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Research Paper

Herbal toothpaste-A possible remedy for oral cancer

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ABSTRACT

Toothpaste is a paste or gel dentifrice used with a toothbrush as an accessory to clean and maintain the aesthetics and health of our teeth promoting oral hygiene. Now a day we use commercial toothpaste which contains many chemical compounds like sodium lauryl sulfate, which is harmful to our gum. We have developed some common food materials and waste materials which can replace these harmful or costly chemicals like citric acid, coloring agents and preservatives making our toothpaste economically more viable than commercial toothpastes. The developed toothpaste contains natural ingredients and waste materials like baking soda(teeth whitener), egg shell powder (ca^{+2} source), clove oil (sensitivity), glycerin (preservative), lemon peel (substitute for citric acid), orange peel, banana peel (substitute for iron) etc. Microbial and sensory tests have been done with our developed product. Recent researches shows Vitamin C can kill cancer cells acting as a per-oxidant, if dosed in proper amount which is found in fruit peels and some herbs which are abundant. We aimed to develop the toothpaste that can destroy cancer cells inside our mouth. Apart from making the toothpaste that cures all problems of teeth and mouth, our other objective of this project to find the proper dosage of vitamin C which when taken orally along with the toothpaste, can identify and destroy the cancer cells. Here no chemical preservatives are added; instead glycerin and common salt are added as natural preservatives. This toothpaste can cure various diseases of teeth like Gingivitis, tooth decay, cavity, gum bleeding, bad breath and dental-caries as well as it has anti-smoking and anti-cancer properties.

Keywords: Oral hygiene; Economically viable; Waste materials; Vitamin C; Oral cancer.

INTRODUCTION

Toothpaste protects, cleans and polishes teeth. It makes oral hygiene more efficient. It has a fresh taste and smell, and freshen the breath. Brushing twice a day with toothpaste is essential to maintaining a healthy mouth. Some or all of the following may be included in the same toothpaste:

(a) Plaque and calculus reducing agents (b) Anti-bacterial substances (c) Fluoride

(d) Breath fresheners (e) Desensitizing agents (f) Abrasives (g) Whitening ingredients

Desensitizing agents make the dentine in a tooth less sensitive to hot and cold, and to sweet flavors. Anti-bacterial agents help to prevent the formation and build-up of bacteria and plaque, which cause decay and gum disease. Plaque is the main cause of gum disease and tooth decay. Plaque can harden into tartar or calculus, which can only be removed by

a dentist. An anti-calculus agent may help to prevent plaque from hardening on the teeth. Abrasives are used to remove stains from teeth and make them look whiter and cleaner. Toothpastes that are designed for smokers with nicotine-stained teeth usually contain abrasives. Diseases of teeth include Gingivitis, Tooth decay, Gum bleeding, yellow teeth, Bad breadth, Dental caries, etc.

Basis of our research: Most brand-name commercial toothpastes contains a number of ingredients that are not healthy for us or the environment.

Bleach and peroxide are commonly used as whitening agents in commercial toothpastes. But both bleach and peroxide can be an irritant to the mouth and skin in small doses, and are considered to be hazardous materials because they can cause severe chemical burns in large doses. *Artificial flavorings and scents* are commonly made from synthetic chemicals derived from petrochemicals or coal tar. Manufacturers argue that artificial flavors are safer than natural flavors because their composition is standardized and regulated. But do you really think that consuming anything made from crude oil is safe for you and your family?

Commercial toothpaste ingredients also affect the environment. *EDTA (ethylene diamine tetra acetic acid)* and formaldehyde are commonly used a preservatives in toothpaste, and many other cosmetics and personal care products. They are known environmental pollutants. *Triclosan* is used in toothpaste for bacteria and tartar control. The problem is that it can combine with other materials to create dioxins, which are dangerous pollutants. *Sodium Lauryl Sulfate (SLS)* is used as a detergent and helps make the toothpaste foam. It is a known skin irritant and some people are very allergic to this chemical. SLS is believed to cause or aggravate canker sores in those prone to such irritations. Foam comes from Sodium Lauryl Sulfate, clinically proven to irritate the mucosa of the mouth. Its ability to break and attract dirt in the mouth also means it will attract dirt onto itself on the teeth if the mouth is not thoroughly rinsed – which is usually the case, i.e. that the mouth is not thoroughly rinsed. A report published in the Journal of *The American College of Toxicology* in 1983 showed that concentrations as low as 0.5% could cause irritation and concentrations of 10-30% caused skin corrosion and severe irritation. SLS is also absorbed into the body from skin inside mouth. Once it has been absorbed, one of the main effects of sodium lauryl sulfate is to mimic the activity of the hormone Estrogen. This has many health implications and may be responsible for a variety of health problems from PMS and Menopausal symptoms to dropping male fertility and increasing female cancers such as breast cancer, where estrogen levels are known to be involved. Sodium lauryl sulfate also dissolves the oils on your skin, which can cause a drying effect. It is also well documented that it denatures skin proteins, which causes not only irritation, but also allows environmental contaminants easier access to the lower, sensitive layers of the skin. Saliva is rich in oxygen, and without it, the mouth becomes anaerobic, which is a perfect environment for anaerobic bacteria, which produce sulfur as a waste product. When these bacteria find an environment in which they can thrive, the amount of sulfur in your mouth rises, making your breath smell bad and causing an unpleasant taste. Stopping use of toothpastes containing SLS can also help you end this problem. Without SLS, your toothpaste may be less foamy, but your mouth will be healthier. SLS is too harsh a surfactant and detergent to be allowed to come into contact with such delicate tissue as the lining of your mouth. One of the most common ways *fluoride* is made is by filtering airborne industrial waste given off by fertilizer producers.

Till our knowledge, our product is first of its kind especially for the utilization of the wastes for preparation our product and possibility of curing oral cancer. This type of work is reported first time here.

Our aim of work is to make toothpaste purely of natural ingredients which doesn't contain any chemical compounds or artificial colors, sweeteners, preservatives that may harm to our tooth as well as buccal cavity. So we have made the toothpaste purely of

herbs and herbal extracts. We have extracted colors from herbal ingredients. The details of the herbs we used will be discussed later. The toothpaste won't be harmful to children also.

Utilization of waste materials (Reducing the production cost of the toothpaste): One of the prime focuses of our project is to make our toothpaste economically viable and cheaply available to everyone. So, we have developed the toothpaste using waste materials like peels, leaves, seeds as an active ingredient for our toothpaste. We have used egg shell powder as supplement for $CaCO_3$.We have checked their properties and only those waste materials that have certain properties that are helpful for our mouth and teeth are used.

Cure almost all the problems of teeth: There are several problems of teeth like gingivitis, tooth decay, cavity, dental caries, cankers, etc. These problems of teeth occur due to accumulation of several germs and bacterial accumulation inside our teeth due to unhygienic oral awareness. In older days, only old people had to go to dentists, but a recent survey showed that the maximum percent of teeth disease cases has been reported on children than old people. The bacterial strains mainly found inside our mouth is *streptococcus mutans*. *Streptococcus mutans* is a Gram-positive, facultative anaerobic bacterium commonly found in the human oral cavity and is a significant contributor to tooth decay. Early colonizers of the tooth surface are mainly *Neisseria sp*. and *streptococci*, including *S. mutans*. The growth and metabolism of these pioneer species changes local environmental conditions (e.g. Eh, pH, co aggregation and substrate availability), thereby enabling more fastidious organisms to further colonize after them, forming plaque. Along with *S. sobrinus*, *S. mutans* plays a major role in tooth decay, metabolizing sucrose to lactic acid using the enzyme Glucansucrase. The acidic environment created in the mouth by this process is what causes the highly mineralized tooth to be vulnerable to decay. *S. mutans* is one of a few specialized organisms equipped with receptors that improve adhesion to the surface of teeth. Sucrose is used by *S. mutans* to produce a sticky, extracellular, dextran-based polysaccharide that allows them to cohere to each other, forming plaque *S. mutans* produces dextran via the enzyme dextransucrase (a hexosyltransferase) using sucrose as a substrate in the following reaction:

$$n \text{ sucrose} \rightarrow (\text{glucose})_n + n \text{ fructose}$$

Sucrose is the only sugar *S. mutans* can use to form this sticky polysaccharide.

Conversely, many other sugars-glucose, fructose, and lactose-can be digested by *S. mutans*, but they produce lactic acid as an end product. It is the combination of plaque and acid that leads to dental decay. Due to the role the *S. mutans* plays in tooth decay, there have been many attempts to make a vaccine for the organism. So far, such vaccines have not been successful in humans. Thus we developed the toothpaste and experimented on mouth swab and successfully inhibited the growth by our toothpaste.

Can be used for sensitive of teeth: Nowadays, many people suffer from sensitivity of teeth. We have taken that into account and made our toothpaste such that the paste goes to the open roots of the teeth and heal it as well as reduce the pain.

Can be used as a mouth freshener: The toothpaste is prepared in such a way that it can be used as a mouth freshener. The person using the toothpaste can have a cooling, fresh feeling after brushing the teeth with our toothpaste.

Can prevent smoking and boost energy: Smoking is bad for health. It is one of the prime causes for oral cancers. Besides, several other diseases of teeth are caused by smoking. A smoker knows that well, but cannot give up habit of taking nicotine. We have added certain herbs (discussed later) that has anti-nicotinic properties and using our toothpaste over a period of time will lower the urge for nicotine and slowly diminishing the habit. We have also added certain energy boosting herbs that will enhance the oral hygiene.

Cure Oral Cancer: Once, the primary objective is accomplished, we will experiment to develop the toothpaste to prevent as well as cure cancer by destroying the cancer cells. Every person must brush their teeth twice a day. So we theorized that if the person has cancer in oral cavity (pallet, gums, tongue, etc.) and brushes his teeth regularly with our toothpaste, then while brushing, our paste will come in contact the affected cancer areas and the chemicals from the herbs get diffused within the membrane and it will help destroying the cancer cells. There is no definite cure of cancer till now. But the herbs in this toothpaste contain several chemicals like *adaptogen, apigenin* which is proved to induce the apoptosis (programmed cell death) of cancer cell and also inhibits the growth of cancer cell in our buccal cavity. These also inhibit the formation of new blood vessels that feed malignant tumor cells in mouth. These chemicals have huge anti-cancer property which is very helpful to cure oral cancer. According to latest research, high dose of vitamin C, acting as a per-oxidant, can destroy cancer cells without destroying the normal cells. We have given several herbs containing rich amount of vitamin C and herbs already proved to have cancer curing properties. So, our main objective is to find the proper dose of vitamin C which when taken can destroy cancer cells. This idea is purely ours and once we find the proper amount of herbs (dosage of vitamin c), our toothpaste will be one of the few toothpastes that can cure oral cancer. As our toothpaste will contain high amount of vitamin C, it will reduce the chance of a person having oral cancer. Thus, we are aiming to make toothpaste that can prevent as well as cure oral cancer as well as can be economically viable to common people.

Upgradation of Quality of Rural Livelihood: India is a developing country in the 21st century, yet a large mass of people leads a rural livelihood. A large section of these people are addicted to tobacco and other products that are harmful for their mouth**.** They don't brush regularly and even if they brush, they do it with plant twigs, which are also harmful for their mouth and teeth as the twigs are not entirely germ free and may contain several harmful chemicals. Another important aspect is their addiction towards tobacco. Tobacco is the only companion during their leisure time which may cause oral cancer, ulcers, toothache, premature falling of teeth, bad breadth and several other problems of teeth. We have prepared a toothpaste form 32 kinds of herbs including fruit peels and other agricultural wastes, which are abundant in the rural civilization. Due to the immense availability of the herbs found everywhere, our toothpaste will be cheaper than other herbal toothpaste (not to mention about commercial toothpastes which contains SLS, fluoride and other costly chemicals).Due to its less cost even the rural people can even afford it. Moreover, they can even prepare the toothpaste by themselves once the proper amount is told to them, as the herbs, waste products we used are found in abundant even at rural areas. Thus, we can reduce the oral cancer risks which are more frequent in rural areas. Thus our toothpaste will eventually be helpful to them as they can use the toothpaste which has anti-bacterial, anti-nicotine, anti-oxidant, and anti-inflammatory and several other properties, besides preventing and curing cancer. All the herbs given will produce a synergistic effect for our toothpaste.

MATERIALS AND METHODS

Ingredients used in our toothpaste: The ingredients that are used for preparation of our product are shown in table-1 and table-2.The proper choice of herbs and proper proportions of mixing is the most important part of our project.

Procedure for manufacturing of our toothpaste:

(1) The base ingredients (shown in table-1) are weighed in a digital balance.

(2) Herbs are procured considering the parts of it which has most effective properties.Table-1 and table-2 shows the herbs taken for experimentation.

(3) The herbs are then freed from any and all affected and infected parts.

(4) The plant parts are cleaned in running tap water for 10 minutes, and then they are cleaned in distilled water thoroughly for 10minutes to remove the traces foreign particles adhered to the plant body.
(5) The herbs are then completely dried in tray drier at 60^{o}C.
(6) Crushing and grinding of the herbs are done.
(7) The grinded herbs are then passed through sieve apparatus with very fine pore diameter to get the powdered form which can be easily mix in the base.
(8) Mixing with the base ingredients. Here we experimented by varying the proportion of each and every herb (from 30 herbs) and found right proportion* that can kill bacteria, as well as impart freshness.
(9) Packing of their toothpaste in air tight sealed containers is done. (From step 6 all the steps are followed in aseptic conditions within the laminar)
(*We cannot disclose the proportion as the research of our toothpaste on the cancer cells is still on progress and the proportion is under experimentation).

RESULTS

Analysis of the herbal toothpaste:
The analysis of the herbal toothpaste has been carried out by performing several tests-
(1) Microbial test: The microbial test has been carried out in two steps-Antibacterial tests, storage test.
(A) Antibacterial test: (done inside the laminar to prevent contamination):
(I) Antibacterial test was done in agar plate - one agar plate prepared with *B. subtilis* (for positive control), another agar plate was prepared with the mouth swab (taken from inside mouth after 24hours of brushing).The agar plate with *Bacillus subtilis* is taken as positive control. In both the plates bacterial colonies were observed to be grown after an incubation of 1 hour. Then a small amount of our herbal toothpaste was streaked in the middle of the agar plate. After 48 hour incubation it was found that a zone of inhibition formed around the applied toothpaste (in the middle) which indicated that our toothpaste could inhibit the growth of bacteria inside our mouth. Appropriate positive control (agar plate containing mouth flora: *Bacillus subtilis*) cultured using the spread plate technique and negative control (agar plate containing only nutrient agar) were plated in duplicate to determine the sources of contamination, if any, in the work and as a useful guide in identification of microbial colonies isolated from the mouth swab.
(II) Minimum inhibitory concentration test (MIC): Minimum inhibitory concentration test is also done to find the right amount of toothpaste that can destroy the bacteria grown inside our mouth.
***(B) Storage test (Kept in air tight container in room temp conditions)*:** The storage test of our herbal toothpaste is carried out throughout 6 months period. The toothpaste was stored for 6months in air tight container in our research laboratory conditions. Our herbal product is found to be fresh and proper after 6months.Color, taste, flavor and mouth feel remained the same. During this time, a periodic (2 months) bacterial test was done to check microbial contamination. No fungal or bacteria contamination was seen during this period.
(2) Physicochemical test: The physico chemical tests include testing the pH of our product was also performed which is shown in table-3. From the pH test it can be concluded that *our toothpaste was neither acidic nor basic* .So our experimental product is appropriate for the buccal cavity of our mouth.
***(3) Sensory test*:** The sensory test is done based on the *9 point hedonic scale* chart. Usually five tests have been carried out with the toothpastes we prepared which includes flavor, color, texture, taste and mouth feel test.
The numbering system is as follows:
1=highly unacceptable 5=neither acceptable nor rejectable 9 =highly Acceptable.

The numbers were judged and given by the teachers and students. We surveyed our 4 products (table-4) *on 15 persons*. The first product is based on the common ingredients of commercial toothpaste. The second product (PRODUCT B) is made of pure herbal ingredients with SLS added to make foam. We have then calculated the average (shown in table-5) to get the final review of our products.

At first, we had given products a, b and c and analyzed *product c* **(***herbal toothpaste***)** taking the points given by the people. There, the points on color, texture became less. So, for enhancing color we added red beet color and texture by sieving more minute particles of the ingredients we added and made the *product d* and tested and data are calculated.

(4) Cost Estimation and Feasibility of the Herbal Toothpaste in Market: The production cost of our product is given in table-6.The data from table-6 shows that:

The price of 32.5gm is Rs.11.60

So, the price of 100gm is Rs. 35.68/-

The price of 30gm commercial toothpaste in market is: Rs. 30/-

The price of our herbal toothpaste in market should be: Rs. 40/-(Taking all the production costs in account).

Cost estimation of our product considering industrial profits:

A .Capital cost:

Land cost= Rs. 15 lakh (approx.)

Shed cost= Rs. 2 lakh (approx.)

Machineries= Rs. 10 lakh (approx.)

Number of units produced per day = 1000

B. Variable cost:

Electricity bill= Rs.5000 (for production of 1000 units per day).

Labour cost= Rs.26, 600 (including skilled and unskilled laborers).

Raw material cost=Rs.36, 000(for 100kg/day).

Other production cost=Rs.2000 (packets for toothpaste, etc.).

***C. Depreciation time*=** 20 years.

D. Depreciation cost= Rs.360.

E. Rate of interest= 15%.

Therefore, considering all these factors the total cost of all the units will be Rs.70 per day.

So, Cost per unit will be Rs.80

DISCUSSION

Medical benefits of herbs used in our toothpaste:

Turmeric (Curcuma longa): Turmeric is currently being investigated for possible benefits in oral cancer (Lin, et al., 1997). A daily intake of turmeric about half a teaspoon reduces the possible growth of false DNA patterns and carcinogens that cause development of cancer.

Green tea (Camellia sinensis): The predominant polyphenols (a type of bioflavonoid) in green tea—EGCG, EGC, ECG, and EC have antioxidant activity. These chemicals, especially *EGCG (epigallocate chingallate)* and ECG, have substantial free radical scavenging activity and may protect cells from DNA damage caused by reactive oxygen species (Feng, et al., 2002). Tea polyphenols have also been shown to inhibit tumor cell proliferation and induce apoptosis in laboratory and animal studies (Tea and Cancer Prevention). Most studies of tea and cancer prevention have focused on green tea (Lambert, et al., 2003).

Echinacea (Echinacea sp.): Echinacea can cut the chances of catching a cold by more than half, and shorten the duration of a cold by an average of 1.4 days (Sachin, et. al., 2007). Echinacea flower sap is used for oral immune stimulation (Parnham, 1996).

Neem (Azadirachta indica): Neem leaf aqueous extract effectively suppresses oral squamous cell carcinoma induced by 7, 12-dimethylbenz[a] anthracene (DMBA), as

revealed by reduced incidence of neoplasm. Neem may exert its chemo preventive effect in the oral mucosa by modulation of glutathione and its metabolizing enzymes (Balasenthil, et al., 1999).

Aloe Vera (Aloe Vera): Aloe vera may be effective in treatment of gum wounds. Evidence on the effects of its sap on wound healing, some studies, for example, show that aloe vera promotes the rates of healing (Davis, et al., 1989***).***

Peppermint: Animal study has suggested that Peppermint may have radio protective effects in patients undergoing cancer treatment (Baliga, 2010*).*

Pudina leaf (Mentha spicata): Mint is used for dental care because of its germicidal and freshening properties. Anti-cancer properties: The phytonutrient, called *perillyl alcohol*, in mint has been shown in studies on animals to prevent the formation of skin, colon and lung cancer (www.lifemojo.com/lifestyle).

Nayantara (Catharanthus pussilus): This plant contains Vinca alkaloids which are anti-mitotic and anti-microtubule agents. They are now produced synthetically and used as drugs in cancer therapy and as immunosuppressive drugs (Takimoto, et al., 2008).

Choti elaichi (Elettaria cardamomum): It helps to produce a smoky flavor. It disinfects the oral cavity of the germs and drives away bad breath. Based on animal and in vitro study, cardamom has also been found to regulate inflammatory and immune activities and may be useful for cancer prevention (www.toddcaldecott.com).

Indian Ginseng (Withania somnifera) (queen of Ayurveda): Ginseng is noted for being an adaptogen, one which can, to a certain extent, be supported with reference to its anti-carcinogenic and antioxidant properties. Laboratory analysis indicates that ashwagandha extract possesses the anti-angiogenic activity, also known as the ability to prevent cancer from forming new blood vessels to support its' a unbridled growth add references. Ashwagandha is rich in phytochemicals such as, withananine, choline, trapino, and alkaloids. It is an anti-depressant**,** anti-oxidant and actually known for its anti-aging and longevity benefits. Ashwagandha is a single herb with anti-stress adaptogenic action that widely leads to better physical fitness and helps to cope with life's daily stress (Saeed, et al., 2007).

Liquorice: Curreli Francesca, et al.(2005) indicated that glycyrrhizin acid disrupts latent Kaposi sarcoma (as also demonstrated with other herpes virus infections in the active stage), exhibiting a strong anti-viral effect. Plant part used is root.

Gotukola (Centella asiatica): Centella is a mild adaptogen, is mildly antibacterial, antiviral, anti-inflammatory, anti ulcerogenic, anxiolytic, nervine and vulnerary, and can act as a cerebral tonic, a circulatory stimulant, and a diuretic (Bradwejn, et al., 2000; Winston, et al., 2007).

Cayenne Pepper (Capsicum annuum): It is used for spicy flavor. Cayenne pepper is high in vitamin A. It also contains vitamin B6, vitamin E, vitamin C, riboflavin, potassium and manganese (walsh-botanicals.weebly.com).

Black cumin seed (Nigella sativa): The chemical compound thymoquinone isolated from *N. sativa* seed oil blocks pancreatic cancer cell growth *in vitro* and kills the cells by enhancing the process of programmed cell death (apoptosis) acting as an HDAC inhibitor (www.parasitetesting.com). While the studies are in the early stages and no clinical study has started, the researchers speculated thymoquinone may eventually have some use as a preventative strategy in patients who have gone through surgery and chemotherapy or in individuals who are at a high risk of developing cancer.

Parsley (Petroselinum crispum): Apigenin, a chemical found in great quantities in parsley, has been found to have potent anti-cancer activity (walsh-botanicals.weebly.com). It works by inhibiting the formation of new blood vessels that feed a tumor. The methanolic extract of parsley is antimicrobial.

Tulsi (Ocimum tenuiflorum): Study showed its beneficial effect on blood glucose levels is due to its *antioxidant* properties (Sethi, et al., 2004). Tulsi also shows some promise for

protection from radiation poisoning and cataracts. It has anti-oxidant properties and can repair cells damaged by exposure to radiation.

Indian gooseberry (Phyllanthus emblica): Saeed et al. (2007) showed that it has anti-bacterial and anti-cancer properties, it is the richest source of vitamin C. It contains bioflavonoids, flavones, polyphenols and carotenoids. It is an anti-oxidant, immune-modulator, hypoglycemic, hypolipidemic, hypotensive. It inhibits aging process, boosts immunity and restores body's vitality, facilitates absorption of iron. Experimental preparations of leaves, bark or fruit have shown potential efficacy against laboratory models of disease, such as for inflammation, cancer, age-related renal disease, and diabetes (Ganju, et al, 2003; Rao, et al., 2005; Yokozawa, et al., 2007).

Valerian (Valeriana officinalis): The nut peels are used to reduce cough, determine the effect of Valeriana officinalis (Valerian) for improving the quality of sleep in patients with cancer receiving adjuvant therapy, determine the safety of this therapy, in terms of frequency and severity of adverse events, in these patients**.**

Carrot (Daucus carota): It is an antioxidant and prevents tonsillitis add references. It contains vitamin A and also contains a pigment called beta carotene which helps in reducing oral cancer (www.anagen.com/carrot.htm)**.**

Beet (Beeta vulgaris): It has been suggested the pigment molecule *betanin* in the root of red beets may protect against oxidative stress and has been used for this purpose in Europe for centuries (Carmen Socaciu, 2008).

Ajwain (Trachyspermum ammi): It is principally used in scientific cultures and commerce. Regular use of ajwain leaves seems to prevent kidney stone**.** This has been claimed to have a positive effect in the treatment of cancer.

Bay leaf (Laurus hobilis): Anti-inflammatory, anti-oxidant, anti-bacterial, anti-fungal, antiseptic, appetite stimulant, arthritis, astringent, bile flow stimulant, bronchitis, cancer, There is not enough scientific evidence to safely recommend bay leaf for use in adults. It has been used for toothache, oral hygiene, a digestive aid and an infection fighter (www.nutrition-and-you.com/bay-leaf.html).

Clove: Cloves are also said to be a natural anthelmintic (Balch, et al., 2000). The essential oil is used in aromatherapy when stimulation and warming are needed, especially for digestive problems**.** Topical application over the stomach or abdomen are said to warm the digestive tract. Clove oil, applied to a cavity in a decayed tooth, also relieves toothache (Alqareer, et al., 2006).

Lemon Peel: Contains high amount of vitamin C.

Orange Peel (Citrus sinensis): Contains high amount of vitamin C, phyto-chemical antioxidants, soluble and insoluble dietary fiber have been found to be helpful in reduction in the risk for cancers, many chronic diseases like arthritis, and from obesity and coronary heart diseases**.** Orange peel extract has pronounced cancer preventative activity. Based on studies, researchers have determined orange peel extract inhibits the way cancer cells divide and grow. In laboratory studies, orange peel extract prevented breast, skin, liver, lung, pancreatic, colon and stomach cancers (www.heartspring.net).

Banana Peel (Musa acuminate): Vitamin A and vitamin B, rich in banana has antioxidant, antacid properties, antioxidant phenolic compounds are also present**.** It disinfects the oral cavity of the germs and drives away bad breath. Based on animal and in vitro study, cardamom has also been found to regulate inflammatory and immune activities and may be useful for cancer prevention, Contains high amount of vitamin C and Iron.

Pumpkin Peel (Cucurbita maxima): Contains high amount of vitamin C. Pumpkin is found having high zinc content that is really good for the skin. Pumpkin is also found to be high in beta-carotene, vitamin A, and vitamin C. These two vitamins are believed to help diseases like heart diseases and cancer, and they are known as antioxidants. Moreover, antioxidants are known to fight free radicals (www.pumpkinpeels.com).

Mango Peel (Magnifera indica): Contains high amount of vitamin C. Mangiferin from the leaves has been reported to possess anti-inflammatory, diuretic, choleric and cardio tonic activities and displays a high antibacterial activity against gram positive bacteria. It has been recommended as a drug in preventing dental plaques.

Papaya Peel (Carica papaya): Contains high amount of vitamin C. Papaya has antibiotic, antifungal, antimicrobial, anti-inflammatory, abortifacient, pugative, and diuretic properties. It protects against macular degeneration, colon, cancer, prostate cancer, breast cancer, and other similar conditions as it is rich in antioxidants and compounds like isothiocyanate**.**

Jackfruit seeds: Contains Vitamin A, C and B. The seeds contain minerals like calcium, zinc and phosphorus that strengthen the teeth. They contain lignans, isoflavones, saponins that are called phytonutrients. They have anti-cancer, anti-hypersensitive, anti-oxidant, anti-cancer, anti-aging properties (www.fruitsinfo.com/Jackfruit.php).

Haritaki (Terminalia chebula)**:** Mild laxative, stomachic, tonic, adaptogenic, febrifuge, hepatoprotective, antispasmodic, expectorant, anti-asthmatic, antiviral, hypoglycaemic. The important active constituents are hydrolysable tannins, chebulagic acid, chebulinic acid and corilagin. Useful for hemorrhoids, dental carries, bleeding gums, ulcerated oral cavity. Its paste with water has purifying and healing capacity for wounds. It has a wide antifungal and antibacterial activity**.**It has some anti-tumor activity and effect in inhibiting HIV virus (Gupta, et al., 2010)**.**

Our toothpaste is perfectly suitable for use due to its neutral pH range. Antibacterial tests confirm that the toothpaste inhibits the growth of bacteria inside our mouth, which was collected with mouth swab. Besides storage test of the toothpaste suggests that it can be easily stored for 6 months inside an air-tight container. Sensory analysis helped to check the taste, colour, mouthfeel, texture, etc of our toothpaste. Cost estimation is also done to successfully check the economic feasibility. As our toothpaste is made of waste materials, its' cost become less. Thus the prepared toothpaste along with its medicinal properties, found to kill the germs in our teeth apart from imparting freshness feel and satisfactory taste and flavor. The clinical trials are yet to be done because we are currently working on our secondary objective i.e. destroying cancer cells thus curing oral cancer and yet to find the right proportion, besides we are facing problems of getting and maintaining cancer cells in laboratory conditions. Once we successfully destroy cancer cells in the laboratory, we will move to clinical trials. Thus the results confirm our first phase of our project of making herbal toothpaste which can destroy microbial flora inside our mouth and fight bad breadth, tooth decay, etc.

CONCLUSION

From the above results of our products activity, it can be concluded that the toothpaste is theoretically as well as experimentally serve the basic properties of general toothpaste with an advantage of having the medicinal properties of 32herbs which makes it unique in its category. From the microbial tests it is seen that the toothpaste can easily inhibit growth of bacteria, pH test shows that our product is within neutral range. Although our product lacks much of foam, it successfully whitens the teeth, kills germs, imparts freshness feel inside mouth.

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Table-1: Herbal ingredients used for formulation.

Base Ingredients	Utilization of waste	Herbs	Essential oil
Egg shell powder (Ca^{2+})	Lemon peel	Turmeric	Clove oil
Glycerin	Orange peel	Green Tea	Peppermint oil
Baking soda	Pumpkin peel	Pudina Leaf	
Lemon juice	Mango peel	Nayantara	
Common salt (NaCl)	Banana peel	Echinacea	
Saccharine	Papaya peel	Choti Elaichi	
	Jackfruit seed	Neem	
		Aloe Vera	
		Bay Leaf	
		Brahmi	

Table-2: Special herbs used having high value of specific medicinal property.

Herbs to boost energy	Herbs to cure cancer	Herbs to quit smoking
Indian ginseng	Nayantara	Avena sativa
Gotu kola	Parsley	Valerian
Fennel	Ashwagandha	Hyssop
Licorice root	Green tea	Haritaki
Cayenne	Indian gooseberry (amla)	Ginseng
Peppermint	Turmeric	Gotu kola
Ajwain	Black cumin seeds	
	Tulsi	

Table -3: pH test of our product.

Product type	Product A	Product B	Product C	Product D
pH	6	7.2	7.4	7.3

Table- 4: Formulation of our product.

Product A	Base ingredients + Sodium lauryl sulfate + Clove oil + Peppermint oil+ citric acid+$CaCO^3$
Product B	Base ingredients + Sodium lauryl sulfate + Clove oil + Peppermint oil + Herbs + Natural green color
Product C	Base ingredients + Clove oil + Peppermint oil + Herbs + Natural green color
Product D	Base ingredients + Clove oil + Peppermint oil + Herbs +Red beet color

Table-5: Final sensory test result of our product.

Attribute	Product A	Product B	Product C	Product D
Flavor	6.93	7.71	8.71	8.79
Colour	7.14	8.00	8.28	8.64
Texture	7.28	7.71	8.50	8.57
Taste	7.71	7.71	8.79	8.50
Mouth feel	7.43	8.29	8.71	8.71

Table -6: Production cost of our product (in laboratory).

INGREDIENTS	COSTS (in Rs.)
Total 32 Herbs	1.0212
Base Ingredients	10.577
Total	**11.60**

