Introduction

Oral disease is ~~O~~one of the major human health problems. It ~~is oral disease~~ includes dental~~ing~~ caries and periodontitis ~~those~~ caused by bacterial infection ~~of~~ from *Streptotococcus mutans*, *Enterococcus faecalis*, and *Streptococcus sanguis*.[1,2] ~~.~~The ~~i~~Increasing ~~of~~ prevalence ~~number and~~ of antibiotic resistance against bacteria ~~were~~ have ~~l~~ead~~l~~ed to ~~to needed discovery~~the discovery of new antibacterial agents to overcome~~solve~~ this problem. Dental caries is a transmissible bacterial disease process caused by acids from bacterial metabolism diffusing into the enamel and dentine.[3] Periodontitis is defined as an inflammatory disease ~~of~~ affecting the supporting tissues of the teeth caused by specific microorganisms or groups of specific microorganisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with periodontal pocket formation.[4] ~~A~~Regarding antibiotic resistance ~~from~~from ~~—~~an evolutionary perspective, bacteria use two major genetic strategies to adapt to ~~the~~ antibiotic attacks. These are ~~that is~~ mutations in genes often associated with the mechanism of action of the compound and the acquisition of foreign DNA coding for resistance determinants through horizontal gene transfer (HGT).[5]

The rationale of the root canal treatment is to debride and sterilize the root canal ~~and~~ to eliminate pathogens ~~where~~ causing tooth infection ~~occurs~~, ~~as~~ and ~~a~~ thorough ~~and~~ controlled ~~of~~ root canal sterilization is required for ~~a~~ predictable treatment outcomes.[6] ~~The~~ ~~Following~~ After a root canal preparation, the canal should be considerably clean with diminished number of pathogens. Oral pathogens such as *E. faecalis* ~~s~~are seldom found in failed endodontic treatments where infection of the root canal and periapical tissue re-occurs. The bacterium~~a~~ are able to survive in unfavorable conditions, forming a biofilm~~s~~ which enables it~~s it~~ to penetrate dentinal tubules.[7,8] *E. faecalis* is not only found in the root canals, ~~and canit~~but can also exist in both the root canals and in the saliva.[9] Even though r~~R~~oot canal treatment has a considerably high success rate of 85% ~~which is considered high~~, ~~but in long term,~~ some ~~have~~ can fail~~ed~~ over the long term ~~and became~~to become reinfected.[10]

Bioactive compounds from natural products ~~is~~ are an enormous source of promising new antimicrobial agents with diverse structures of active secondary metabolites; these can be used to treat oral disease caused by pathogenic oral bacteria.[11,12] In a~~continuing of our~~ continue~~d~~ous search for ~~discovery~~ new bioactive compounds from natural sources, ~~we~~ explored potential active constituents as such as the antibacterial agent from the interesting medicinal plant of Kemangi (*Ocimum basilicum* L.) were explored. Kemangi is an ~~those an~~ edible spice~~s~~ plant commonly known as sweet basil including ~~of~~ Lamiaceae.[13,14] ~~The Kemangi contained~~It contains monoterpene and diterpenoid as its major components, making it a ~~well known~~well-known ~~of famous~~ source ~~for of~~for essential oil (basil oil) ~~as~~ and an important component of fragrances. Phytochemical analysis of leaf extracts have shown ~~showed~~ that it contain~~sed~~ the secondary metabolites of phenolic, terpenoid, steroid and flavonoid compounds.[15] Beside~~s~~ ~~of~~ essential oil as its major component, two compounds were isolated from the non-essential oil part, namely ~~the~~ diterpenoids of 2-(2-vinylcyclohexa-1,5-dienyl) propan-1-ol and 1-(2-vinylcyclohexa-1,4-dienyl) propan-2-ol ~~were isolated from the non-essential oil part~~.[13]

The ethanol extracts ~~was~~ showed antimicrobial activity against Acinetobacter, Bacillus, Escherichia, Staphylococcus, while the methanol extract was active against Acinetobacter, Bacillus, Brucella, Escherichia, Micrococcus, ~~dan~~ ~~—~~and Staphylococcus.[16] ~~Then,~~ ~~t~~The ethanol extract of Kemangi was reported to inhibit the

bacterial growth of *S. epidermidis, S. aureus, B. paludis, and B. subtilis* with inhibition zone values of 12, 12, 10 and 12 mm, respectively. Apart from that, , and also was reported that the methanol extract of *O. basilicum* was found to have MIC values of 60, 40 and 80 μ g/mL against bacteria of *K. pneumoniae*, *S. typhii* and *S. aureus*, respectively.[17,18]

As an alternative to antibacterial agents for root canals sterilization, search for new antibacterial and anti-inflammation agents, irrigants, medicaments, and materials for endodontic treatment are in demand. Edible plants and herbs have emerged as a possible alternative, since screenings have shown theirthat they contain significant active phytotherapby compounds.[19,20]

Medicinal plants have been accepted as an alternative therapy to complement of modern medicine. For this research, choosing an edible vegetable as the source for developing an antibacterial agent was done performed with an assumption that the process for drug development would be simpler. The toxicity levels of vegetables is are negligible , since as they are consumed in on a daily basis.

Based on a our continuedous search for a new antibacterial agent from the Indonesian plants, this paper describes the isolation, structure determination and their activity of the edible plant Kemangi (O. basilicum L.) against the particular pathogenic oral bacteria of *Streptococcus mutans* ATCC 25175 and *Streptococcus sanguinis* ATCC 10556 from edible plant of Kemangi (*O. basilicum* L.).[21,22,23] This study primarily aims to determine investigate the overall potency and investigate the antibacterial effects of the edible plant Kemangi against the oral bacteria of *Enterococcus faecalis*, *Streptococcus mutans*, and *Streptococcus sanguinis*.

In order to evaluate the antibacterial activity, the extracts were tested against *E. faecalis*, *S. mutans* and *S. sanguinis*. The assay data in Table 2 represented states that extracts to have different sensitivitiesy to different each bacteria, thus suggestingthose assumed that their mechanisms of to inhibiting bacterial growth were are different. Based on the antibacterial data, the most active most extracts were active extract against *S. mutans*, since tThree extracts of methanol, *n*-hexane, and ethyl acetate were active from all assay concentrations of 1-5%, with inhibitions zonesinhibition zone values of 7.2-16.2 mm., Tand the activity of ethyl acetate at 5% of 16.2 mm was almost nearly the same as thewith activity of 2% of chlorhexidine as the gold standard at 17.9 mm. Some pPrevious data have reported on for somethe activity of the extracts against *S. mutans*.[31]

Further antibacterial data analysis showed that the extract was also active against *E. faecalis*, especiallyespecially of methanol those which was active at 1-5% with inhibition zones values of 6.9-10.4 ppm, respectively, while and *n*-hexane and ethyl acetate extracts was only active from 4-5% and 3-5%, respectively. The antibacterial activities of the extract against *E. faecalis* were lower than the gold standard of 2% of chlorhexidine as gold standard. Some extracts active against *E. faecalis* also have been reported in previous data. On the other hand, antibacterial activity of extract against *S. mutans* was only present in *n*-hexane and ethyl acetate extracts at 4 and 5%, but the this data is very important because the inhibition value of *n*-hexane at 5% of 9.4 mm was the nearest of to 10.9 mm at 2% of chlorhexidine which is or theas gold standard. On the other hand, some extracts active against *E. faecalis* also have been reported in previous data.[32]

The prediction role values oof the antibacterial activitiesy of single and combinations extractscombination extracts contribute to antibacterial activitywere was then evaluated against all bacteria. By Using the same assays, samples formulations

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were used to ~~could be~~ determine~~d~~ the synergistic effects~~ets study~~ of the extracts. As shown in Table 3, the antibacterial activity of the ~~combinations extracts~~combination extracts described that only two combination extracts of M+Hex and *n*-Hex-Ea were active; this~~ which suggested~~ suggests that active constituents of extracts ~~were to have~~had antagonistic effects which~~to~~ each other while tire when combined. This data ~~wa~~is supported by published reports; previous researchers have ~~those~~ reported some extracts to have synergistic and antagonistic effects.[33] ~~This~~The observed data can be used as important information ~~that will~~and a guide ~~in order to~~to further determine the most appropriate separation and purification methods to isolate the active compounds from the extracts.