NEW METHOD FOR RAPID, SIMPLE AND EFFICIENT DETECTION OF NITRITES

DESCRIPTION OF THE TECHNOLOGY

Nowadays, there is a **dual need**:

On one side, the need to provide **new methods for the formylation of indolizines** that do not require highly-reactive and/or highly-toxic substances and do not require a precise the control of the parameters.

On the other hand, it is essential to have **efficient methods for detecting nitrites** due to the risk of their accumulation in both physiological and environmental systems. The intake of this anion can have a detrimental effect on the health of mammals, macro-invertebrates and most aquatic organisms. Nitrites are widely used as preservatives, protecting food from micro-organisms, but, in contrast, under acidic conditions in the stomach, they can give rise to highly carcinogenic compounds (gastric cancer).

To cover these needs, the **Institute for Organic Synthesis** (ISO) of the University of Alicante has developed a reaction of 1,3-disubstituted indolizines with the Eschenmoser salt that allows to obtain not the product of dimethylaminomethylation, but the one of a direct and regioseletive formylation at the position 7 of the indolizine ring. The reaction takes place in acetonitrile at room temperature, in the presence of sodium bicarbonate as a base (*see Figure 1*)

The resulting products have shown high selectivity in the detection of nitrite ions compared to other thirteen anions in an acidic medium. The presence of the nitrite ion with this test is manifested in solution with the appearance of a coloration ranging from reddish, more or less intense, to pinkish, depending on the concentration of the nitrite ion, while the rest of the anions present a pale yellow colour or are colorless (*see Figure 2*).

The **nitrite detection test** can be applied in solution (with more intense colouring), as well as on a white support, such as a cotton swab. For lower concentrations of nitrite, the presence of sodium chloride accelerates the appearance of the colour. This test has been successfully applied in the detection of 3 mg L-1 (3 ppm) of sodium nitrite in drinking water, an amount set by the World Health Organisation as a safe limit, as well as in the detection of nitrites as preservatives in various foods (e.g. Frankfurt sausages). Moreover, the test is equally effective in detecting the maximum amount of nitrite in drinking water set by the EPA (1 ppm, 1.45 × 10-5 M).

In short, a novel test for the rapid, simple and efficient detection of nitrite at low concentrations has been achieved.

MARKET APPLICATION SECTORS

The main sectors of application are the **pollution and environmental impact sector and the agro-food sector**, since this invention may represent a great progress in the detection of nitrites in water and food.

TECHNICAL ADVANTAGES AND BUSINESS BENEFITS

- The colour change in the procedure for detecting nitrites is immediate, except in the case of very low concentrations.
- The test can be applied in solution or on cotton swabs at a wider range of concentrations.
- No highly reactive or toxic substances are required.
- It only involves an organic substance at very low concentration 10-4 M.
- It does not require any exhaustive control of the process.
- No apparent generation of residues and/or harmful products.
- The high range of concentrations.
- Selectivity.

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CURRENT STATE OF DEVELOPMENT

Different methods of testing for nitrites have been developed on a **laboratory scale** with positive results in both drinking water and different foods.

INTELLECTUAL PROPERTY RIGHTS

This technology is protected by **patent application**.

- Title of the patent: “Formilación de indolizinas y detección de nitritos”
- Application number: P202030552
- Date of application: 9/06/2020

COLABORATION SOUGHT

The Institute for Organic Synthesis (ISO) is looking for companies interested in acquiring this technology for **commercial exploitation** through patent licensing agreements.

RELATED IMAGES

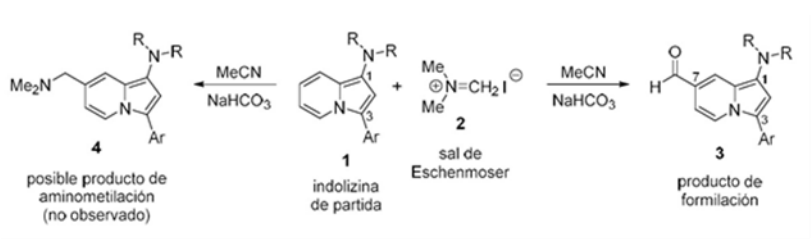

Figure 1: Reaction of an indolizine of general structure (1), substituted at the positions 1 and 3, with the Eschenmoser’s salt (2) in the presence of sodium bicarbonate. The typical product of dimethylaminomethylation (4, not formed) and the formylation product (3, observed) are shown.

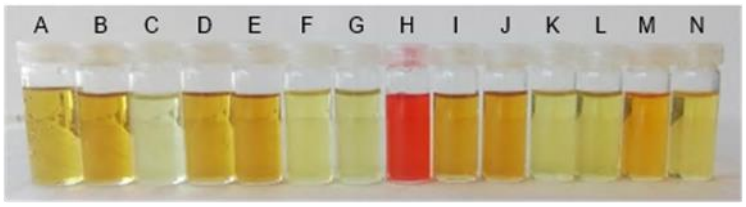

Figure 2: Nitrite ion selective detection test (NaNO2, reddish solution), against thirteen anions, using a formylindolizine in acidic medium. Salts: KCN, PhCO2K, KF, KCl, KBr, KI, KOAc, K2P4O7, K3PO4, KH2PO4, NaN3, K2S y NaHS. All concentrations are 10–4 M.

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