

CLAIMS

1. Material comprising a partially polar adsorbent solid support impregnated in a solution comprising vanillin.
2. Material according to claim 1, characterized in that the solution comprises ethanol.
3. Material according to claim 2, characterized in that the vanillin is at a concentration of at least 10%.
4. Material according to claim 3, characterized in that the vanillin is at a concentration range from 10 to 50%.
5. Material according to any of the preceding claims, characterized in that the support is paper.
6. Use of a material according to any of the preceding claims as colorimetric sensor for visually detecting the growth of microorganisms.
7. Use of a material according to the preceding claim, characterized in that the detection is carried out in the vapor phase without direct contact between the material and the microorganisms.
8. Use of a material according to claim 6 or 7, wherein the color change is visually noticeable when the concentration of microorganisms is equal or higher than 10 cfu per ml or mg of food.
9. Use of a material according to any of claims 6-8, characterized in that the detected microorganisms are molds, yeasts and/or bacteria.
10. Use of a material according to any of claims 6-9, characterized in that the detection of microorganisms takes place in a packaged product.
11. Use of a material according to the preceding claim, characterized

in that the packaged product is a food, pharmaceutical or cosmetic product.

12. Use of a material according to claim 10 or 11, characterized in that the package is formed by said material.

13. Use of a material according to claim 10 or 11, characterized in that said material adheres to the inner face of the product package by an adhesive.

14. Use of vanillin as a colorimetric reagent for visually detecting growth of microorganisms in the vapor phase.

The invention claimed is:

1. A smart package for detection of growth of microorganisms in a packaged product comprising a colorimetric sensor material positioned at an inner face of the package at an area not in contact with a product to be held in the package and exposed to atmosphere inside the package, said sensor material comprising a partially polar adsorbent solid support and vanillin impregnated in the solid support, wherein the sensor material exhibits a detectable color change when microorganisms are present in the package, caused by reaction of vanillin with compounds in vapor generated by metabolism of the microorganisms in the package, thereby indicating the presence of the microorganisms in a packaged product.

2. The smart package according to claim 1, wherein the solid support is paper.

3. The smart package according to claim 1, wherein the area of the package where the sensor material is positioned is transparent, permitting visually viewing the color change.

4. The smart package according to claim 1, wherein the sensor material is placed on a lid of the package, or adhered to the inner face of the package.

5. The smart package according to claim 1, wherein the sensor material forms a part of the package.

6. The smart package according to claim 1, wherein the sensor material is formed by impregnating the solid support in a solution having a concentration of vanillin of at least 10%.

7. The smart package according to claim 1, wherein the sensor material is formed by impregnating the solid support in an ethanol solution having a concentration of vanillin from about 10 to about 50%.

8. A method of detection of growth of microorganisms in a packaged product comprising:

holding a product in a smart package, said smart package having a colorimetric sensor material positioned at an inner face of a package at an area not in contact with the product and exposed to atmosphere inside the package, said sensor material comprising a partially polar adsorbent solid support and vanillin impregnated in the solid support; and

visually detecting a color change of the sensor material caused by reaction of vanillin with compounds in vapor

generated by metabolism of microorganisms in the package, thereby identifying the presence of the microorganisms in the packaged product.

9. The method according to claim 8, wherein the microorganisms include molds, yeasts and/or bacteria.

10. The method according to claim 8, wherein the color change is visually detectable at a concentration of microorganisms equal or higher than 10 CFU per ml or mg of the product contained in the package.

11. The method according to claim 8, wherein an intensity of changed color on the sensor material correlates with a concentration of microorganisms in the package.

12. The method according to claim 8, wherein the color change on the sensor material is irreversible.

13. The method according to claim 8, wherein the product contained in the package includes a food, pharmaceutical, or cosmetic product.

14. The method according to claim 8, wherein the sensor material is formed by impregnating the solid support in a solution having a concentration of vanillin of at least 10%.

15. The method according to claim 8, wherein the sensor material is formed by impregnating the solid support in an ethanol solution having a concentration of vanillin from about 10 to about 50%.

16. The method according to claim 8, wherein the solid support is paper.

17. The method according to claim 8, wherein the area of the package where the sensor material is positioned is transparent, permitting visually viewing the color change.

18. The method according to claim 8, wherein the sensor material is placed on a lid of the package, or adhered to the inner face of the package.

19. The method according to claim 8, wherein the sensor material forms a part of the package.