

[0084] One preferred method of preparing AGIIS can be described briefly as: Concentrated sulfuric acid is added to chilled water (8°-12° C.) in the reaction vessel, then, with stirring, calcium sulfate is added to the acid in chilled water to give a mixture. Temperature control is paramount to this process. To this stirring mixture is then added slurry of calcium hydroxide in water. The solid formed from the mixture is then removed. This method involves the use of sulfuric acid, calcium sulfate, and calcium hydroxide, and it has several unexpected advantages. Firstly, this reaction is not violent and is not exceedingly exothermic. Besides being easy to control and easy to reproduce, this reaction uses ingredients each of which has been reviewed by the U.S. Food and Drug Administration ("U.S. FDA") and determined to be "generally recognized as safe" ("GRAS"). As such, each of these ingredients can be added directly to food, subject, of course, to certain limitations. Under proper concentration, each of these ingredients can be used as processing aids and in food contact applications. Their use is limited only by product suitability and Good Manufacturing Practices ("GMP"). The AGIIS so prepared is thus safe for animal consumption, safe for processing aids, and safe in food contact applications. Further, the AGIIS reduces biological contaminants in not only inhibiting the growth of, and killing, microorganisms but also destroying the toxins formed and generated by the microorganisms. The AGIIS formed can also preserve, or extend the shelf-life of, consumable products, be they plant, animal, pharmaceutical, or biological products. It also preserves or improves the organoleptic quality of a beverage, a plant product or an animal product. It also possesses certain healing and therapeutic properties.

[0085] The sulfuric acid used is usually 95-98% FCC Grade (about 35-37 N). The amount of concentrated sulfuric acid can range from about 0.05 M to about 18 M (about 0.1 N to about 36 N), preferably from about 1 M to about 5 M. It is application specific. The term "M" used denotes molar or moles per liter.

[0086] Normally, a slurry of finely ground calcium hydroxide suspended in water (about 50% of w/v) is the preferred way of introducing the calcium hydroxide, in increments, into a stirring solution of sulfuric acid, with or without the presence of calcium sulfate. Ordinarily, the reaction is carried out below 40° C., preferably below room temperature, and more preferably below 10° C. The time to add calcium hydroxide can range from about 1 hour to about 4 hours. The agitation speed can vary from about 600 to about 700 rpm or higher. After the mixing, the mixture is filtered through a 5 micron filter. The filtrate is then allowed to sit overnight and the fine sediment is removed by decantation.

[0087] The calcium hydroxide used is usually FCC Grade of about 98% purity. For every mole of concentrated acid, such as sulfuric acid, the amount, in mole, of calcium hydroxide used is application specific and ranges from about 0.1 to about 1.

[0088] The phosphoric acid used is usually from JT Baker of about 85-88%.

[0089] The calcium monohydrogen phosphate is usually of 98-99%; and the calcium phosphate ("the tribasic") is obtained from Mallinckrodt. Other phosphate salts used are all of reagent grade.

[0090] The optional calcium carbonate is normally FCC Grade having a purity of about 98%. When used with calcium hydroxide as described above, for every mole of concentrated acid, such as sulfuric acid, the amount, in mole, of calcium

carbonate ranges from about 0.001 to about 0.2, depending on the amount of calcium hydroxide used.

[0091] The optional carbon dioxide is usually bubbled into the slurry containing calcium hydroxide at a speed of from about 1 to about 3 pounds pressure. The carbon dioxide is bubbled into the slurry for a period of from about 1 to about 3 hours. The slurry is then added to the reaction vessel containing the concentrated sulfuric acid.

[0092] Another optional ingredient is calcium sulfate, a Group IIA salt of a dibasic acid. Normally, dihydrated calcium sulfate is used. As used in this application, the phrase "calcium sulfate," or the formula "CaSO₄," means either anhydrous or hydrated calcium sulfate. The purity of calcium sulfate (dihydrate) used is usually 95-98% FCC Grade. The amount of calcium sulfate, in moles per liter of concentrated sulfuric acid ranges from about 0.005 to about 0.15, preferably from about 0.007 to about 0.07, and more preferably from about 0.007 to about 0.04. It is application specific.

[0093] In the event that CaSO₄ is used for the reaction by adding it to the solution of concentrated H₂SO₄, the amount of CaSO₄, in grams per liter of solution based on final volume, has the following relationship:

Final AGIIS Acid Normality (N)	Amount of CaSO ₄ in g/l
1-5	5
6-10	4
11-15	3
16-20	2
21-36	1

[0094] The AGIIS obtained could have an acid normality range of from about 0.05 to about 31; the pH of lower than 0; boiling point of from about 100 to about 106° C.; freezing point of from about -8° C. to about 0° C. AGIIS obtained from using the reaction of H₂SO₄/Ca(OH)₂/CaSO₄ had the following analyses (average):

[0095] AGIIS With Final Acid Normality of 1.2 N, pH of -0.08

[0096] H₃O⁺, 2.22%; Ca, 602 ppm; SO₄, 73560 ppm; K, 1.36 ppb; impurities of 19.68 ppm, and neither Na nor Mg was detected.

[0097] AGIIS With Final Acid Normality of about 29 N, pH of about -1.46

[0098] H₃O⁺, 30.68%; Ca, 52.9 ppm; SO₄, 1422160 ppm; K, 38.02 ppb; and neither Na nor Mg was detected.

[0099] Aqueous solutions of other alkalis or bases, such as Group IA hydroxide solution or slurry and Group IIA hydroxide solution or slurry can be used. Groups IA and HA refer to the two Groups in the periodical table. The use of Group IIA hydroxide is preferred. Preferably, the salts formed from using Group IIA hydroxides in the reaction are sparingly soluble in water. It is also preferable to use only Group IIA hydroxide as the base without the addition of Group IA hydroxide. After the reaction, the resultant concentrated acidic solution with a relatively low pH value, typically below pH 1, can then be diluted with de-ionized water to the desired pH value, such as pH of about 1 or about 1.8.

[0100] As discussed above, AGIIS has relatively less dehydrating properties (such as charring sucrose) as compared to the saturated solution of CaSO₄ in the same concentration of H₂SO₄. Further, the stability and non-corrosive nature of the AGIIS of the present invention can be illustrated by the fact that a person can put his or her hand into this solution with a