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ACID COMPOSITIONS

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ABSTRACT OF THE DISCLOSURE

Food compositions such as beverages and gels containing as an acidulating agent an amino tri(lower alkylidene phosphonic acid).

This invention relates generally to acid-containing food compositions and, more particularly, to food compositions, especially dry mix food compositions including effervescent food compositions, containing a novel acidulating agent.

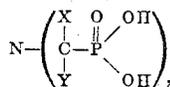
Organic food acids, such as citric, tartaric, adipic, fumaric and lactic acids are some of the known acidulating agents which can be used in edible compositions to provide a desirable acid taste or tang and/or to provide an acid pH. Citric acid and fumaric acid are the predominantly used organic food acids in edible compositions. As is well known, however, the foregoing organic acids all have limitations such as, for example, citric acid is hygroscopic and fumaric acid is not readily soluble in cold water, which oftentimes presents problems in their use or seriously restricts their use. As can be appreciated, therefore, an organic acidulating agent which can be used in food compositions and which minimizes or obviates the limitations of conventionally used organic food acids would represent an advancement in this art.

It is, therefore, an object of the present invention to provide food compositions containing a novel acidulating agent.

It is another object of the present invention to provide dry mix food compositions including effervescent food compositions containing a novel acidulating agent.

It is a further object of the present invention to provide an organic acidulating agent as an additive in food compositions which minimizes or obviates the limitations of conventionally used organic acids, such as citric acid and fumaric acid.

The above objects, as well as other objects of this invention, can be accomplished by incorporating into food compositions an amino tri(lower alkylidene phosphonic acid) having the formula



wherein X and Y are members selected from the group consisting of hydrogen and lower alkyl groups (1-4 carbon atoms).

Amino tri(lower alkylidene phosphonic acid) compounds illustrative of the invention include:

- (1) amino tri(methylene phosphonic acid)
- (2) amino tri(ethylidene phosphonic acid)
- (3) amino tri(isopropylidene phosphonic acid)
- (4) amino tri(butylidene phosphonic acid)
- (5) amino mono(ethylidene phosphonic acid)di(methylene phosphonic acid)
- (6) amino di(methylene phosphonic acid)mono(isopropylidene phosphonic acid)
- (7) amino di(methylene phosphonic acid)mono(butylidene phosphonic acid).

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The amino tri(lower alkylidene phosphonic acids) may be prepared by various means, one of which comprises reacting ammonia, a suitable carbonyl containing compound (ketone or aldehyde) and orthophosphorous acid preferably at elevated temperatures (about 70-200° C.) and in an aqueous medium having a pH below about 4 and preferably in the presence of a halide compound such as HCl.

The amino tri(lower alkylidene phosphonic acids) can be advantageously used as acidulating agents because such are, among other things, some of the strongest organic acids known, can be readily formulated into food compositions and are compatible in such compositions, and are non-hygroscopic and readily soluble in both hot and cold water.

As being illustrative of their acidity, the following table compares the acid value of amino tri(methylene phosphonic acid) with other common food acids with the pK of the strongest hydrogen being shown:

TABLE 1

Acid:	pK ₁
(1) Tartaric (99.5%) -----	3.02
(2) Citric (91%) -----	3.06
(3) Lactic (40%) -----	3.86
(4) Phosphoric (75%) -----	2.12
(5) Amino tri(methylene phosphonic acid) (50%) -----	<2.0

As being illustrative of their acidity and solubility, the following table compares amino tri(methylene phosphonic acid) with the conventionally used organic food acids citric acid and fumaric acid:

TABLE 2

Acid	Solubility in water (25° C.), percent	Rate of solubility	Percent needed to achieve in water (25° C.)	
			pH-3	pH-2.5
(1) Citric.....	58	Rapid.....	0.041	0.20
(2) Fumaric.....	0.7	Slow.....	0.024	0.20
(3) Aminotri(methylene phosphonic acid).....	60	Rapid.....	0.009	0.05

Typical food compositions in which the novel acidulating agents of the present invention can be used include beverage compositions, such as, carbonated beverage mix compositions (both dry and liquid), dry kola mix compositions, and fruit flavored compositions; non-nutritive sweetened food compositions; gelatin food compositions; and aliginate jelly and dessert compositions. These specific areas of utilization are by no means the extent of their use, and, therefore, the invention is not intended to be limited thereto.

In general, effective amounts of the acidulating agent which can be used in food compositions vary depending upon, inter alia, type of food composition, other additives present and the like and usually amounts which impart a pH from about 2.0 to 5.5 are suitable. Usually such amounts can range as widely as from about 0.1% to as high as 60 to 70% by weight of the composition. In some cases buffering salts can be advantageous used with the acidulating agent and such include the alkali metal and alkaline earth metal phosphates with sodium and calcium phosphates being preferred.

The invention is not to be limited to any particular method of preparing the food composition containing the acidulating agent. The acidulating agent may be mechanically mixed in, slurried with or dissolved in the food composition or, if desired, the acidulating agent can be pre-