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The majority of cosmetic oral care products are either in the form of a powder, paste or gel to facilitate tooth cleaning or as a liquid to freshen the mouth and rinse the teeth. Both types of product may claim to remove dental plaque, eliminate harmful microorganisms, brighten and whiten teeth and to stop bad breath. Ingredients recommended for these products are the focus of this feature.

People routinely brush their teeth with a toothbrush and a dentifrice to remove food particles and bacteria that accumulate in the mouth. Brushing regularly minimises problems like a build-up of plaque, cavities, gingivitis, caries, and bad breath. Dental plaque comprises a mass of microorganisms embedded in a polysaccharide matrix that adheres firmly to dental surfaces. It is removed only with difficulty and rapidly reforms on the tooth surface after removal. The formation of plaque on the teeth can eventually produce gingivitis, periodontitis and other types of periodontal disease, as well as dental caries and dental calculus.

Gingivitis is characterized by inflammation or infection of the gums and the alveolar bones that support the teeth. It is caused by bacteria in the mouth and particularly those involved in plaque formation. The plaque and bacterial toxins are believed to be the causative agents for oral tissue inflammation within the mouth. Periodontitis is a progressively worsened state of gingivitis and both are inflammatory disorders caused by interactions between oral pathogens and the host's immune response. Because of this most oral care products are aimed at eliminating the harmful bacteria that are fundamental to dental problems.

Triclosan and cetyl pyridinium chloride have long been used as antibacterial agents in oral care products but are now falling out of favour and alternatives are being sought, preferably of natural origin. **Cosphaderm** Magnolia Extract 98 consists of magnolol and honokiol with a purity of at least 98 %. It shows a strong pH-independent efficiency against Streptococcus mutans and Streptococcus oralis that are the principal cause of caries and against Actinobacillus Actinomycetemcomitans, Fusobacterium nucleatum and Porphyromonas gingivalis, the principal cause of periodontitis.

Eugenol is an active constituent of clove oil and Patent USP 9,2132,103 claims small amounts of eugenol in combination with thymol and terpineol has a synergistic activity and provides fast antimicrobial activity and allows a reduction in thymol and terpineol content. The composition also contains 1 - 5% by weight benzalkonium chloride, which may account for much of the improvement claimed. An oral composition wherein the essential oil is selected from a group consisting of clove oil, cinnamon oil, oregano oil, peppermint oil, sesame oil is described in Patent USP 9,554,986 and an abstract of this appears in this magazine. The patent also claims the essential oils used permit a probiotic blend of beneficial oral bacteria to survive.

The use of probiotics is popular in certain foodstuffs and there is now a growing trend in cosmetic products. The theory is that the human biome comprises a mixture of beneficial bacteria and that if these are allowed to flourish they inhibit the growth of harmful bacteria. An example promoted for skin care and to combat body odour and of possible interest for oral hygiene products is Probiulin FOS [INCI: Inulin, fructose] from **Gova.** This relatively new area of oral hygiene was described in detail with many references by Anna Haukioja in the European Journal of Dentistry [Ref 1].

Stay-C 50 from **DSM Nutritional Products** is a stable form of vitamin C [INCI: Sodium ascorbyl phosphate] and a presentation by DSM describes enhancing performance of oral care products with Stay-C 50. DSM maintains that Streptococcus mutansisis is the principal causative plaque bacterium for caries and Porphyromonas gingivalis and Actinobacillus actinomycetemcomitans are the causative bacteria for gingivitis and periodontitis. These causative bacteria are inactivated by the

addition of 0.1 – 0.5% Stay-C 50 to formulations at above pH 6.8 and in the presence of a chelating agent to avoid degradation by heavy metal ions. For a chelating agent with more consumer appeal that BHT consider phytic acid. Available as Dermofeel PA or the sodium salt as Dermofeel PA-3 from **Dr. Straetmans**, they are said to prevent staining in oral care applications.

Chitoglycan [INCI: Carboxymethyl chitosan] from **Sinerga** is a water-soluble chitosan derived from chitin and described as a filmogenic moisturising, protective and softening product specifically to be used against plaque in dental hygiene preparations. It is a very stable material within the pH range 4 – 7 and said to be effective against Candida albicans, Staphylococcus aureus, and streptococcus of the oral cavity. Its cosmetic activity is said to be similar to hyaluronic acid and **Principium** supplies sodium hyaluronate as PrincipHyal Auror and PrincipHyal Cube of different molecular weights and claims that used together, they help treat gingivitis.

Bioland supplies hyaluronic acid and has published the result of studies on hyaluronic acid and oral health. Dry mouth may be caused by stress or age and lack of saliva can lead to damage of the oral mucosa, virus infection and tooth decay. Hyaluronic acid has anti-inflammatory properties and can act as a substitute for saliva and help in tissue regeneration. Tests show that application of Hyaluronan hyaluronic acid reduced the occurrence of mouth ulcers, and significantly helped reduce plaque formation. In summary Bioland reported that hyaluronic acid contributes towards controlling inflammation and it increases the number of new blood vessels and helps oral wound healing through regeneration of epithelial cells.

CR&D claims its Glycohyal LW [INCI: Glycerin, hydrolyzed glycosaminoglycans, hyaluronic acid] prevents formation of mouth ulcers and some infections by protecting the mucous membrane with a thin film of hyaluronic acid. **CR&D** also provides Oliglycan [INCI: Glycerin, aqua, Tremella fuciformis extract, Lentinus edodes extract, zinc PCA, copper PCA] that contains bioavailable zinc, complexed with hydrolyzed glycosaminoglycans of vegetal origin. It is claimed to prevent tartar and plaque formation and to block the sulphur compounds characteristic of halitosis. Decreased microcirculation in the gums can also be a problem and CR&D suggest the inclusion of Nicoment [INCI: Menthyl nicotinate] in oral hygiene compositions to stimulate blood flow without gums irritation.

A tooth is comprised of an inner dentin layer and a hard protective outer enamel layer. The enamel layer is composed of hydroxyapatite mineral crystals that create a some-what porous surface. Each day dental enamel is demineralised by acids present in the mouth and re-mineralised by the calcium and phosphate ions carried in saliva. Under normal circumstances the dynamic balance between demineralisation and remineralisation is stable. This equilibrium results in healthy teeth which are not affected by caries, and are not eroded, decalcified or hyper-sensitive however, a decrease in saliva leads to a loss of mineralisation. **Kalichem** suggests that incorporating Kalident calcium hydroxyapatite in dental products and their use over an extended period can do much to alleviate problems caused by excessive demineralisation of dental enamel.

Besides any added active ingredients toothpastes essentially consist of a mild abrasive a humectant, a surfactant, a rheology modifier and flavouring.

Toothpaste abrasives are traditionally calcium carbonate, sodium bicarbonate, insoluble phosphates or silica, this latter being used for gel-type compositions. If looking for a natural material **Greentech** suggest the use of Greensil [INCI: Banbusa arundinacea stem extract]. Bamboo contains deposits of silica in the cell walls of the stem and after grinding these secretions, an extremely fine powder is obtained which can be substituted for all or part of the mineral content of a toothpaste. Activated

bamboo charcoal is suggested as a toothpaste abrasive by **CPS (Huzhou) Biotechnology** for those who don't mind their toothpaste being black!

Toothpastes do not have to be either white or black: **Sunjin** supplies a range of pigmented scrub agents for toothpaste that are 300 microns in diameter and based on carnauba wax. Special effects in toothpastes and mouthwashes are made possible by the addition of Flamenco Sparkle pigments from **BASF**. Cosmospheres from **Sprig Pharma** are coloured beads containing either menthol or methyl lactate to impart a fresh cooling effect when they burst in the mouth during the brushing process. Currently they are available in white, green. dark and light blue or black! **Salvona** suggests HydroSal Fresh Cool and SalCool to provide a sustained cooling effect. Although both contain menthyl lactate and ethyl menthane carboxamide they each are multi-component with different activities. FreshCool relies on its delivery system for long lasting freshness while SalCool is described as a neurocosmetic that provides the perception of freshness without physically dropping the temperature of the skin. Its ingredients act in a non-competitive manner on the different sensory nerve endings to extend the effect without users getting adapted to the sensation.

Cellulose and cellulose derivatives are popular rheology modifiers for toothpastes and Exilva Cellulose from **Borregaard** is described as a completely natural and sustainable cellulose-based performance enhancer. Exilva is pseudoplastic so it thins when shear is applied, such as squeezing from a toothpaste tube, but viscosity recovers immediately upon removal of the shear, so a toothpaste retains its ribbon shape on the brush. Exilva is available as a 2% suspension or a 10% paste and does not require hydration time.

Surfactants are added to toothpastes to help their disintegration during use, to foam in the mouth, and to aid cleaning. Sodium lauryl sulphate is the one most commonly used but others are of interest. **Ajinomoto** suggests Amisoft MS-11 [Sodium myristoyl glutamate], which is a mild surfactant with good foaming ability. It is from a natural source, is biodegradable, and when combined with silica, it removes tooth staining. Ajinomoto also markets CAE as an amino acid-based cationic surfactant [Ethyl cocoyl arginate] that has anti-bacterial properties.

For products making natural claims **BASF Care Creations** suggests two COSMOS approved surfactants; Plantacare 1200 UP [lauryl glucoside] and Plantapon ACG-HC [Sodium cocoyl glutamate]. Andean Q Ultra from **Desert King** is a purified natural aqueous extract of the Chilean soap bark tree, Quillaja saponaria, which works as a gentle foaming and cleansing agent and is of interest as the foaming agent in toothpastes and mouthwashes.

Many of the active ingredients and flavourings suggested for toothpaste are also found in mouth washes but to provide a clear solution with little or no use of alcohol an effective solubiliser is usually required. **Dr Straetmans** suggests Symbiosolv Clear and Symbiosolv XC to solubilise perfumes and flavourings. They are both PEG-free and their content of glycosides and sodium cocoyl glutamate also help the cleaning action of the final composition.

Finally, according to **Cornelius**, oil pulling is an alternative oral health care practice that consists of swishing or holding oils in the mouth for an extended period of time. Enthusiasts believe that oil pulling, also called Kavala Graha or Gandusha, will draw out impurities and toxins and wash them from the mouth. Cornelius states that its refined and organic grades of coconut and sesame oil are both suitable for oil pulling purposes.

Ref 1: Haukioja A. Probiotics and Oral Health. European Journal of Dentistry. 2010;4(3):348-355

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