Optical biosensor for the detection of hydrogen peroxide in milk

Helena Vasconcelos, Ana Matias, Pedro Jorge, Cristina Saraiva, João Mendes, João Araújo, Bernardo Dias, Paulo Santos, José M. M. M. Almeida, Luís C. C. Coelho

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INESCTEC
ASSOCIATE LABORATORY
PORTUGAL

FCT Fundação para a Ciência e a Tecnologia

Outline

Hydrogen peroxide in milk

Hydrogen peroxide detection

Method principle

Experimental results

Conclusion

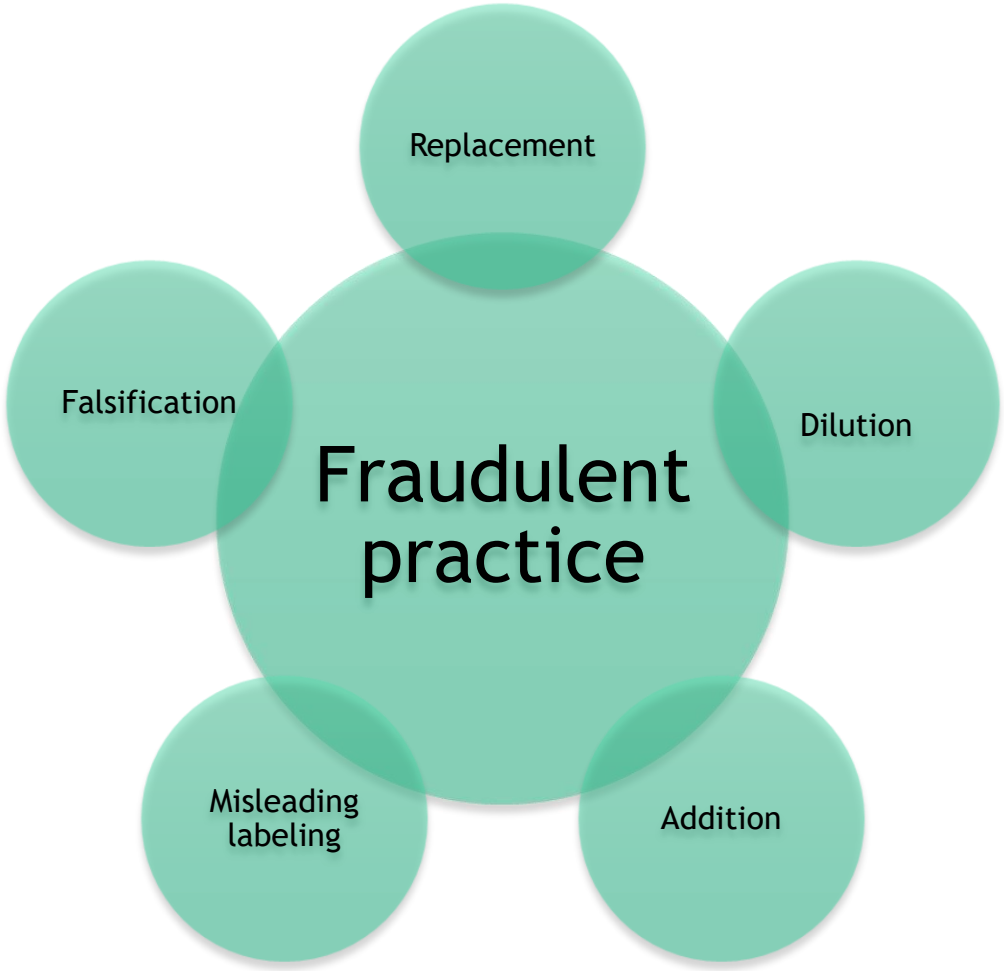
Objective

Detection of H_2O_2 using a hydroxyethylcellulose-based membrane

Hydrogen peroxide in milk

- Milk is one of the most complete foods for humans, containing nutrients including:
  - Carbohydrates;
  - Proteins;
  - Fats;
  - Minerals;
  - Vitamins.
- Owing to its rich composition, milk becomes a substrate for the growth of undesirable microorganisms that can easily deteriorate milk.

Hydrogen peroxide in milk



Scheme 1. Examples of food fraud

Hydrogen peroxide in milk

Examples of substances used as adulterants

- Hypochlorite;
- Formaldehyde;
- Potassium dichromate;
- Salicylic acid;
- **Hydrogen peroxide**

Is used in the dairy industry as an antimicrobial agent, thus helping preserve the raw milk in the absence of refrigeration.

Hydrogen peroxide in milk

Effects of adding hydrogen peroxide to milk

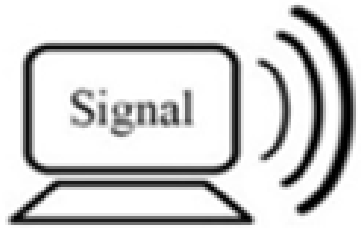
- Decrease in the nutritional value of the food, due to the destruction of vitamins A and E;
- Generates reactive and cytotoxic oxygen species, including hydroxyl radicals, that can initiate oxidation and damage nucleic acids, lipids and proteins;
- Milk can lead to negative effects on the health of the population, especially in individuals immunocompromised persons.

Hydrogen peroxide detection

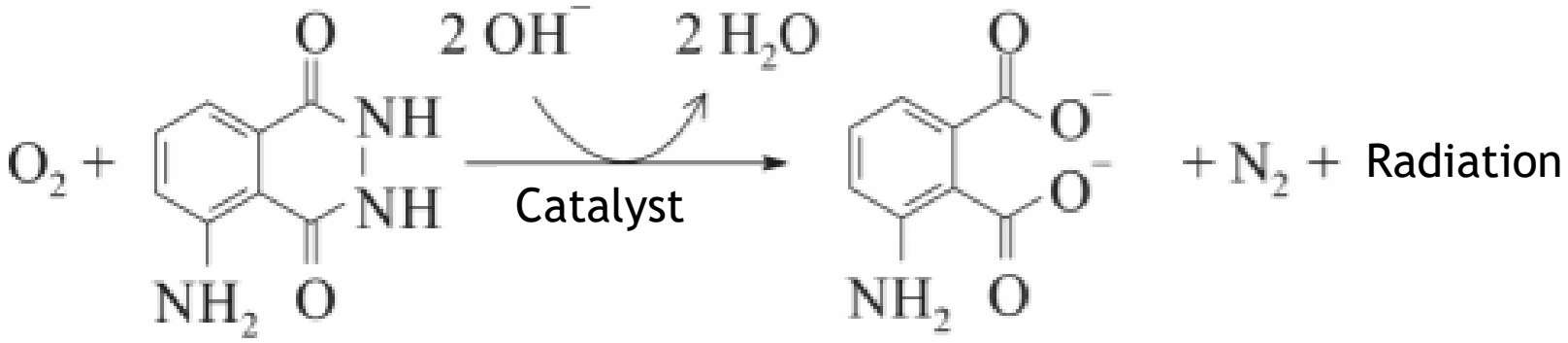
500µL of milk sample + H_2O_2

Cobalt chloride (II)
Luminol
EDTA
Sodium sulfate lauryl
Sodium phosphate tribasic
Hydroxyethyl cellulose

Membrane



Method principle



Luminol

3-aminophthalate

Experimental results

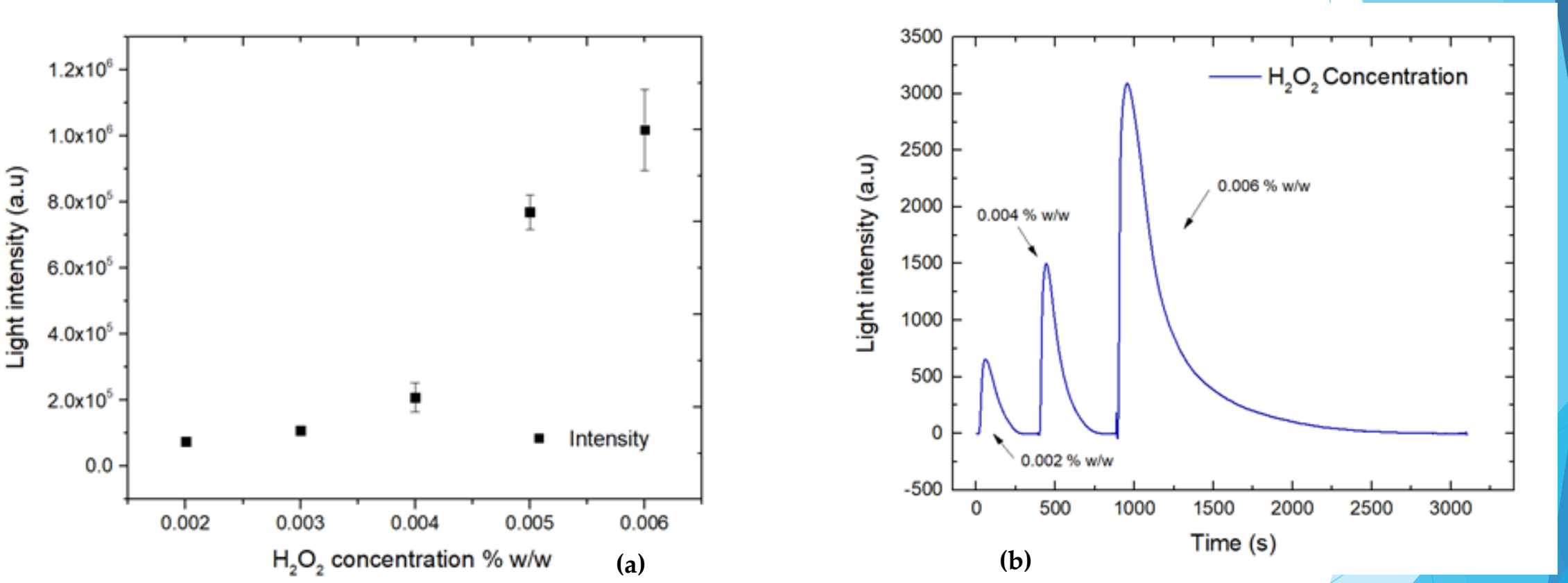


Figure 1.: (**a**) integral of the decay time for each H_2O_2 concentration; (**b**) Spectra showing the variation of the intensity of the light emission to the concentration 0.002, 0.004 and 0.006 %w/w as a function of the reaction time.

Conclusions

- As an application of this methodology, it was possible to detect H_2O_2 concentrations of 0.002% w/w to 0.006% in semi-fat milk, proving that the detection limit and linearity range of the proposed method are suitable for the analysis of milk samples in loco.

Acknowledgment

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Thank you for your attention