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CURCUMIN IN THE DETECTION AND WARNING OF CYANIDE ADULTERATED FOOD PRODUCTS

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(56) Prior Art Documents
US 4746616
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(57) Claim

1. A food, drug or other oral composition which detects and warns of the presence of cyanide therein, said composition comprising curcumin and having an original color, said curcumin being present in an amount sufficient to cause the color of at least a portion of said composition to change from the original color to a red-orange color when said curcumin is in the presence of cyanide, said color change being detectable by observation thereby providing a warning of the presence of cyanide in said composition.

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(54) Title: CURCUMIN IN THE DETECTION AND WARNING OF CYANIDE ADULTERATED FOOD PRODUCTS

(57) Abstract

Curcumin is employed for the purpose of detecting and warning of the presence of cyanide in a food, drug or other oral composition. Curcumin may be added to the composition or it may be incorporated in packaging material, preferably on or near the side which contacts the product packaged therein. In the presence of cyanide, the curcumin displays a color change of at least a portion of the food, drug or oral composition, the packaging material or both. The color change is sufficient to be detected by an observer thereby providing a warning of cyanide adulteration of the product. A printed message means may also be provided to warn against consumption of the composition upon detection of the color change.

CURCUMIN IN THE DETECTION AND WARNING OF CYANIDE ADULTERATED FOOD PRODUCTS

FIELD OF THE INVENTION

The present invention relates to the detection of cyanide in food, drug or other oral compositions for the purpose of warning consumers of the presence of cyanide prior to consumption of the composition.

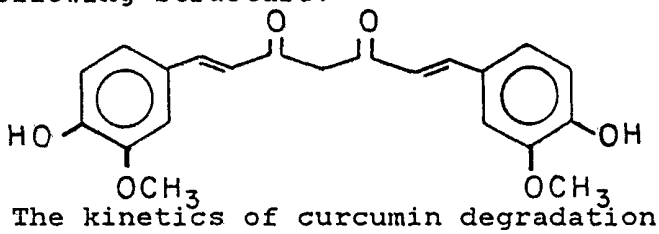
BACKGROUND OF THE INVENTION

Cyanide is a readily available poison which is extremely dangerous and often fatal when consumed in relatively small dosages. The presence of cyanide in foods is difficult to detect since it does not possess an easily noticeable odor or color. As a result, a consumer cannot personally detect or be warned of cyanide adulteration which has occurred in a food product.

Packaging devices have been provided which warn a consumer of potential tampering or adulteration of the packaged products. These systems generally involve a physical modification of the package such as the presence of a plastic seal which when broken indicates tampering. However, if the warning signal given by the package is overlooked by the consumer or circumvented by the tamperer such as by injection, the consumer would not detect adulteration.

Curcumin also known as turmeric yellow has been used as a food dye on foods having acid to neutral

pH values. Curcumin is the main coloring matter in turmeric which is a dried and ground root of curcuma longa, a perennial herb native to China, India and South America. Curcumin has the chemical name 1,7-bis (4-hydroxy-3-methoxy phenyl) -1,6-heptadiene -3,5-dione and the following structure:



The kinetics of curcumin degradation in aqueous solution was studied by Tannesen and Karlsen in 1985. At pH greater than 7.5, curcumin molecules are extremely unstable with the solution color being an orange red. Below pH 7, curcumin solution is yellow. At pH 7.75, the half life of curcumin is 50 minutes. At pH 10.8, it is about one minute. Degradation products have been identified to be ferulic acid and feruloylmethane.

The photochemical stability was studied by the same scientists and published in 1986. The curcumin degradation follows first order kinetics with the best stability in methanol (half life being 92.7 hours).

Sodium and potassium cyanide are commercially available and extremely poisonous compounds. When dissolved in water, the resulting aqueous solutions have a high alkalinity. The presence of less than 100 milligrams of sodium or potassium cyanide in food products neutral to sight acid pH will cause the food pH to be alkaline. Accordingly, it is desirable to utilize curcumin to indicate the presence of cyanide in food products.

It is therefore an object of the present invention to employ curcumin to detect and warn of the presence of cyanide in or on food, drug or like

products by using curcumin as a cyanide indicator in the product or the product packaging.

SUMMARY OF THE INVENTION

In accordance with one embodiment of the present invention there is provided a food, drug or other oral composition which detects and warns of the presence of cyanide therein. The composition contains typical food, drug or oral product ingredients and curcumin in an amount sufficient to cause a color change in at least a portion of the composition when the curcumin is in the presence of cyanide. The color change provides a sufficient deviation from the original color of the composition to allow an observer or potential consumer of the composition to detect and be warned of the presence of cyanide.

In accordance with another embodiment of the present invention there is provided a packaging material which detects and warns of the presence of cyanide in or on a product packaged therein. The packaging material comprises curcumin in an amount sufficient to cause a color change in at least a portion of the packaging when the curcumin is in the presence of cyanide. The color change is sufficient to be detectable from the original color of the packaging or composition thereby providing a warning of the presence of cyanide.

In accordance with still another embodiment of the present invention there is provided a consumable capsule which detects and warns of the presence of cyanide in a food, drug or other oral composition contained therein. The capsule comprises curcumin in an amount sufficient to cause a color change in at least a portion of the capsule when the curcumin is in the presence of

cyanide. The color change of the capsule is sufficient to be detectable from the original color thereby providing a warning of the presence of cyanide.

In accordance with yet another embodiment, the present invention provides a method for warning of the presence of cyanide in a food, drug or other oral composition. The method comprises incorporating curcumin in the composition in an amount sufficient to cause a color change in at least a portion of the composition from its original color when the curcumin is in the presence of cyanide. The method further comprises providing a means for warning against consumption of the composition when the change in color appears.

In accordance with a further embodiment, the present invention provides a method for warning of the presence of cyanide in a packaged food, drug or other oral composition wherein the packaging comprises curcumin in an amount sufficient to cause the color of at least a portion of the composition or a portion of the package to change from the respective original color. The method further comprises providing a means for warning against consumption of the composition when the color change appears.

In accordance with a still further embodiment, the present invention also provides a system for warning of the presence of cyanide in a food, drug or other oral composition. The system comprises a food, drug or oral composition comprising curcumin present in an amount sufficient to cause a color change in at least a portion of the food, drug or other oral composition when the curcumin is in the presence of cyanide, and a means for warning against consuming a product which has undergone a color change.

DESCRIPTION OF PRESENTLY PREFERRED EMBODIMENTS

In accordance with the present invention it has now been discovered that curcumin can be employed to detect and warn of the presence of cyanide in food, drug or other oral compositions. As used herein, the term food, drug or oral composition means any ingestible product or product intended to be taken into the mouth. Such compositions include any food, drug or like composition intended for contact with the oral cavity. Accordingly, the food or oral composition may be chewed, swallowed, allowed to dissolve, or swirled about in the oral cavity such that at least a portion of the composition is likely to enter the digestive tract. Examples of materials suitable for use with the present invention would include foods, beverages, nutritional supplements, chewing gums, oral medications, toothpastes and mouthwashes.

It has further been discovered that curcumin can also be applied to, deposited on, or incorporated into a packaging material in which a food or oral composition is packaged. When the packaging material is in the presence of cyanide, the packaging or at least a portion thereof will display a color change sufficient to warn of the presence of cyanide in the food or oral composition. The packaging material may be any known packaging item including commonly known paper, wax, plastic, foil, or like wrappers. The packaging material may be flexible wrapping material or may be formed into a box or bottle shape. In addition the packaging material may be a consumable capsule and the food, drug or other oral composition is contained therein. In any event, curcumin is incorporated in or is present on the packaging material in an amount sufficient to display a color change in at least a portion of the packaging material, the color change

being detectable and thereby providing a warning of the presence of cyanide in the material contained or packaged therein.

The curcumin should be present in the food, drug or oral composition in an amount sufficient to display a change in color from the original intended color of at least a portion of the composition. The color change occurs under alkaline conditions created by the presence of cyanide. When utilized in most food products, curcumin is preferably present in an amount of at least 0.001 per cent by weight of the composition. More preferably, curcumin is present in an amount between about 0.001 and about 0.1 per cent by weight of the composition.

The curcumin may be added to the food or oral composition by any manner of addition known in the art. Curcumin may be dissolved or suspended in an alcohol or glycerin and thereafter mixed with other composition ingredients. Alternatively curcumin may be added in the powder form by mixing with the other composition ingredients.

The method of addition of the curcumin to the other composition ingredients does not have a significant effect on the advantages realized. It is to be understood, however, that the particular method of combining the ingredients may require different amounts of curcumin.

In accordance with another embodiment of the present invention curcumin may be incorporated in or deposited on the side of the packaging material contacting a food, drug or other oral composition packaged therein. The curcumin may be incorporated in any way known to those skilled in the art. Accordingly, curcumin may be added to the packaging during manufacture or applied to the packaging material by

sprinkling or dusting the compound on an outer layer of the packaging which preferably contacts the product when packaged therein. Preferably curcumin may be applied by dissolution in a suitable solvent and sprayed or otherwise coated on the surface of the packaging material.

It is to be understood that curcumin may be applied as a complete layer, interval strip, or other geometric design such as squares, triangles, dots, etc. Moreover, curcumin may be applied upon a change in color to spell out a particular warning or depict a recognizable warning design, figure, display, pattern, or picture. Such means for detecting the presence of cyanide in the food or oral composition are preferably present to warn the consumer against consumption of the composition when the color change occurs. Additional means for warning the consumer, while not necessary, may be provided. Such means may include a warning message or pictorial warning on the package or nearby display indicating the significance or relevance of the color change with regard to the presence of cyanide.

Curcumin is incorporated in the packaging material in an amount sufficient to display a detectable color change in at least a portion of the packaging when that portion is in the presence of cyanide. The color change is sufficient to allow an observer or potential consumer to be warned of possible adulteration of the product packaged therein and therefore against consumption. Preferably, the curcumin is applied to the packaging material in an amount between about 2.0 to about 200 micrograms per square inch of the packaging.

In yet another embodiment of the present invention, curcumin is incorporated into a consumable capsule material, such as but not limited to gelatin

which is then used to make capsules containing edibles, vitamins, pharmaceutical agents or the like. In the event of cyanide adulteration of the material contained in the capsule, the capsule will exhibit a color change thereby warning of the presence of cyanide.

The following examples are merely intended to illustrate the present invention. It is to be understood that these examples are not to be construed as a limitation of the present invention, the scope of which is defined in the appended claims.

EXAMPLES

Example 1

A dry chicken soup mix is prepared from the following dried ingredients: 20g Noodles, 3g carrots, 2g peas, 2g chicken fat, 0.5g parsley, 0.2g salt; 1g corn syrup (DE-39) 1g corn starch and 0.02g (10% curcumin in glycerin). To this mixture is added 500mg potassium cyanide and 10ml hot water. The soup instantly turns red while the control mixture having no cyanide remained yellow - typical of chicken soup. This illustrates that a rehydratable soup mix or drink mix can be colored with curcumin to warn of cyanide adulteration before the food product is consumed.

Example 2

A sugarless chewing gum is formulated with

26%	gum base
48%	sorbitol
8%	mannitol
10%	glycerin
7%	hydrogenated starch hydrolysate syrup

1%	flavor
0.02%	FD and C Blue #2
0.01%	curcumin

The gum has a light green color. When 50mg potassium cyanide (KCN) powder is dusted onto this gum, the color changes to red/orange within 14 days. This color remains for at least 2 months. The control having no added cyanide remains light green.

Example 3

The surface of the gum in Example 2 is adulterated with 50mg potassium cyanide (KCN) in 0.1ml water. The gum stick surface turns red-orange within 15 minutes and remains that color for at least 2 months. The control having no added cyanide remains light green.

Example 4

Curcumin is applied to the tissue side of single stick tissue/foil wrappers of peppermint chewing gum as follows: 216.2mg of 10% curcumin in glycerin is dissolved in 10ml alcohol. 50 microliters of this solution is evenly applied onto the 6sq inch tissue and allowed to dry at room temperature for 15 minutes. The sugar chewing gum is placed in the tissue/foil wrappers and adulterated on the surface with either 50mg KCN powder or 50mg KCN in 0.1ml water (injections). The gum dusted with KCN produces red spots on the wrapper within 30 minutes. The gum injected with aqueous KCN instantly has a red inner tissue color which bleeds onto the gum making it red on the surface. Aging studies indicate that the curcumin on the single stick tissue remains reactive to cyanide for over 5.5 months.

The cyanide tainted gum wrappers remain discolored for at least 5.5 months.

Example 5

Curcumin is applied to the tissue side of single stick tissue/foil wrappers of sugarless peppermint chewing gum in the same manner as Example 4. Aqueous cyanide injected into the gum is detected immediately as a blood red color on wrapper and gum. Cyanide dusted on the gum surface is detected within 30 minutes as red spots on the wrapper. The curcumin on the wrappers remains reactive for at least 5.5 months. The color caused by cyanide adulteration remains visible for at least 5.5. months.

Example 6

A gelatin containing curcumin was prepared as follows: 10 grams of dry gelatin were dissolved in 50ml of water at 65°C to give a 20% gelatin solution. 10ml of a 1% curcumin in ethanol solution was added quickly with vigorous stirring and the mixture was spread on aluminum foil and cooled to solidify. The product was a bright yellow gelatin film.

A 2 square inch piece of the above film was contacted with 20mg KCN powder. The film turned from light yellow to dark red within 25 minutes. This illustrates that drugs in gelatin capsules with curcumin will warn consumers of cyanide adulteration.

Example 7

It is to be understood that various warning messages, labels, diagrams, figures and the like may be provided with a food, drug or other oral composition. Thus, the chicken soup mix of Example 1 may be packaged in a pouch which may contain a printed warning thereon

such as "Warning. Do not consume this product if a red color appears.", or the like.

As a further example a recognizable warning symbol such as a skull and cross bones may be printed on the wrapper of Example 4 with a curcumin containing die. A yellow background may be produced by applying conventional food package dye to the wrapper obscuring the warning image until the wrapper is in the presence of or contacts a cyanide adulterated product. At this time the image printed with curcumin containing dye turns a red-orange color and becomes easily detectable.

I CLAIM:

1. A food, drug or other oral composition which detects and warns of the presence of cyanide therein, said composition comprising curcumin and having an original color, said curcumin being present in an amount sufficient to cause the color of at least a portion of said composition to change from the original color to a red-orange color when said curcumin is in the presence of cyanide, said color change being detectable by observation thereby providing a warning of the presence of cyanide in said composition.

2. The composition of claim 1 comprising curcumin in an amount between about 0.001 and about 0.1 percent by weight.

3. The composition of claim 1 wherein said composition is a liquid.

4. The composition of claim 1 wherein said composition is a solid.

5. A packaging material which detects and warns of the presence of cyanide in a food, drug or other oral composition which is packaged therein, said packaging material having an original color and comprising curcumin in an amount sufficient to cause the color of at least a portion of said packaging material to change from the original color to a red-orange color when said curcumin is in the presence of cyanide, said color change being detectable by observation thereby providing a warning of the presence of cyanide in said food, drug or other oral composition.

6. The packaging material of claim 5 wherein the curcumin is deposited on the side of the packaging contacting the food, drug or other product packaged therein.

7. The packaging material of claim 5 wherein the curcumin is incorporated into the packaging material.

8. The packaging material of claim 5 wherein said material comprises curcumin in an amount between about 2.0 and about 200 micrograms per square inch of material.

9. A consumable capsule which detects and warns of the presence of cyanide in a food, drug or other oral composition contained therein, said capsule comprising curcumin and having an original color, said curcumin being present in said capsule in an amount sufficient to cause the color of at least a portion of said capsule to change from the original color to a red-orange color when said curcumin is in the presence of cyanide, said color change being detectable by observation thereby providing a warning of the presence of cyanide in said food, drug or other oral composition.

10. The capsule of claim 9 wherein the curcumin is deposited on the side of the capsule contacting the food, drug or other product contained therein.

11. The capsule of claim 9 wherein the curcumin is incorporated into the capsule.

12. The capsule of claim 9 comprising curcumin in an amount between about 0.001 and about 1 percent by weight.

13. A method for warning of the presence of cyanide in a food, drug or other oral composition having an original color said method comprising incorporating curcumin in said composition in an amount sufficient to cause the color of at least a portion of said composition to change from the original color to a red-orange color when said curcumin is in the presence of cyanide and providing a means for warning against consumption of said composition when said red-orange color appears.

14. The method of claim 13 wherein said warning means is present on the material in which the food, drug or other oral composition is packaged.

15. The method of claim 13 wherein said warning means comprises a printed message.

16. The method of claim 13 wherein said warning means comprises a design.

17. The method of claim 13 wherein curcumin is incorporated in an amount between about 0.001 and about 1 per cent by weight of the composition.

18. A method for warning of the presence of cyanide in a packaged food, drug or other oral composition, said packaging having an original color, said method comprising incorporating curcumin in said package in an amount sufficient to cause the color of at least a portion of said package to change from the

original color to a red-orange color when said curcumin is in the presence of cyanide and providing a means for warning against consumption of said composition when said red-orange color appears.

19. The method of claim 18 wherein said warning means is present on the material in which the food, drug or other oral composition is packaged.

20. The method of claim 18 wherein said warning means comprises a printed message.

21. The method of claim 18 wherein said warning means comprises a design.

22. The method of claim 18 wherein said packaging is an edible capsule.

23. The method of claim 18 wherein curcumin is incorporated in an amount between about 2.0 and about 200 micrograms per square inch of the package.

24. A method for warning of the presence of cyanide in a packaged food, drug or other oral composition, said composition having an original color, said method comprising incorporating curcumin in said package in an amount sufficient to cause the color of at least a portion of said composition to change from the original color to a red-orange color when said curcumin is in the presence of cyanide and providing a means for warning against consumption of said composition when said red-orange color appears.

25. A system for warning of the presence of cyanide in a food, drug or other oral composition

having an original color, said system comprising a packaging means having an original color and comprising curcumin in an amount sufficient to cause the color of at least a portion of said composition or said packaging means to change from the respective original color to a red-orange color when said curcumin is in the presence of cyanide thereby warning of the presence of cyanide.

26. The system of Claim 25 further comprising a printed message means for warning against consumption of said composition when said red-orange color appears.

27. A system for warning of the presence of cyanide in a food, drug or other oral composition having an original color, said system comprising a food, drug or other oral composition having an original color and comprising curcumin in an amount sufficient to cause the color of at least a portion of said composition to change from the respective original color to a red-orange color when said curcumin is in the presence of cyanide thereby warning of the presence of cyanide.

28. The system of Claim 27 further comprising a printed message means for warning against consumption of said composition when said red-orange color appears.

INTERNATIONAL SEARCH REPORT

International Application No PCT/US89/00384

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(4): G01N 33/02 U.S. Cl: 436/1

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System [5]	Classification Symbols
U.S.	436/1,20,109; 426/97,88.

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [6]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category [15]	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
A,P	US,A,4,746,616 (Honigs et al.) 24 May 1988 See entire document.	1-28
A	US, A, 4,019,860 (Fischer et al.) 26 April 1977, See entire document.	1-28
A	US, A, 3,312,528 (McConnaughey) 04 April 1967, See entire document.	1-28

[15] Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [8]	Date of Mailing of this International Search Report [9]
20 April 1989	23 MAY 1989
International Searching Authority [10]	Signature of Authorized Officer [20]
ISA/US	T. J. Wallen