

ORAL COMPOSITION

This invention relates to dextranase-containing oral compositions such as dentifrices, mouthwashes or the like, and more particularly, to such oral compositions capable of keeping dextranase effective and stable for a long period of time and providing a pleasant sensation during use.

It is well known in the art to incorporate dextranase in oral compositions such as dentifrices as an active ingredient for caries prophylaxis to prevent the formation of dental plaque. For examples, U.S. Patent Nos. 3,574,824, 3,622,661, 3,686,393, 3,751,561, 3,981,989, 3,991,177, 4,115,546, 4,140,758 and 4,150,113, British Patent Nos. 1,373,003 and 1,427,300, and German Patent No. 1,948,469 disclose dextranase-containing oral compositions.

Inconveniently, dextranase tends to be deactivated by moisture, anionic surfactants and other ingredients in oral compositions. A number of approaches were proposed to keep dextranase stable in oral compositions, but none of them could successfully stabilize dextranase particularly when the oral compositions were stored at elevated temperatures. There is the need for a method capable of keeping dextranase more stable in oral compositions.

Oral compositions such as dentifrices, because of their intended use in the mouth, should preferably taste good and provide high foaming properties to ensure a pleasant mouth feel. Furthermore, for dentifrices,

particularly toothpastes, it is desired that a creamy or gel mass be smoothly extrudable from a collapsible tube. Most masses tend to deteriorate in extrudability when aged for a long time at low temperatures. Smooth extrusion from a tube at low temperatures is thus one of the important requirements for dentifrices.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a dextranase-containing oral composition in which dextranase is kept stable for a long period of time.

Another object of the present invention is to provide a dextranase-containing oral composition giving a pleasant sensation during use.

Making extensive investigations to provide an oral composition capable of keeping dextranase stable for a long time and giving a pleasant sensation during use, the inventors have found that this object can be achieved by selecting a dextranase enzyme produced by a fungus of the genus *Chaetomium*, and combining with it a particular admixture of water-soluble salts of alkyl sulfates having restricted numbers of carbon atoms in the alkyl chain.

A number of organisms are known in the art which can produce dextranase enzymes, for example, organisms of *Penicillium* (Japanese Patent Publication No. 50-20154), *Flavobacterium* (Japanese Patent Publication No. 50-20155),

Helminthosporium (Japanese Patent Publication No. 47-34150),
Chaetomium (Japanese Patent Publication No. 46-42955),
Gibberella, Gloeosporium, and Glomerella (these three from
Japanese Patent Publication No. 47-50391), Fusarium
5 (Japanese Patent Publication No. 47-34149), Brevibacterium
(Japanese Patent Publication No. 47-37029), Paecilomyces
(Japanese Patent Publication No. 47-34148), Streptomyces
(Japanese Patent Publication No. 47-7345), Humichora,
Sporotrichum, Anixiella, and Acrosperum (these four from
10 Japanese Patent Publication No. 47-10033). Aspergillus,
Verticillium, Spicaria, Carpentelece and Talaromyces are
also known. Most of the dextranase enzymes produced by
these organisms are generally prone to deactivation in
anionic surfactant/water systems. Unexpectedly, the
15 inventors have found that if a dextranase enzyme produced
by the genus Chaetomium, one of fungi, is selected among
these dextranase enzymes, a mixture of water-soluble salts
of alkyl sulfates is selected as the anionic surfactant,
the mixture comprising those water-soluble salts of alkyl
20 sulfates having 10, 12, 14, and 16 carbon atoms in the alkyl
group in amounts of 0 - 20%, 50 - 80%, 10 - 30%, and 0 - 15%
(percents being by weight), respectively, and the
Chaetomium-produced dextranase together with the mixture
of the particular alkyl sulfate salts are blended in an
25 aqueous oral composition such as toothpastes, then the
above-mentioned Chaetomium-produced dextranase is not
significantly deactivated even at elevated temperatures

in the anionic surfactant/water systems, allowing the dextranase to be kept stable and active for a long time. It has also been found that the Chaetomium-produced dextranase has a higher activity than those dextranase enzymes produced by the other organisms. The combination of the present invention allows the dextranase to continuously exert its increased activity for a prolonged period of time. In addition, the thus prepared oral compositions are suitable for application in the mouth as they are excellent in taste, foaming property and mouth feel. Particularly, toothpastes containing the above-mentioned combination are stable at low temperatures and can be smoothly extruded from a tube even after storage at low temperatures for a long time. These characteristics suggest that the resultant oral compositions such as dentifrices are of high quality. Based on these findings, the inventors have arrived at the present invention.

Therefore the present invention is directed to an oral composition containing dextranase. According to the present invention, a dextranase enzyme produced by a fungus of the genus Chaetomium is used as the dextranase component in combination with a stabilizing amount of an admixture comprising water soluble salts of alkyl sulfates having 10, 12, 14, and 16 carbon atoms in the alkyl group in the following proportion:

C ₁₀ -alkyl sulfate salt	0 - 20%,
C ₁₂ -alkyl sulfate salt	50 - 80%,

C₁₄-alkyl sulfate salt 10 - 30%, and

C₁₆-alkyl sulfate salt 0 - 15%,

based on the weight of the admixture. The oral composition containing this combination is improved in stability and activity of dextranase and gives a pleasant sensation during use.

The above and other objects, features and advantages of the present invention will become more apparent and understandable from the following description.

DETAILED DESCRIPTION OF THE INVENTION

The dextranase enzyme used in the dextranase-containing oral compositions of the present invention includes those dextranase enzymes which are produced by a fungus of the genus *Chaetomium*. This type of dextranase may be prepared by following the procedure described in Japanese Patent Publication No. 46-42192, for example, except that the organism used is replaced by the genus *Chaetomium*. The dextranase enzyme prepared by this procedure has a titer generally ranging from 10^5 units to 5×10^7 units per gram, and thus is effective for the purpose of the present invention. According to the present invention, such a dextranase enzyme produced by the genus *Chaetomium* is combined with a specific admixture of alkyl sulfate salts, resulting in oral compositions in which the dextranase remains active and stable for a long time. On the other hand, those dextranase enzymes produced by fungi

of other genres, for example, of *Penicillium*, *Aspergillus*, *Streptomyces*, *Sporotrichum*, *Bacillus*, etc. are not only lower in activity than the *Chaetomium*-produced dextranase, but also remain unstable even when combined with the
5 specific admixture of alkyl sulfate salts selected for the present invention, failing to attain the objects of the present invention.

The above-mentioned *Chaetomium*-produced dextranase may be blended in oral compositions in amounts of 100 to
10 100,000 units, and more preferably in amounts of 1,000 to 50,000 units per gram of the compositions. It is to be noted that one unit is the amount of enzyme which produces free reducing sugars corresponding to 1 μ g of glucose per minute when the reaction is effected in a substrate of
15 dextran.

The admixture of alkyl sulfate salts which can be used in the present invention comprises water-soluble salts of alkyl sulfates having 10, 12, 14, and 16 carbon atoms in the alkyl chain, more specifically, water-soluble
20 salts of decyl sulfate, lauryl sulfate, myristyl sulfate, and palmityl sulfate in amounts of 0 - 20% (C_{10}), 50 - 80% (C_{12}), 10 - 30% (C_{14}), and 0 - 15% (C_{16}), respectively. By blending an admixture of water-soluble salts of alkyl sulfates having the above-specified distribution of carbon
25 atom number in an oral composition containing the *Chaetomium*-produced dextranase, the stability of dextranase can be increased and the quality of the composition can

be improved. On the contrary, the dextranase cannot be stabilized when salts of alkyl sulfates having a carbon atom number distribution outside the above-defined range are used. For example, admixtures of alkyl sulfate salts containing more than 50% of sodium decyl sulfate, more than 90% of sodium lauryl sulfate, or more than 50% of sodium myristyl sulfate cannot fully stabilize the dextranase. Although admixtures of alkyl sulfate salts containing more than 50% of sodium palmityl sulfate or more than 50% of sodium stearyl sulfate can stabilize the dextranase, oral compositions containing them have extremely reduced foaming property, a disagreeable sensation during use, and poor low-temperature stability. It is thus not recommendable in practice to use them as an activating or foaming agent in oral compositions. It should be noted that these percents are based on the weight of the admixtures.

The above-mentioned admixture may preferably comprise water-soluble salts of alkyl sulfates having 10, 12, 14, and 16 carbon atoms in the alkyl chain in the proportion:

C ₁₀ -alkyl sulfate salt	3 - 18%,
C ₁₂ -alkyl sulfate salt	60 - 75%,
C ₁₄ -alkyl sulfate salt	12 - 25%, and
C ₁₆ -alkyl sulfate salt	0 - 10%,

based on the weight of the admixture. Further, the admixture may preferably comprises at least 98% by weight of the above-specified salts of alkyl sulfates having 10,

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12, 14, and 16 carbon atoms in the alkyl chain, and such admixtures are most effective for the purpose of the present invention.

5 The water-soluble salts of alkyl sulfates used herein may preferably be sodium and potassium salts, but not limited thereto.

10 The above-mentioned admixture of alkyl sulfate salts may be blended in oral compositions in amounts of 0.1% to 7%, and particularly, in amounts of 0.3% to 3% by weight based on the total weight of the compositions. Amounts of less than 0.1% are too small to provide foaming power, degrading the mouth feel. Another problem arises in the stability of oral compositions, and particularly, liquid separation will occur in toothpaste compositions. 15 If the amount of the admixture of alkyl sulfate salts is above 7%, the stability of dextranase and the low-temperature stability of the oral compositions such as dentifrices are adversely affected.

20 The dextranase-containing oral composition of the present invention is used in the form of dentifrices such as toothpaste, liquid dentifrices and powder dentifrice, liquid oral refreshers, mouthwashes and the like and thus may further contain other commonly used ingredients depending on a particular type of composition.

25 For dentifrices, an abrasive may be blended generally in an amount of 20 to 90%, and particularly in an amount of 20 - 60% for toothpastes, examples of the

abrasive including dicalcium phosphate dihydrate and anhydride, calcium primary phosphate, calcium tertiary phosphate, calcium carbonate, calcium pyrophosphate, aluminum hydroxide, alumina, silicic acid anhydride, silica gel, aluminum silicate, insoluble sodium metaphosphate, magnesium tertiary phosphate, magnesium carbonate, calcium sulfate, methyl polymethacrylate, bentonite, zirconium silicate, and synthetic resins, and mixtures thereof. Among these, preferred are those aluminum oxide compounds having the general formula:



wherein $n \geq 0$, preferably $3 \geq n \geq 0$, that is, alumina and hydrated aluminas. The use of these aluminum oxide compounds as a main abrasive contributes to further stabilization of dextranase. The preferred aluminum oxide compounds are alpha-alumina and hydrated alpha-aluminas. Among the hydrated alpha-aluminas, gibbsite, bayerite, boehmite, diaspore, etc. are preferred, the former two trihydrates being most preferred because of their mild abrasiveness. The best is gibbsite which is commercially available.

In preparing paste-like compositions, typically toothpastes, a binder may be blended generally in an amount of 0.3 to 5% by weight, including carrageenan, cellulose derivatives such as sodium carboxymethyl cellulose, methyl cellulose, hydroxyethyl cellulose, sodium carboxymethyl hydroxyethyl cellulose, etc., alkali metal alginates such

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as sodium alginate, propylene glycol alginate, gums such as xanthan gum, tragacanth gum, karaya gum and gum arabic, synthetic binding agents such as polyvinyl alcohol, sodium polyacrylate, carboxyvinyl polymer and polyvinyl pyrrolidone, and inorganic binding agents such as silica gel, aluminum silicate gel, veegum and LAPONITE[®], and mixtures thereof. Particularly when an alkali metal monofluorophosphate is used as an additional active ingredient, carrageenan and an alkali metal alginate may preferably be incorporated to improve the stability and mouth feel of dentifrices.

In preparing paste-like or liquid oral compositions, typically toothpastes and mouthwashes, a humectant may be blended generally in an amount of 10 to 70% by weight, including sorbitol, glycerine, ethylene glycol, propylene glycol, 1,3-butylene glycol, polyethylene glycol, polypropylene glycol, xylitol, maltitol, lactitol, etc., and mixtures thereof. Preferably, 1 to 5% by weight of propylene glycol may be used as a binder disperser. Although larger amounts of propylene glycol used tend to reduce the retentivity of dextranase in an aged composition, a sorbitol-based humectant containing 1 part by weight of propylene glycol per 6 to 60 parts by weight of sorbitol is free of such tendency.

In addition to the above-specified admixture of alkyl sulfate salts, another anionic surfactant may be optionally blended in an amount of 0 to 3% by weight,

including sodium salts of higher fatty acids, water-soluble salts of sulfonated monoglycerides of higher fatty acids having 10 to 18 carbon atoms in the fatty acid group, such as sodium lauryl monoglyceride sulfonate and sodium coconut monoglyceride sulfonate, sodium monoglyceride monosulfates of higher fatty acids, olefin sulfonates, paraffin sulfonates, sodium N-methyl-N-palmitoyl touride, sodium N-lauroyl sarcosinate, sodium N-lauroyl- β -alanine, etc., and mixtures thereof. In addition, one or more nonionic and/or amphoteric surfactants may be used in combination with the anionic surfactant in an amount of 0 - 5% by weight based on the total weight of the composition. Examples of the nonionic surfactants include alkanoyl mono- and di-ethanol amides such as lauroyl mono- and di-ethanol amides, stearyl monoglyceride, sucrose fatty acid esters having 12 to 18 carbon atoms in the fatty acid group such as sucrose monolaurate and dilaurate, lactose fatty acid esters, lactitol fatty acid esters, maltitol fatty acid esters, stearic acid monoglyceride, polyoxyethylene sorbitan monolaurate, polyoxyethylene-hardened castor oil, condensates of sorbitan monostearate with approximately 60 moles of ethylene glycol, condensates of ethylene oxide with propylene oxide, and their derivatives such as polyoxyethylene polyoxypropylene monolauryl ester. Examples of the latter include betaine and amino acid type amphoteric surfactants.

Among the above-listed anionic surfactants,

water-soluble salts of N-acyl sarcosinates having 10 to 20 carbon atoms in the acyl group such as sodium N-lauroyl sarcosinate are highly effective in stabilizing dextranase. Therefore, the above-specified admixture of alkyl sulfate salts and an N-acyl sarcosinate provide a preferred combination of anionic surfactants for the present composition. The N-acyl sarcosinate may preferably be blended in an amount of 0.5% or less.

Flavors may also be used alone or in admixture in an amount of 0.1 to 10%, preferably 0.5 to 5% by weight of the combined weight of the composition, for example, menthol, carvone, anethole, eugenol, methyl salicylate, limonene, ocimene, n-decylalcohol, citronellol, α -terpineol, methyl acetate, citronellyl acetate, methyl eugenol, cineol, linalool, ethyl linalool, thymol, spearmint oil, peppermint oil, lemon oil, orange oil, sage oil, rosemary oil, cinnamon oil, pimento oil, cinnamon leaf oil, wintergreen oil, clove oil and eucalyptus oil. Also included are a sweetener in an amount of 0 to 1%, preferably 0.01 to 0.5% by weight, for example, sodium saccharin, stevioside, neohesperidin dihydrochalcone, glycyrrhizin, perillartine, thaumatin, aspartyl phenylalanine methyl ester, p-methoxy-cinnamic aldehyde, etc.; a preservative, for example, p-hydroxymethylbenzoic acid, p-hydroxyethylbenzoic acid, p-hydroxypropylbenzoic acid, p-hydroxybutylbenzoic acid, sodium benzoate, lower fatty acid monoglycerides, etc.; and other ingredients, for example, gelatin, peptone, arginine

hydrochloride, albumin, casein, titanium dioxide, coloring matters and the like. For example, toothpastes may be prepared by kneading any desired ingredients selected from the foregoing ingredients with a proper amount of water.

5 Other types of oral composition may also be prepared by selecting any desired ingredients as usual and mixing them by a conventional procedure.

Paste-like and liquid oral compositions may generally have a pH ranging from 5 to 10, but not limited thereto.

10 In addition to the dextranase, the oral compositions of the present invention may further include other additional active ingredients, for example, enzymes such as amylase, protease, mutanase, lysozyme, bacteriolytic
15 enzyme, lytic enzyme, etc.; alkali metal monofluorophosphates such as sodium monofluorophosphate and potassium monofluorophosphate, fluorides such as sodium fluoride and stannous fluoride, tranexamic acid, ε-aminocaproic acid, chlorhexidine salts, aluminum chlorohydroxyallantoinate,
20 dihydroxycholesterol, glycyrrhetinates, glycyrrhetinic acid, glycerophosphate, chlorophyll, sodium chloride, caropeptide, water-soluble inorganic phosphoric acid derivatives, and the like, alone or in admixture. Preferably, alkali metal monofluorophosphates such as sodium monofluorophosphate
5 may be combined with dextranase because they not only stabilize dextranase, but also retain sufficient dextranase in aged dentifrice compositions. In this case, the alkali

metal monofluorophosphate may preferably be blended in an amount of 0.1 to 1% by weight. Mutanase coacts with dextranase to provide a synergistic effect of dissolving dental plaque and preventing reformation of dental plaque.

5 Dextranase may advantageously be combined with lytic enzyme to increase the efficacy of the latter. Examples of the water-soluble inorganic phosphate are potassium and sodium salts of orthophosphoric acid, pyrophosphoric acid and polyphosphoric acid while the potassium salts are preferred.

10 Among the foregoing ingredients, omega-amino acids, having the general formula:



wherein R represents a cyclohexane ring or $n\text{-C}_4\text{H}_8$, that is, tranexamic acid and ϵ -aminocaproic acid or an alkyl ester or aryl ester derivative thereof may preferably be
15 combined with both the dextranase and the admixture of alkyl sulfate salts to further improve the stability of dextranase. One or more omega-amino acids may be blended in the oral composition in an amount of 0.01 - 3% by weight.
20 Examples of the alkyl ester and aryl ester derivatives of tranexamic acid and ϵ -aminocaproic acid include hexyl tranexamate, phenyl tranexamate, hexyl ϵ -aminocaproate, and heptyl ϵ -aminocaproate.

In summary, the dextranase-containing oral
25 composition of the present invention uses a dextranase enzyme produced by the genus Chaetomium in combination with a specific admixture of water-soluble salts of C_{10} , C_{12} ,

C₁₄, and C₁₆ alkyl sulfates, providing increased stability of dextranase as well as ensuring a pleasant sensation during use.

The following examples are included merely to aid in the understanding of the invention, and variations may be made by one skilled in the art without departing from the scope of the invention. Unless otherwise stated, all percents are by weight.

Examples 1 and 2 & Comparative Examples 1 to 9

Toothpastes having the following formulation were prepared using dextranase enzymes and admixtures of sodium alkyl sulfates shown in Table 1.

<u>Formulation</u>	<u>% by weight</u>
Dicalcium phosphate	50
Sorbitol	20
Sodium saccharin	0.1
Lauroyl diethanol amide	1.5
Sodium alkyl sulfates	1.5
Carrageenan	1.0
Sodium monofluorophosphate	0.76
Dextranase (10 ⁶ units/g)	0.2
Flavor	1.0
Water	Balance
	100.0%

An organoleptic test was carried out by a panel of 15 specialized members to evaluate the taste and foaming of these toothpaste compositions upon use. The quantity

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of dextranase in the toothpaste compositions was measured both immediately after preparation and after aging for one month at 40°C, determining the retentivity of dextranase after a one-month 40°C aging relative to the initial. In addition, each of the toothpaste compositions was encased in an aluminum-laminated tube and aged for one month at -5°C. The extrudability of such an aged toothpaste from the tube was evaluated in comparison with that of a fresh toothpaste.

10 The results are shown in Table 1. The criteria used for evaluation are as follows.

Retentivity of dextranase (aged 40°C, 1 month)

- o : more than 70% of dextranase retained
- Δ : 30 - 70% of dextranase retained
- 15 x : less than 30% of dextranase retained

Taste

- o : not bitter
- x : bitter

Foaming

- 20 o : excellent
- Δ : fair
- x : poor

Low-temperature extrusion (aged -5°C, 1 month)

- o : optimum to extrude
- 25 x : hard to extrude

Overall evaluation

- o : no problem in all aspects

- △ : no problem in all aspects except for somewhat
low retentivity of dextranase
- * : no commercial value

Table 1

	Source of dextranase	Number of carbon atoms in alkyl group of sodium alkyl sulfate	Dextranase retentivity	Taste	Foaming	Low-temp. extrusion	Overall evaluation
C.Ex. 1	Penicillium	C ₁₀ -C ₁₆ mixture A* 99%	x	o	o	o	x
C.Ex. 2	Yeast	"	x	o	o	o	x
C.Ex. 3	Bacterium	"	x	o	o	o	x
Ex. 1	genus Chaetomium	"	o	o	o	o	o
Ex. 2	"	C ₁₀ -C ₁₆ mixture B** 99%	o	o	o	o	o
C.Ex. 4	"	C ₈ 99%	x	x	Δ	o	x
C.Ex. 5	"	C ₁₀ 99%	x	x	o	o	x
C.Ex. 6	"	C ₁₂ 97%	Δ	o	o	o	Δ
C.Ex. 7	"	C ₁₄ 98.5%	Δ	o	o	o	Δ
C.Ex. 8	"	C ₁₆ 99.5%	o	o	x	x	x
C.Ex. 9	"	C ₁₈ 99%	o	o	x	x	x

Note: "Ex." shows "Example", and "C.Ex." shows "Comparative Example"

* C₁₀-C₁₆ mixture A has the following distribution of carbon atom number

Sodium salt of C ₁₀ alkyl sulfate	4%
" C ₁₂ alkyl sulfate	65%
" C ₁₄ alkyl sulfate	21%
" C ₁₆ alkyl sulfate	9%

** C₁₀-C₁₆ mixture B has the following distribution of carbon atom number

Sodium salt of C ₁₀ alkyl sulfate	16%
" C ₁₂ alkyl sulfate	69%
" C ₁₄ alkyl sulfate	13%
" C ₁₆ alkyl sulfate	1%

As apparent from the results of Table 1, among dextranase enzymes, that produced by the genus Chaetomium remains most stable in toothpastes. By using the dextranase enzyme produced by the genus Chaetomium in combination with a specific admixture of sodium alkyl sulfates having 10, 12, 14, and 16 carbon atoms in the alkyl chain, the dextranase can be kept stable for a long time in toothpastes. In addition, this combination improves the taste and foaming of toothpaste preparations as well as the low-temperature extrusion from a tube, resulting in a toothpaste which is easy to extrude and favorable to use.

A variety of dextranase enzymes were evaluated for activity by the following procedure.

Dextranase activity evaluation:

A 1-g mass was sampled out of each of the

toothpastes of Comparative Examples 1 to 3 and Example 1
and diluted with 4 ml of a phosphoric acid buffer at pH
7.0. The resulting supernatant was added to a dextran
substrate at pH 7.0, and the system was allowed to react
at 40°C for 10 minutes to produce a free reducing sugar.
The ability to produce free reducing sugar is regarded as
the titer of a dextranase enzyme. The titer of a dextranase
enzyme produced by the genus Chaetomium is assumed to be
100, and the titers of other dextranase enzymes are computed
on this basis. The results are shown in Table 2.

Table 2

Source of dextranase	Titer*	Remarks
Chaetomium	100	Example 1
Penicillium	91	Comparative Example 1
Yeast	91	Comparative Example 2
Bacterium	68	Comparative Example 3

* ability to produce reducing sugar at 40°C for 10 min.

As seen from the results of Table 2, the
dextranase enzyme produced by the genus Chaetomium has the
highest activity. It is concluded that when a dextranase
enzyme produced by the genus Chaetomium is combined with
a specific admixture of water-soluble salts of alkyl
sulfates, there is obtained a dentifrice composition which
has the high activity and stability of dextranase, continues
to exert the efficacy of dextranase for a long time, and

provides improved dentifrice characteristics.

Example 3 Toothpaste

A toothpaste having the following formulation was prepared, and evaluated for various factors by the same procedures as in Example 1.

<u>Ingredient</u>	<u>% by weight</u>
Aluminum hydroxide	50
Silicic acid anhydride	3
Propylene glycol	2
Sorbitol	20
Sodium alkyl sulfates	1.0
Lauroyl diethanol amide	1.5
Carrageenan	1.0
Gelatin	0.3
Sodium monofluorophosphate	0.76
Flavor	1.0
Sodium saccharin	0.1
Dextranase (10^6 units/g)	0.2
Water	Balance
	100.0%
Dextranase retentivity	o
Taste	o
Foaming	o
Low-temperature extrusion	o

The dextranase enzyme used was that produced by the genus Chaetomium. The admixture of sodium alkyl sulfates used had the following distribution of alkyl carbon

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atom numbers.

	C ₁₀ alkyl	5%
	C ₁₂ alkyl	65%
	C ₁₄ alkyl	18%
5	C ₁₆ alkyl	11%

Example 4 Toothpaste

	<u>Ingredient</u>	<u>% by weight</u>
	Dicalcium phosphate	40
	Sorbitol	15
10	Glycerine	5
	Sodium alkyl sulfates	1.5
	Myristoyl diethanol amide	2.0
	Sodium alginate	1.0
	Gelatin	0.5
15	Flavor	1.0
	Sodium saccharin	0.1
	Dextranase (10 ⁶ units/g)	0.3
	Water	Balance
		100.0%
20	Dextranase retentivity	o
	Taste	o
	Foaming	o
	Low-temperature extrusion	o

25 The dextranase enzyme used was that produced by the genus Chaetomium. The admixture of sodium alkyl sulfates used had the following distribution of alkyl carbon atom numbers.

C ₁₀ alkyl	17%
C ₁₂ alkyl	68%
C ₁₄ alkyl	13%
C ₁₆ alkyl	1%

5 Example 5 Toothpaste

<u>Ingredient</u>	<u>% by weight</u>
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Calcium carbonate	50
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Propylene glycol	3
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Sorbitol	30
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Lauroyl sarcosinate	0.3
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Sodium alkyl sulfates	0.8
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Palmitoyl diethanol amide	1.0
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Carrageenan	0.5
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Sodium alginate	0.5
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Tranexamic acid	0.1
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Sodium monofluorophosphate	0.76
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Flavor	1.0
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Sodium saccharin	0.1
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Dextranase (10 ⁶ units/g)	0.1
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Water	Balance
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100.0%

Dextranase retentivity	o
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Taste	o
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Foaming	o
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Low-temperature extrusion	o
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The dextranase enzyme used was that produced by the genus Chaetomium. The admixture of sodium alkyl

sulfates used has the following distribution of alkyl carbon atom numbers.

	C ₁₀ alkyl	2%
	C ₁₂ alkyl	76%
5	C ₁₄ alkyl	15%
	C ₁₆ alkyl	5%

Example 6 Toothpowder

	<u>Ingredient</u>	<u>% by weight</u>
	Calcium carbonate	80
10	Sorbitol	10
	Sodium alkyl sulfates	1.5
	Myristoyl diethanol amide	1.5
	Carrageenan	0.8
	Sodium alginate	0.3
15	Gelatin	0.5
	Sodium monofluorophosphate	0.76
	Flavor	1.0
	Sodium saccharin	0.1
	Dextranase (10 ⁶ units/g)	1.0
20	Water	Balance
		100.0%
	Dextranase retentivity	o
	Taste	o
	Foaming	o

25 The dextranase enzyme used was that produced by the genus Chaetomium. The admixture of sodium alkyl sulfates used had the following distribution of alkyl carbon

atom numbers.

C ₁₀ alkyl	12%
C ₁₂ alkyl	75%
C ₁₄ alkyl	11%
C ₁₆ alkyl	0.5%

Example 7 Toothpaste

<u>Ingredient</u>	<u>% by weight</u>
Silicic acid anhydride	20
Sorbitol	35
Glycerin	30
Sodium alkyl sulfates	1
Lauroyl diethanol amide	1.2
Carrageenan	0.3
Sodium alginate	0.8
Gelatin	1.0
ϵ -Aminocaproic acid	0.1
Flavor	1.0
Sodium saccharin	0.1
Dextranase (10^6 units/g)	0.5
Water	Balance
	100.0%
Dextranase retentivity	o
Taste	o
Foaming	o
Low-temperature extrusion	o

The dextranase enzyme used was that produced by the genus Chaetomium. The admixture of sodium alkyl

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sulfates used had the following distribution of alkyl carbon atom numbers.

	C ₁₀ alkyl	14%
	C ₁₂ alkyl	55%
5	C ₁₄ alkyl	25%
	C ₁₆ alkyl	6%

Example 8 Mouthwash

	<u>Ingredient</u>	<u>% by weight</u>
	Ethanol (90%)	20
10	Sodium saccharin	0.3
	Sodium alkyl sulfates	0.5
	Flavor	1.0
	Dextranase (5×10^6 units/g)	1.0
	Water	Balance
15		100.0%
	Dextranase retentivity	o
	Taste	o

The dextranase enzyme used was that produced by the genus Chaetomium. The admixture of sodium alkyl sulfates used had the following distribution of alkyl carbon atom numbers.

	C ₁₀ alkyl	10%
	C ₁₂ alkyl	58%
	C ₁₄ alkyl	28%
25	C ₁₆ alkyl	2%



Example 9 Oral refresher

<u>Ingredient</u>	<u>% by weight</u>
Ethanol	30
Glycerin	15
5 Sodium saccharin	0.3
Sodium alkyl sulfates	0.1
Flavor	3.0
Dextranase (2×10^6 units/g)	0.5
Water	Balance
10	100.0%

Dextranase retentivity o

Taste o

The dextranase enzyme used was that produced by the genus Chaetomium. The admixture of sodium alkyl sulfates used had the following distribution of alkyl carbon atom numbers.

C ₁₀ alkyl	8%
C ₁₂ alkyl	68%
C ₁₄ alkyl	16%
20 C ₁₆ alkyl	7%



(37)

Claims

1. An oral composition comprising
a dextranase enzyme produced by a fungus of
the genus *Chaetomium*, and
a stabilizing amount of an admixture comprising
water-soluble salts of alkyl sulfates having 10, 12, 14,
and 16 carbon atoms in the alkyl chain in the following
proportion:

C ₁₀ -alkyl sulfate salt	0 - 20%,
C ₁₂ -alkyl sulfate salt	50 - 80%,
C ₁₄ -alkyl sulfate salt	10 - 30%, and
C ₁₆ -alkyl sulfate salt	0 - 15%,

based on the weight of the admixture.

2. The oral composition according to claim 1 wherein
the admixture comprises water-soluble salts of alkyl
sulfates having 10, 12, 14 and 16 carbon atoms in the alkyl
chain in the following proportions:

C ₁₀ -alkyl sulfate salt	3 - 18%,
C ₁₂ -alkyl sulfate salt	60 - 75%,
C ₁₄ -alkyl sulfate salt	12 - 25%, and
C ₁₆ -alkyl sulfate salt	0 - 10%,

based on the weight of the admixture.

3. The oral composition according to claim 1 or 2
wherein the admixture comprises at least 98% by weight of
the water-soluble salts of alkyl sulfates having 10, 12,



14, and 16 carbon atoms in the alkyl chain.

4. The oral composition according to claim 1 or 2 wherein the admixture is present in an amount of 0.1% to 7% by weight based on the total weight of the composition.

5 5. An oral composition substantially as in any of the examples, other than those included for comparison only.
