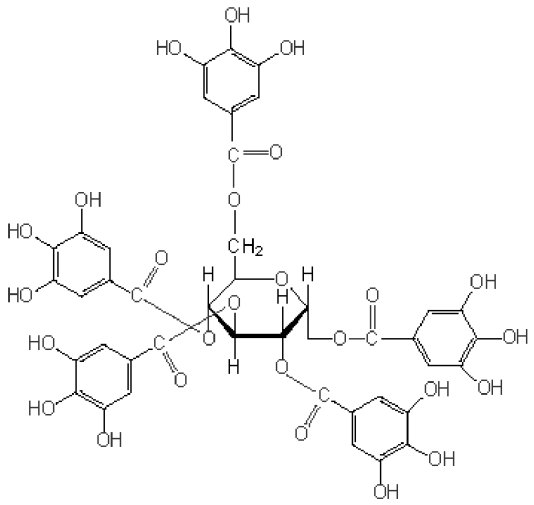

Figure 2. Structure of tanines.[17]

The form of its complex is based on the formation of hydrogen chain and hydrofobic interaction between tanine and protein.[11] Tanine is an active compound that has antibacterial activity.[13] Antimicrobial activity of tanine depends on the ability of this compound to inhibit the activity of some enzyme selectively or its ability to inhibit inter ligan chain in some receptor.[11]

Eugenia polyantha Wight can be used in periodontics, like in the periodontitis case. Periodontitis treatment are mechanically (scalling, curretage, or gingivectomy) and chemically (oral rinse).[14] Tanine in the bay leaf functions as astringent.[6] Astringent is a medicine which has the ability to decrease the mucous matrix. It also cause protein precipitation on the cell surface which have low permeability.[13] Whereas, tanine is one of active matters of *Eugenia polyantha Wight* and part of phenol group,[15] that can inhibit the growth of bacteria by precipitation and denaturation of bacteria protein.[16] The structure of tanines can be seen in figure 2.

Flavonoid is a genetic term used for aromatic heterocyclic oxygen compound which is derived from 2 – phenilbenzopiran or its 2, 3 – dehydro.[10] Flavonoid is one of natural phenolic compound present in most plant. It is found in seeds and fruits. It is synthesized in small amount about 0.5–1.5% and can be found in almost every part of a plant.[18] Antusianin (anthocyannis) is a subgroup of flavonoid, responsible to give yellow, red and blue pigment. Flavonoid is classified based on the level of oxidation level into catechin, leukoanthocianidine, flavanol, flavon and antocianidine.[10]

Flavonoid coumpound in the form of aglikon in the intestine is absorbed along with the secretion of the bile through the ephitelia into the vacular system. Through the vena porta, most of the flavonoids are headed to the liver as the primary organ for metabolism. Metabolism process can also take place in the big intestine as well as in the renal organ. Some of the biological function will increase when flavonoid is absorbed. Those functions include the

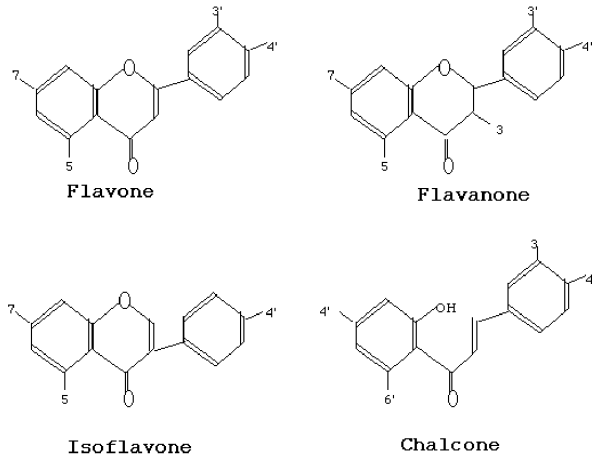

Figure 3. Structure of flavonoid.[20]

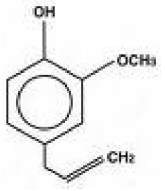

Figure 4. The structure of essential oil (Eugenol).[24]

protein sinthesys process, cell differentation, proliferation and angiogenesis.[19] In vivo and in vitro studies showed that flavonoid has biological and pharmacologic activities, including antibacterial activity.[19]

Flavonoid in *Eugenia polyantha Wight* has an anti-inflammatory effect and can support vascular wall, therefore the bleeding can be stopped. The mechanism of flavonoid as anti-inflammatory is through prostaglandine synthesis inhibiting and proline hydroxylation stimulating.[19] The structure of flavonoid can be seen in figure 3.

Essential oil is mainly consists of terpenoid compound with atomic carbon framework of five.[10] The characteristics of essential oil are highly evaporized in room temperature without decomposition, bitter, sweet smell in accordance with plant that produce it and soluble in organic solvent but not water soluble. Another compound that form essential oil including phenilpropane biosynthetic is phenol compound such as eugenol, khavikol and khavibetol.[21] Essential oil in some plants have biological activity as antibacterial and antifungal, so essential oil can be used as food preservatives and natural antimicrobial.[22] Essential oil has antiseptic and antioxidant activity. Essential oil also has activity to inhibit the growth of some bacteria and fungi.[23] The structure of essential oil can be seen in figure 4.

DISCUSSION

Recently, a lot of exploitation on natural sources is used as alternative therapy. Because the side effects are less than synthetic drugs, one of the natural sources used is bay tree or *Eugenia polyantha Wight*. All part of *Eugenia polyantha Wight* can be used as alternative medical therapy, including the leaves, roots, and barks. The chemical properties of *Eugenia polyantha Wight* consist of tanine, flavonoid, essensial oil, including citric acid and eugenol.[1]

Eugenia polyantha Wight can be used in conservative and endodontics such as pulpitis treatment. Pulpitis is an inflammatory of the pulp that is caused by bacterial invasion. Acute pulpitis treatment is relief of pain by eugenol application or prescribing the medicines. In reversible pulpitis, the treatment is filling or reducing the amount of *Streptococcus mutans*. *Streptococcus mutans* is one of the bacteria that caused caries.[25] Recent studies showed that *Eugenia polyantha Wight* can reduce *Streptococcus sp* colony in samples who rinsed with 100%, 75% and 50% *Eugenia polyantha Wight* solution. because it contains tanine, flovonoid and essential oil, that has antibacterial effect.[25] Eugenol or clove oil is an acidic essential oil that is used as pulp irritant and mild antiseptic.[26] Infuse of *Eugenia polyantha Wight* can be used as oral rinse for relief of pain or analgesic, because eugenol can inhibit interdental neuron impulse.[27]

The use of *Eugenia polyantha Wight* in prosthodontics is as a denture cleanser. Soft deposits from food easily adhere on denture. These soft deposits must be removed or cleaned regularly, to prevent bacteria and fungi from growing. Denture cleanser must be bactericidal and fungicidal.[28] Forty percent, 60%, and 80% extract of *Eugenia polyantha Wight* can inhibit *Candida albicans* growth in acrylic resin denture base.[29]

Flavonoid has antibacterial properties because it has the ability to interact directly with the DNA of the bacteria.[19] The basic structure of the DNA itself has an important role in the transcription and duplication process, therefore, every compound that has the ability to disturb the stability of the double helix DNA structure will be able to affect all the growth process and metabolism of the bacteria.[19] Those interaction will result in the damage of the permeability of the bacteria cell wall, microsome and lysosome. In addition, flavonoid is also capable in producing transduction energy that will affect the cytoplasm of the bacteria and slow down its motility. It is known that the hydroxyl ion present in flavonoid can chemically change the organic compound and nutrition transportation thus cause toxicity effect to the bacteria cell.[18] Astringent oil inhibits the growth of the *Candida albicans* by protein and nucleic acid denaturizing. Protein denaturizing process involve the changes in the protein molecular constituent stability and causes protein structural changes and allows coagulation process to happen. The protein that undergoes the denaturizing process will lose its physiological activity and incapable to function well. The changes occur in the protein and cell wall will increase the cell permeability. The damage and the increase in the cell permeability will wreck the cell.[21]

Flavonoid in *Eugenia polyantha Wight* can be used as analgesic. Flavonoid in honey can reduce cytokine (IL-1 and TNFα) produced by macrophage and expression

receptor of cytokine, so pain and tissue destruction can be reduced. Flavonoid can increase mitogenesis process, cell interaction and adhesion that have a role in ephitelization process.[30]

Beside that, flavonoid in *Eugenia polyantha Wight* can be used in oral surgery. Flavonoid can accelerate post extraction healing process. Flavonoid can increase proliferation of fibroblast and collagen production. Flavonoid can also reduce pain after tooth extraction, by inhibiting prostaglandin synthesis.[19]

The conclusion of this article is *Eugenia polyantha Wight* has many pharmacological activities that are useful in dentistry.

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