A new non-invasive method for the diagnosis and prevention of colorectal cancer

DESCRIPTION OF THE TECHNOLOGY

The research group of "Atomic - mass spectroscopy and analytical chemistry under extreme conditions" of the University of Alicante, in collaboration with the General University Hospital of Alicante, has developed a device adapted for the qualitative and quantitative analysis of volatile organic compounds (VOCs) in solid and/or semi-solid samples, which consists of the following three elements (Figure 1):

1. A headspace adsorptive magnetic extraction device comprising an inert container for depositing the sample. The container comprises a lid and two magnets, one located in the lower part of the lid, which comprises a magnetic sorbent containing a nanomaterial with graphite oxide and iron oxide supported on the magnet, and; another located in the upper part of the lid. This device is configured to be coupled with the next one;
2. A thermal desorption system coupled to a gas chromatograph-mass spectrometer that provides a qualitative analysis of VOCs, relating the position of the peaks and their retention time to the identification of VOCs, and quantitative analysis, evaluating and calculating the area of each peak;
3. A mass spectrometer that provides qualitative and quantitative analysis of VOCs as a function of the mass to load ratio of VOCs.

The headspace adsorptive magnetic extraction device allows the volatilisation of VOCs from a sample, subjected to a certain temperature. The volatile compounds in the headspace are subsequently retained in an adsorbent trap, which is then desorbed and injected for separation and detection by gas chromatography-mass spectrometry.

This apparatus allows the extraction, identification and quantification of VOCs (P-cresol, 1H-indol, 3(4H)-dibenzofuranone or tetrahydrofolate) from stool samples, known as biomarkers in subjects suffering from colorectal cancer (CRC), or in subjects who are predisposed to suffering from CRC, to provide a prognosis of the subject's condition or to provide a negative prognosis.

Therefore, this device can be used as a rapid, effective, selective and non-invasive ex vivo diagnostic method of CRC in a very large number of subjects. To do so, the following steps should be followed:

I. Obtain a stool sample from the subject;
II. Extract at least one VOC contained in the sample and identify and quantify the concentration of this VOC with the chromatograph through its retention time and mass spectrum;
III. To compare the concentration of at least one VOC with the concentration of a reference of the characteristic compound in a non-cancer individual sample, where the increase or decrease in the concentration of the biomarker compared to the reference is indicative that the subject is suffering from, or has a predisposition to, cancer, or provides a negative prognosis of the subject's condition.

A typical chromatogram of a subject's ex vivo sample may contain all four of the biomarker compounds cited, in both CRC and healthy control patients.

MARKET APPLICATION SECTORS

The technology described can be used as a method of diagnosis and prevention of CRC. More specifically, this technology is useful to extract and perform accurate, simple, sensitive and effective analysis of VOCs for application as a non-invasive screening test for CRC.

TECHNICAL ADVANTAGES AND BUSINESS BENEFITS

The main advantages of the technology described are as follows:

- The developed methodology allows a reliable, effective, reproducible and fast analysis of VOCs (biomarker compounds) in solid and/or semi-solid samples.
- It has good sensitivity and selectivity.
- It is a non-invasive ex vivo diagnostic methodology for CRC.
- Useful for a very large number of subjects.
- Environmentally friendly use.
- The sorbent used can be reused after a stage after adequate cleaning, which improves its economic profitability and its use at a commercial level.

CURRENT STATE OF DEVELOPMENT

The technology is developed at laboratory scale and has been used for the diagnosis of CRC in stool samples.

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INTELLECTUAL PROPERTY RIGHTS

This technology is protected by a patent application with title “Apparatus and methods for the diagnosis of colorectal cancer". Application number: P202030487; Application date: 26 May 2020.

COLLABORATION SOUGHT

Companies (mainly, medical diagnostic laboratories and analytical instrumentation companies) interested in acquiring this technology for commercial exploitation through patent license agreements or R&D projects to develop new applications for other types of diagnostics.

RELATED IMAGES

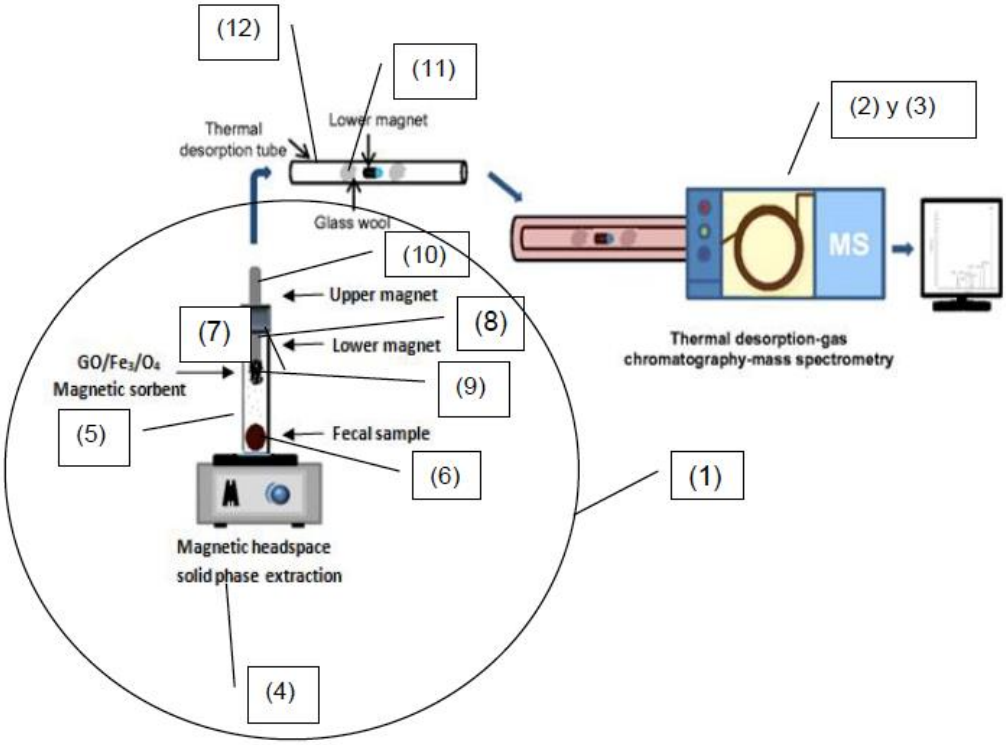

Figure 1. *Schematic diagram of the devices used to carry out the analysis, being (1) headspace adsorptive magnetic extraction device; (2) gas chromatograph; (3) mass spectrometer; (4) apparatus for applying temperature and producing magnetic agitation; (5) inert container; (6) solid/semisolid sample; (7) lid; (8) magnet; (9) sorbent supported on the magnet; (10) magnet; (11) glass wool; (12) glass tube.*

CONTACT DETAILS

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