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(54) Title: ORAL HEALTH COMPOSITION COMPRISING ALCHEMILLA VULGARIS

(57) Abstract: The present invention relates to *Alchemilla vulgaris* for use in oral health applications, an oral composition comprising*Alchemilla vulgaris*, and the use of *Alchemilla vulgaris* or the composition, in the improvement or maintenance of oral health in an animal, preferably through the reduction or control of dental plaque and/or alteration of the bacterial content of dental plaque, in the oral cavity of the animal. The invention also includes *Alchemilla vulgaris* for use in the prevention or treatment of gingivitis in an animal. The invention also provides a method for improving or maintaining oral health in an animal.

ORAL HEALTH COMPOSITION COMPRISING ALCHEMILLA VULGARIS

TECHNICAL FIELD

The present invention relates to *Alchemilla vulgaris* for use in oral health applications, an oral composition comprising *Alchemilla vulgaris* , and the use of *Alchemilla vulgaris* or the composition, in the improvement or maintenance of oral health in an animal.

BACKGROUND OF THE INVENTION

The need to maintain or improve oral health in an animal is of great importance. Poor oral health can lead to gum disease (gingivitis) and ultimately tooth loss, which can have severe effects on the wellbeing of the animal.

Poor oral health can be caused by a number of diseases and conditions. One of the most prevalent amongst cats and dogs is periodontal disease. Periodontal disease affects all cats and dogs at some stage during their lives. The aetiological agent in all cases of periodontal disease is plaque.

Current dietary methods for reducing or controlling plaque formation (and therefore associated conditions, such as gingivitis), in companion animals are usually mechanical means, such as hard chews or treats which act to scrape the plaque from the teeth, when chewed or consumed by the animal. The mechanical means rely on texture for their efficacy and a chewy rather than brittle texture is preferable to resist breakage of the means and therefore to also increase tooth cleaning time during chewing. Cats are less keen than dogs to chew for prolonged periods. Therefore products for various animals differ in texture to allow for these different preferences.

Textured toys may also be employed, to remove plaque mechanically from the surface of the teeth, without the animal ingesting any of the product that provides the textured surface.

However, the removal of plaque by mechanical means such as textured foodstuffs or toys relies upon the animal spending sufficient time chewing the mechanical means to scrape the plaque from the surface of the teeth. The amount of time required is difficult to assess and to monitor. In addition, plaque control on all tooth surfaces in the oral cavity is difficult to achieve via mechanical abrasion alone and certain teeth receive more efficient cleaning than others.

Plaque may also be removed or reduced by cleaning the teeth by brushing. However, owner compliance with toothbrushing is poor, with the result that very few dogs and cats receive a daily oral care regime of toothbrushing.

As an alternative to mechanical means for the removal of plaque, certain synthetic compounds such as chlorhexidine and triclosan can be used as antibacterial agents to reduce plaque. However, these compounds are broad spectrum antibacterial agents and, as such, may cause an imbalance in healthy gut microflora populations when ingested regularly. In addition, certain plaque bacteria have been associated with periodontal health and treatment with broad spectrum antibacterials would potentially kill these populations and would actually result in a less healthy oral microflora, leading to a reduction in oral health.

Accumulation of bacterial biofilms on the surface of a tooth can lead to gingivitis if not sufficiently addressed. Gingivitis is an inflammation of the gums caused by bacterial plaque that accumulates on the gum line. It can cause soreness, redness and bleeding of the gums.

An additional contributory factor to poor oral health is calculus. Since calculus cannot be removed by toothbrushing in normal cases, it accumulates on the tooth surface and irritates the gum tissue, giving rise to gingivitis. This is a further indication of poor or deteriorating oral health.

The addition of calculus formation inhibitors such as sodium tripolyphosphate to pet foodstuffs and to human oral care products helps to prevent calculus accumulation. However, this does not address the bacterial community composition within the dental plaque that is contributing to the detrimental effects of periodontal disease on the oral health of the animal.

Therefore, there is a need for reducing the effects of dental plaque in an animal, in particular by natural methods, without relying solely on mechanical means or synthetic chemicals or compounds and without stressing the animal. Furthermore, there remains a need for the prevention and treatment of gingivitis in an animal.

SUMMARY OF THE INVENTION

Accordingly, the present invention provides *Alchemilla vulgaris* for use in improving or maintaining oral health in an animal.

In an aspect of the invention there is provided the use of *Alchemilla vulgaris* in the treatment of gingivitis in a cat or a dog.

In a further aspect of the invention there is provided an oral composition comprising *Alchemilla vulgaris* when used in the first aspect of the invention.

In still a further aspect of the invention there is provided the use of *Alchemilla vulgaris* in the manufacture of a composition for the treatment of gingivitis in a cat or a dog.

An even further aspect of the invention provides a method for treating gingivitis in a cat or a dog, the method comprising administering to the cat or dog in need of said treatment, an effective amount of an oral composition comprising *Alchemilla vulgaris.*

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The inventors have unexpectedly found that *Alchemilla vulgaris* is able to improve and/or maintain oral health in an animal.

Preferably, the *Alchemilla vulgaris* improves or maintains the oral health of the animal by controlling or reducing dental plaque in the animal, by which it is meant that disease causing factors produced by the plaque and/or dental plaque is reduced in the oral cavity of the animal.

Comprises/comprising and grammatical variations thereof when used in this specification are to be taken to specify the presence of stated features, integers, steps or components or groups thereof, but do not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

DETAILED DESCRIPTION OF THE INVENTION

Dental plaque is a mixed microbial community consisting of aerobic and anaerobic bacteria. Although plaque may vary between individuals the formation process can be broken down into three key events of (i) primary colonisation (adhesion); (ii) secondary colonisation (coaggregation); and (iii) maturation (virulence).

Plaque development begins with a tooth surface covered with a film of proteins and glycoproteins called the tooth salivary pellicle. Pioneer bacterial species adhere to

molecules within the salivary pellicle, first forming a monolayer and subsequently pallisades of bacteria perpendicular to the tooth surface.

The microbe is held for a brief period by a weakly attractive force, during which time a number of specific adhesion mechanisms hold the cell close to the surface for a significant time period. These specific interactions may be a combination of lectin-like, electrostatic and hydrophobic interactions that in some instances could involve delicate structures called fibrils or fimbriae that project from the cell surface. Following this, initial attachment is rendered effectively irreversible by the production of extra-cellular polymers.

In humans streptococci are the most common primary colonisers making up between 47-52% of all bacteria adhering to the salivary pellicle.

During and after this initial phase, secondary colonisation by a variety of bacteria occurs leading to a large increase in bacterial diversity. Foremost among the events of secondary colonisation is the process of coaggregation whereby the primary colonisers now act as the substrate for colonisation.

Coaggregation has been described as 'the recognition between surface molecules on two different bacterial cell types so that a mixed cell aggregate is formed'. It has also be described as 'the adherence among partner cells in a suspension'.

Coaggregation is a highly specific process that takes place between specific bacterial 'partners'. Each strain has its own set of partners and mechanisms of cell-cell recognition. Groups of strains also exist which are able to coaggregate with several other strains. Based on human studies, one such organism that dominates these later colonisers is *Fusobacterium nucleatum*, which is a dominant organism in mature dental plaque.

Coaggregation is known to play an important role in human plaque formation. Coaggregation between different strains of canine oral bacteria has been determined

in vitro suggesting a similar role for this behaviour in dental plaque formation and development in other animals.

At some point during the development of the plaque biofilm, the rate of change in the overall composition slows. The point at which this happens is currently unknown, although it is thought to take several days for the biofilm to reach this state.

In human plaque, a succession of bacterial species occurs as Gram-positive cocci and rods are progressively replaced by Gram-negative filamentous and flagellated organisms. The maturing biofilm also tends to become increasingly anaerobic as it increases in depth.

It is at this point that the biofilm can be said to have reached a climax community, where a number of the bacteria are reliant on others within the biofilm for their survival. It is during this phase that many organisms associated with periodontal disease are present. These bacteria produce a number of compounds that are the causative factor of periodontal disease, such as proteases and haemolysins. Proteases, in particular trypsin, are reported to have a host of abilities, including the ability to degrade immunoglobulins, inactivate cytokines and their receptors, degrade host tissues and promote bleeding in the oral cavity. The bacteria of the plaque is known as the plaque biomass.

Pathogenic bacteria, such as *Peptostreptococcus* are often present in dental plaque, as well as black pigmenting anaerobes, such as *Porphyromonas, Bacteroides* and *Prevotella*, all of which are thought to contribute to disease states.

The *Alchemilla vulgaris* of the invention is useful for inhibiting the formation of such biofilms and/or inhibiting the detrimental activities of the biofilm and therefore improving or maintaining oral health by controlling or reducing dental plaque in an animal. The *Alchemilla vulgaris* of the invention is also provided for the prevention or treatment of gingivitis in an animal.

By reducing the level of pathogenic bacteria in the biofilm, the health of the dental plaque is improved. Thus, the *Alchemilla vulgaris* of the invention is useful in altering the bacterial content of the plaque, preferably by reducing the pathogenic bacterial content of the plaque in the oral cavity of an animal. The *Alchemilla vulgaris* may also promote the healthy bacteria of the plaque. The *Alchemilla vulgaris* of the invention is useful in improving the health of the dental plaque present in the oral cavity of an animal.

The *Alchemilla vulgaris* of the invention preferably reduces the level of inflammatory proteases and/or black pigmenting anaerobes in dental plaque in an animal. These are key disease causing agents that are found in dental plaque.

Most preferably, *Alchemilla vulgaris* inhibits or reduces pathogenic bacteria in dental plaque, which may include *Peptostreptococcus sp.*

The *Alchemilla vulgaris* of the invention is suitable for any animal including a human. However, in a preferred embodiment the animal is a companion animal or a human. By companion animal it is meant any animal that is kept as a pet, which includes a cat, a dog, a horse, a rabbit, or a guinea pig. Preferably, the composition is for a cat or a dog or a human.

The skilled person understands that other names are used to refer to *Alchemilla vulgaris* .

The *Alchemilla vulgaris* of the invention can be the whole plant or a part thereof. It may be the root, bark, stem, leaf or any combination thereof. The *Alchemilla vulgaris* may be dried, crushed, ground or shredded. Preferably, the *Alchemilla vulgaris* is *Alchemilla vulgaris* bark.

Additionally or alternatively an extract of *Alchemilla vulgaris* may be used. Suitable extracts include a methanol extract, ethanol extract, a chloroform extract or a water extract.

A second aspect of the invention provides an oral composition comprising *Alchemilla vulgaris* .

The *Alchemilla vulgaris* may comprise between 0.1%-20% by weight of the composition, more preferably 1-15% by weight, more preferably 3-10% by weight, or 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10% by weight. Most preferably, the *Alchemilla vulgaris* comprises about 3% by weight of the composition.

The composition may comprise *Alchemilla vulgaris* as the only active ingredient with respect to the improvement or maintenance of oral health. Alternatively, the composition may comprise *Alchemilla vulgaris* as part of a cocktail including one or more further oral health improving or maintaining, or plaque reducing or controlling components.

Hereinafter in this text, the term "oral composition" covers all compositions that come into contact wuth the oral cavitiy, preferably the surface of a tooth of an animal, including a foodstuff, diet and supplement. Any of these forms may be solid, semi-solid or liquid. The composition may be a paste or a gel.

The composition may be in the form of a supplement to be added to any foodstuff that does not contain sufficient levels of *Alchemilla vulgaris* to improve or maintain oral health including prevention or treatment of gingivitis, or to control or reduce dental plaque in an animal, by way of reduction or inhibition of disease causing factors and/or biomass in the plaque.

The concentration of *Alchemilla vulgaris* in the supplement may be used in addition to the animal's main diet or foodstuff. This can be done by including a quantity of the supplement with the animal's diet or by additionally feeding the animal a quantity of the supplement. The supplement can be formed as a foodstuff with extremely high levels of the *Alchemilla vulgaris* composition of the invention, which requires dilution before feeding to the animal. The supplement may be in any form, including

solid (e.g. a powder), semi-solid (e.g. a food-like consistency/gel), a liquid, a paste or alternatively, it may be in the form of a tablet or capsule. The liquid can conveniently be mixed in with the food or fed directly to the animal, for example via a spoon or via a pipette-like device. The supplement may be high in one or more components of the invention or may be in the form of a combined pack of at least two parts, each part containing the required level of one or more component.

Preferably the *Alchemilla vulgaris* or a composition comprising *Alchemilla vulgaris* is incorporated into a commercial petfood product composition or a commercial dietary supplement composition. The petfood product may be a dry, semi-dry, a moist or a liquid (drink) product. Moist products include food which is sold in tins or foil containers and has a moisture content of 70 to 90%. Dry products include food which have a similar composition, but with 5 to 15% moisture and presented as biscuit-like kibbles. When the composition comprises a diet, foodstuff or supplement, it is preferably packaged. In this way the consumer is able to identify, from the packaging, the ingredients in the food and identify that it is suitable for the animal in question. The packaging may be metal (usually in the form of a tin or flexifoil), plastic, paper or card. The amount of moisture in any product may influence the type of packaging which can be used or is required.

The composition according to the present invention encompasses any product which an animal may consume in its diet. Thus, the invention covers standard food products for humans or other animals, as well as pet food snacks (for example snack bars, biscuits and sweet products). The composition may be a cooked product. It may incorporate meat or animal derived material (such as beef, chicken, turkey, lamb, blood plasma, marrowbone etc, or two or more thereof). The composition alternatively may be meat free (preferably including a meat substitute such as soya, maize gluten or a soya product) in order to provide a protein source. The composition may contain additional protein sources such as soya protein concentrate, milk proteins, gluten etc. The composition may also contain a starch source such as one or more grains (e.g. wheat, corn, rice, oats, barely etc) or may be starch free. A typical dry commercial dog and cat food contains about 30% crude protein, about 10-20% fat

and the remainder being carbohydrate, including dietary fibre and ash. A typical wet, or moist product contains (on a dry matter basis) about 40% fat, 50% protein and the remainder being fibre and ash. The composition of the present invention is particularly relevant for a foodstuff as herein described which is sold as a diet, foodstuff or supplement for a cat, a dog or any other companion animal or a human.

In the present text the terms "domestic" dog and "domestic" cat mean dogs and cats, in particular *Felis domesticus* and *Canis domesticus.*

The composition may be applied to or incorporated within a chew or treat which the animal may consume in addition to a main meal foodstuff. The composition may be provided as a coating on or incorporated within a main meal foodstuff.

Alternatively, the composition may be a liquid, gel, paste or the like which may be applied as a coating to a non-consumable product, such as a toy for an animal. The composition may be incorporated within the product. When the animal chews the toy, the composition comes into contact with some or all of the oral cavity of the animal and improves or maintains the oral health of the animal.

When the composition is incorporated within or coated onto a chewy or hard product, the additional benefit of improving or maintaining the oral health of the animal by removing plaque through the mechanical action of the product against the teeth of the animal is achieved, as well as by the action of the *Alchemilla vulgaris* in the composition.

The inhibition of certain plaque biofilm forming bacteria by *Alchemilla vulgaris* results in the control or reduction of dental plaque in an animal by the reduction of the bacterial content of the dental plaque.

The composition may be used for an animal with any level of oral health in order to improve or maintain oral health in the animal.

The composition may be used for an animal with good or acceptable oral health in order to maintain oral health. The composition in this case may control dental plaque formation and minimise the destructive effects of certain plaque bacteria on the periodontal health of the animal.

Alternatively, the composition may be used for an animal with poor oral health in order to improve the oral health of the animal. The improvement of oral health may be by way of the control of the further accumulation of dental plaque and slow the progression of the disease into the severest stages. It may also reduce dental plaque already present on the surface of the teeth of the animal. In cases of moderate to severe periodontal disease, the animal may require veterinary and/or dental attention prior to using the composition in order to achieve oral health benefits and reduce the frequency of future veterinary and/or dental intervention.

The composition is an oral composition. By oral composition it is meant that during use the oral cavity of the animal is exposed to the composition, and preferably the composition has direct contact with the surface of a tooth of the animal. Most preferably, the surface of a tooth is directly contacted with the *Alchemilla vulgaris* of the composition.

Such an oral composition can include toothpaste, mouthwash or any other such gel, liquid or paste. The oral composition may be a foodstuff, as previously defined.

A third aspect of the invention provides the use of *Alchemilla vulgaris* in the manufacture of a composition for the improvement or maintenance of oral health in an animal. Preferably, the oral health is improved or maintained by the control or reduction of dental plaque in the animal including reduction and/or inhibition of disease causing factors, biomass or pathogenic bacteria. The use of *Alchemilla vulgaris* in the manufacture of a composition for the prevention or treatment of gingivitis is also provided.

The invention, as a fourth aspect, also provides a method for the improvement or maintenance of oral health in an animal comprising administering to the animal *Alchemilla vulgaris* or a composition of the second aspect. Preferably, the method improves or maintains the oral health of the animal by the reduction or control of dental plaque in the animal, as previously defined.

In the method of the fourth aspect, the oral cavity of the animal is exposed to the composition, by way of consumption of the composition through its inclusion in a foodstuff, or by way of a coating comprising the composition on a toy which the animal chews.

Preferably, the method is for use in an animal susceptible to poor oral health or dental plaque, gingivitis or periodontal disease.

The composition may be administered to an animal with poor oral health to reduce the amount of dental plaque or factors contained therein, and then continued feedings may be carried out to control, reduce or inhibit the formation of further dental plaque or any one or more of the factors contained therein. The animal may require veterinary and/or dental treatment before or during use of the composition to remove calculus deposits in order to see a beneficial effect of the *Alchemilla vulgaris* or the composition.

By poor oral health is meant the presence of a number of indicators of this status including calculus and plaque accumulation, gingivitis, oral malodour, presence of gingival recession and/or periodontal pockets, as will be appreciated by the skilled person.

All features of each aspect of the invention relate to all other aspects *mutatis mutandis,* as appreciated by the skilled person.

The invention will now be described with reference to the following non-limiting examples and figure, in which:

Figure 1 shows the effect of *Alchemilla vulgaris* on *Peptostreptococcus stomatis* colonies cultured from treated single species biofilms expressed as a percentage of untreated controls. Untreated CFU (100%) = 1.34 x 10^7.

EXAMPLES

Alchemilla vulgaris was tested for its ability to control or reduce dental plaque in an animal by way of the following *in vitro* experiments. Supragingival plaque was obtained from cats and various assays were carried out, as described below, to determine whether *Alchemilla vulgaris* has the ability to improve or maintain oral health in an animal.

Example 1

Initial assays were set up to help determine whether *Alchemilla vulgaris* would be suitable for use in an animal for improving or maintaining oral health.

These assays included ability to inhibit adhesion of plaque forming bacterial strains and ability to inhibit protease production in such bacterial strains.

Alchemilla vulgaris inhibited adhesion of biofilm forming bacterial strains by up to 100% and protease production by up to 66%. *Alchemilla vulgaris* also showed inhibition of haemolysis in 2 out of 8 bacterial strains tested.

These results indicated that *Alchemilla vulgaris* is able to inhibit undesirable oral bacteria and therefore it was tested in further assays for its ability to improve or maintain oral health.

Example 2

Assay inoculum: plaque and saliva sampling from dogs

The assay requires fresh supragingival feline dental plaque and saliva for inoculation. The inoculum consists of pooled dental plaque and unfiltered saliva sampled from a group of 18 cats, varying in age, breed and oral health status.

The plaque and saliva were resuspended in artificial saliva to form the inoculum of approximately 10% plaque and 30% saliva.

Assay set-up

The plate biofilm assay (PBA) utilises a 24 well plate format in which biofilms, representative of feline dental plaque, are grown on hydroxyapatite (HA) discs. Prior to being introduced to the 24 well assay plate, each HA disc is preconditioned for 2 hours in a solution of 50% filter sterilised feline saliva in artificial feline saliva. The preconditioning step stimulates the formation of a salivary pellicle on the HA disc surface. Following preconditioning, each HA disc is placed individually into a well on the 24 well plate. The inoculum is divided into two equal aliquots and the active added to one aliquot at the appropriate concentration. The other aliquot represents the control (no active). A 1ml inoculum is added to each well and the assay plate incubated aerobically with shaking at 38°C for 48 hours. After 24 hours and 30 hours, the discs are transferred into fresh artificial saliva containing the active at the appropriate concentration as before. Biofilm-covered HA discs are removed from the assay plate for analysis after 48 hours. Each HA disc, with the exception of those being used for biomass quantification, is placed into 500µl PBS and vortex mixed for 30 seconds to remove biofilm growth from the disc into solution. Biofilm suspensions are then used for analysis. Biofilm-covered HA discs that are being used for biomass quantification are removed from the 24 well assay plate and used directly in the crystal violet assay.

Example 3

Alchemilla vulgaris extracts tested in the PBA

The extract of *Alchemilla vulgaris* used was a methanol extract (M) for testing in the feline PBA since this showed good activity in the initial screening rounds Extractions were performed as described previously.

In addition, chlorhexidine (Lloyds Pharmacy) was included as the gold standard reference or positive control. However, chlorhexidine is undesirable for use in animal compositions since it is a synthetic chemical and may have potential toxic effects as it is a chemical used in its purest form.

Example 4

Biofilm measures

The following analyses were used to assess the biofilms produced in the feline PBA and the effects of *Alchemilla vulgaris* and the non-botanical compounds on biofilm development:

Biomass quantification (crystal violet assay)

Protease activity

Bacterial viable counts

A brief description of each biofilm measure is given below.

Biomass

The total amount of biofilm grown on the HA discs was quantified using the crystal violet staining method. Biomass was represented as being directly proportional to the OD reading at 595nm (OD_{595}) of the samples compared to controls. Results were expressed as the reduction in OD_{595} seen in active-treated samples compared to no active controls, reflecting the effect of the active treatment on the amount of biofilm growth on the disc.

Alchemilla vulgaris reduced biomass by 85.6%.

Protease activity

Trypsin-like protease activity was measured using the liquid BAPNA assay, a colourimetric assay in which the amount of trypsin present in a sample is directly proportional to the intensity of the colour developed. Samples were quantified against

a trypsin standard curve and results expressed as the percentage inhibition of protease activity in active-treated samples compared to controls.

Alchemilla vulgaris reduced protease production by 100%.

Bacterial counts

Viable numbers of bacteria were quantified using Columbia blood agar plates supplemented with haemin and menadione. Aerobes were counted after incubation for 2 days and anaerobes, including black pigmenting colonies (BPC), were counted after incubation at appropriate conditions for 9 days. Plate counts are expressed as colony forming units (cfu) per ml and differences between control and active plates are expressed in logs.

Alchemilla vulgaris reduced plate counts of black pigmenting colonies by 5.9 logs, compared to the controls.

Example 5

Statistical analysis of data

Each sample was repeated 5 times within the assay. Unless otherwise stated, all extracts were tested in the assay at a concentration of 500 μg/ml. For each sample, all of the values obtained were logged and the means calculated from the log values.

A 2-tailed t-test with unequal variance was then performed. An unequal variance analysis was selected as the individual analyses were independent i.e. the measures were not comparable to one another. For each data set, p values were obtained and these gave an indication of the reproducibility of the data.

Results

A table summarising how *Alchemilla vulgaris* performed in the tests is set out below. Aerobes, anaerobes and black pigmenting colonies (BPC) are expressed as log reductions and protease and biomass are expressed as percentage reductions.

Name	**Aerobe** (Log 10 reduction)	**Anaerobe** (Log 10 reduction)	**BPC** (Log 10 reduction)	**Protease** (% reduction)	**Biomass** (% reduction)
Chlorhexidine	1.91	2.16	4.86	90.0	79.0
Alchemilla vulgaris	1.33	0.87	5.90	100	85.6
Uncaria tomentosa	0.48	0.12	0.23	100	78.1
Camellia sinensis	0	0	0.27	23.0	17.0

Table 1

Alchemilla vulgaris had a significant inhibitory effect on black pigmenting colony counts, protease production and biomass.

Camellia sinensis is well known in the art to have a strong effect on human plaque bacteria. It can be seen from the results above that *Alchemilla vulgaris* is more effective at inhibiting plaque bacteria in feline plaque than *Camellia sinensis*, and thus provides a surprising new botanical ingredient for use in the maintenance or improvement of oral health in an animal.

Example 6

Testing of raw material

The raw plant material of *Alchemilla vulgaris* was also tested in the Plate Biofilm Assay, as well as the extracts described above. The raw plant material was prepared through a 250μm pore size sieve and was tested at 5000μg/ml in the assay. The raw material was also effective at inhibiting the biofilm and reduced biomass by up to 83.8%, and protease by up to 82.4%.

Example 7

Inhibition of human plaque isolates

Alchemilla vulgaris powder was also tested for inhibition of biofilm formation in a human form of the Plate Biofilm Assay using an organism *Peptostreptococcus stomatis* commonly found in human plaque. The final concentration of each agent was 250 μg/ml. Tests were repeated five times in separate assays.

Hydroxyapatite discs were incubated in 20% sterile pooled human saliva for 2 hours at room temperature before inoculation with *Peptostreptococcus stomatis* in artificial saliva (Pratten *et al.*, 1998). Biofilms were cultured for 24 hours at 37°C in anaerobic conditions (10% H_2, 10% CO_2, 80% N_2), mimicking the conditions found in the sub-gingival recesses during the onset and progression of periodontitis.

Biofilms were dispersed, serially diluted and plated onto columbia blood agar containing hemin and menadione (5mg/l) before incubation under anaerobic conditions. Colonies were counted after 24 hours growth at 37°C.

As can be seen in Figure 1, treatment of the biofilms with *Alchemilla vulgaris* reduced bacterial numbers in *Peptostreptococcus* biofilms compared to both untreated controls and those treated with eucalyptus leaf powder a commonly used natural botanical in oral health applications.

Example 8

Various product applications will require survival of the raw material activity following exposure to temperatures up to 120°C. To test this, the *Alchemilla vulgaris*

was heated to 120°C for 10 minutes and its activity tested in the Plate Biofilm Assay compared with non heat-treated controls.

Heat treatment of *Alchemilla vulgaris*, as described above, does not affect its performance. Heat-treated *Alchemilla vulgaris* reduces biomass by 66.2%, compared to 45.2% in the unheated control. Protease production is inhibited by 100% by both the heat-treated and non-heated material.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Use of *Alchemilla vulgaris* in the treatment of gingivitis in a cat or a dog.

2. The use of *Alchemilla vulgaris* according to claim 1, wherein the *Alchemilla vulgaris* alters the bacterial content of dental plaque in the oral cavity of the animal.

3. The use of *Alchemilla vulgaris* according to claim 1 or claim 2, wherein the *Alchemilla vulgaris* reduces or inhibits at least one of inflammatory proteases or pathogenic bacteria in dental plaque.

4. The use of *Alchemilla vulgaris* according to claim 3, wherein the pathogenic bacteria include black pigmenting anaerobes.

5. The use of *Alchemilla vulgaris* according to claim 3, wherein the pathogenic bacteria include *Peptostreptococcus.*

6. An oral composition comprising *Alchemilla vulgaris* when used in the treatment of gingivitis according to any one of claims 1 to 5.

7. The composition according to claim 6, wherein the *Alchemilla vulgaris* is present at a concentration of from 0.1% to 20% by weight of the composition.

8. The composition according to claim 6 or claim 7, wherein the composition is a foodstuff.

9. The use of *Alchemilla vulgaris* in the manufacture of a composition for the treatment of gingivitis in a cat or a dog.

10. A method for treating gingivitis in a cat or a dog, the method comprising administering to the cat or dog in need of said treatment, an effective amount of an oral composition comprising *Alchemilla vulgaris.*

11. The method according to claim 10, wherein the *Alchemilla vulgaris* alters the bacterial content of dental plaque in the oral cavity of the animal.

12. The method according to claim 11, wherein the *Alchemilla vulgaris* reduces or inhibits at least one of inflammatory proteases or pathogenic bacteria in dental plaque.

13. The method according to claim 12, wherein the pathogenic bacteria include black pigmenting anaerobes.

14. The method according to claim 13, wherein the pathogenic bacteria include *Peptostreptococcus.*

15. The use of *Alchemilla vulgar*is according to claim 1, substantially as hereinbefore described with reference to the Examples.

MARS, INCORPORATED

WATERMARK PATENT AND TRADE MARKS ATTORNEYS

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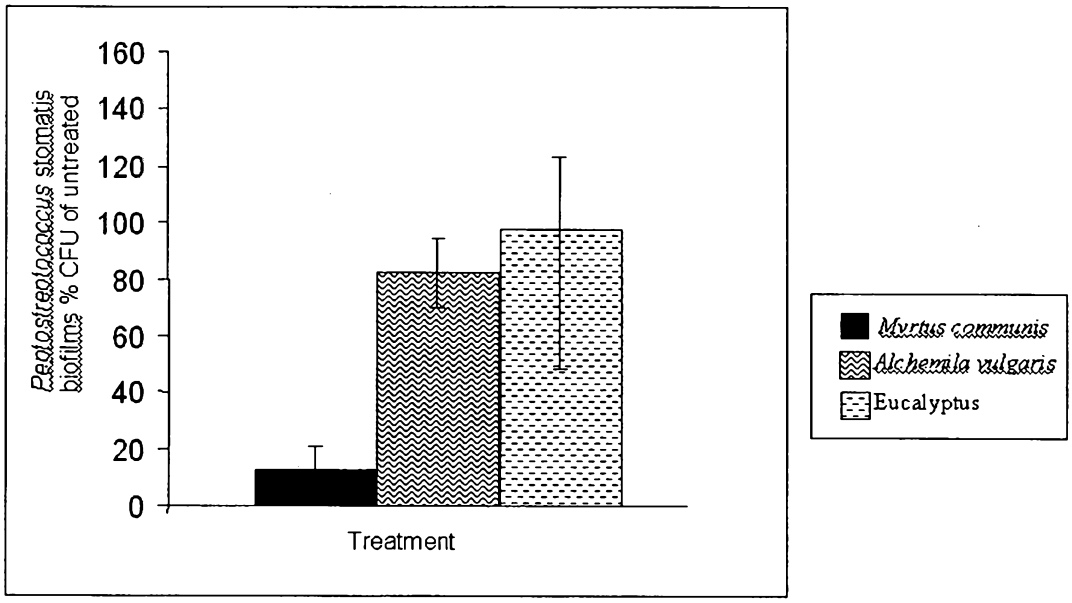
FIGURE 1


Pectostreptococcus stomatis biofilms % CFU of untreated
160
140
120
100
80
60
40
20
0
Treatment
Myrtus communis
Alchemila vulgaris
Eucalyptus