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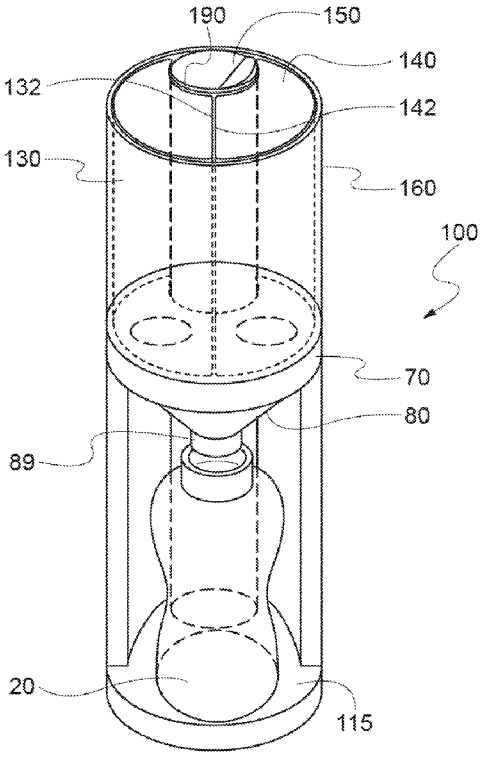


Fig. 1

(57) Abstract: Object of the invention is a system for preparing beverages based on substitutes of breast milk and/or powdered products or the like, where the system comprises: - at least one refillable container (130, 140) of beverage preparation; and - a machine (100) provided with a water line starting from a tank (150) and ending with an outlet (89), where the machine (100) further comprises a support (160) adapted to house said at least one container (130, 140) and a dosing unit (70) adapted to receive at least one beverage preparation, characterized in that: - said at least one container (130, 140) of beverage preparation is introducible in said machine (100) for preparing a beverage; - the tank (150), the support (160) and the container (130, 140) are removable from the machine (100) and washable and in that the container (130, 140) contains at least two doses of beverage preparation.

SYSTEM FOR THE PREPARATION OF DRINKS

DESCRIPTION OF THE INVENTION

Object of the invention is a system for preparing beverages based on substitutes of breast milk and/or powdered products or the like.

In particular, object of the invention is a system comprising a machine for producing beverages, for example but not exclusively, milk-based beverages for children, by adding powdered formulations to a liquid, preferably water, and such to avoid the risk of bacterial contaminations and maintain asepsis.

As it is known, asepsis is a process finalized to prevent the contamination by microorganisms of substrates previously sterilized.

Automated machines or devices for producing beverages are known in the art.

Such known machines are designed for preparing beverages by adding appropriate quantities starting from powdered formulations at different temperatures.

In most of the known solutions there is the need to maintain storages of water and to use dosing units and mixers.

The risks existing in using mixers in closed devices, within which visualizing the possible permanence of product residues is difficult or impossible, are mentioned in different health reports.

In general, known mixers are neither washable, nor removable.

Thus, from what has been previously described it is understood that the use of mixers involves a high risk of contamination and accumulation of bacteria, thereby making critical the hygiene inside them.

Also in case the devices provide for automated washing systems, still remains the possibility that the walls of the mixer continue to house bacteria.

Another known system for sterilizing such devices is to use ultraviolet radiations.

Ultraviolet radiations produce an exponential decrease of the number of vegetative cells or viable spores, depending on the irradiation time.

However no precise information exists on the susceptibility of different microbial species to UV radiation: different strains can have different resistance.

The ultraviolet (UV) portion of the spectrum includes all the radiations from 15 to 390 nm. Wavelengths around 265 nm are those having higher bactericidal efficacy (200 - 295 nm). UV light has little ability to penetrate the matter, therefore only microorganisms on the surface, that are directly exposed to the action of the UV light, are susceptible to be destroyed.

However, the use of UV radiations as a sterilization method in devices for preparing beverages, has anyway a number of drawbacks including the fact that UV disinfection process depends on the availability of electric power. In fact, in case of an interruption of electricity, an alternative disinfection system is necessary.

Furthermore, as mentioned, microorganisms absorb the UV radiation in a different way and not all of them are necessarily destroyed by such radiation.

However, anyway a risk of contamination when water is stagnant remains.

It is also known that the childhood is the period of life with the highest

nutritional demand because the body weight of the child doubles between the first 4 and 6 months of life and triples at the end of the first year of life. Therefore, children are one of the more vulnerable segments of our society. Thus, in order to achieve their optimal nutrition, the research should move towards the improvement of their health and quality of life, not only to achieve immediate benefits. The Applicant is of the opinion that infants, which for any reason cannot be breastfed, should have the same benefits by taking a formulation of substitutes of breast milk adapted to provide the necessary nutrients to them all to assure their physical development and, in particular, their neurological system, similar to that they could have with breast milk. Scientific research in the field of infant nutrition allowed establishing the optimal values of proteins, carbohydrates, fats, vitamins and minerals, in each of the various steps of the children growth. Recent advances allowed understanding the importance of other nutrients to promote a better development in the children in the various organic functions, at the level of the nervous system, sight, immune system, ossification and growth. Amongst these there are the Omega 3 and 6 fatty acids, the best sources of lipids, the nucleotides, iron, taurine, carnitine and choline. The importance of including specific nutritional substances in the formulations for infants has been evaluated in studies by infant nutrition experts, highlighting the participation in development processes of the brain, learning, receptive and expressive language, and visual development.

The food for children comprises a wide range of different matrices: infant food without fats are based on fruits and vegetables (with fat

content lower than 2%), fatty food is based on meat / eggs / cheese and cereal products with varying fats content. Furthermore, breast milk and adapted formulas of substitutes of breast milk, are included. This food has high added nutritional value complemental to milk, contributes to the appropriate energy balance for an optimal growth of the child. Currently, technology achieved a development stage sufficiently important to offer products having high nutritional quality. On the other hand, industrial processes used in preparing this food are particularly aggressive and there are no controls of their effects concerning the food contamination or destruction or depletion of original ingredients. In the last years there has been an increasing interest in understanding, as precisely as possible, the deterioration and contamination food inevitably undergoes during the elaboration, packing and distribution processes, mainly imposed by the requests of health authorities of the various countries by advanced health legislations.

Determination of the four fat-soluble vitamins A, D, E and K, in their different forms, as well as carotenoid β-carotene, that has an activity in vitamin A, has been addressed. Within the group of hydrosoluble vitamins, a representation of the vitamins of group B, thiamine (vitamin B) and its esters, has been identified. All of these vitamins have been determined in different types of functional food, such as dairy products, fermented milks, vegetable food and functional juices or ACE juices. Infant food, cereals and formulas have been examined. Finally, an analysis of nutraceuticals and dietetic supplements containing natural ingredients, normally extracted from plants or fruit, minerals and vitamins, representing the latest advances in nutritional science for a

good health, has been made.

The Applicant has observed that levels of vitamin in food can be as low as some micrograms per 100 grams and often go with a large number of compounds with similar chemical and physical properties. When it is desirable to determine the levels of vitamins in food it is thus necessary to separate vitamins, as well as interfering substances, one from another. Vitamins are generally labile compounds and many are sensitive to oxidation and rupture of the molecule when exposed to oxygen, heat or UV radiation. Most of the essential vitamins are obtained by the balanced intake of natural food. The statement that vitamins cannot be produced by the body is valid for many of them, but it is not strictly true for others. For example, vitamin D can develop in the skin after an adequate exposure to ultraviolet radiation, vitamin K is normally produced in sufficient amount by intestinal bacteria, and niacin can be synthesized in vivo from a precursor amino acid, L-tryptophan. Plants are able to synthesize most of vitamins and serve as a primary source of these essential nutrients. Fruit and vegetables are important sources of vitamins. In countries with inadequate or non-balanced diets, or with particular deficits, typical diseases caused by deficiency of vitamins appear. Examples of common diseases are xerophthalmia, rickets, beriberi, pellagra and scurvy, derived by deficiency of vitamin A, vitamin D, thiamine, niacin and vitamin C, respectively. The lack of one member only of vitamin B is rare in humans as these vitamins are widely found together in nature. Vitamin A has a very important role in sight. It is excellent for the night vision. Furthermore it collaborates in fighting against infections of the body when the immune system grows stronger. Food with

high vitamin A content is: high quality milk, liver, fruit and orange vegetable (melon, carrots, potatoes) and vegetables with dark green leaf (cabbages and spinaches).

Vitamins B consist of a large complex: B: B1, B2, B6, B12, niacin, folic acid, biotin and pantothenic acid. They are important for the metabolic activity; this means they aid in producing energy and releasing it when the body is in the need thereof. They are also involved in manufacturing the red blood cells responsible for carrying oxygen round the body. Food that is rich in vitamin B is: whole-wheat cereals such as wheat and oats, fish and seafood, meat, eggs, dairy products, such as milk and yogurt, green leafy vegetables, beans and peas.

Vitamin C is important to maintain tissues of the body, such as gums and muscles, in good condition. It is also fundamental because it aids the healing and collaborates in fighting against infections. Food that is rich in vitamin C is citrus fruit such as oranges, melon, strawberries, tomatoes, broccoli, cabbages, kiwis and red peppers.

Vitamin D prevents bone issues. Furthermore, it is also excellent in forming strong teeth and aids the body to absorb the calcium it needs. This vitamin is produced in the skin when exposed to sun light. Food that has high vitamin D content includes fortified milk, fish, egg yolk, liver and high quality cereals.

Vitamin E protects cells and tissue so that they are not damaged. It is also important for the health of red blood cells. Food that is rich in vitamin E is: whole-wheat cereals such as wheat and oats, wheat germs, green leafy vegetables, vegetable oils, such as sunflower oil and olive oil, egg yolk, dried fruits and seeds. Vitamin K is responsible for the

coagulation. Food that has high vitamin K content is: green leafy vegetables, dairy products such as milk and yogurt, broccoli and soybean oil. Stability of vitamins is very important when nutritional value of food is considered. Processing and storage produce losses depending on conditions such as pH, temperature and humidity. Niacin and biotin are relatively stable, but the other hydrosoluble vitamins are labile in variable extents and different low conditions. Riboflavin is notoriously susceptible to decomposition due to the light. During home cooking, hydrosoluble vitamins are easily leached in water or in water with cooked meat that has been removed. In case of vitamin C, the rapid heat treatment, such as in recycling fruits and vegetables or pasteurized fruit juice, serves to prevent the loss of vitamins during post-processing storage by inactivated enzymes promoting direct oxidation of ascorbic acid. The term "bioavailability", when applied to vitamins in human nutrition, refers to proportion of the amount of vitamin ingested with food absorbed by the intestine and used by the body. The vitamin can be converted to a form having biochemical function. In alternative, the vitamin can be metabolized in the cell in a non-functional form for its excretion or simply stored within the cell for future use. Bioavailability has not to be confused with stability of the nutrient. While food is transformed it can cause the loss of labile vitamin; bioavailability of the remaining amount of vitamin is not necessarily altered, but it is also influenced by a great number of parameters.

Thus, there is the need to understand the exact composition of substitutes of breast milk to administer to infants.

Object of the present invention is to solve the above mentioned issues

by a system for preparing beverages allowing making and maintaining asepsis in preparing beverages.

Another purpose of the invention is to make a system easy to disassemble, allowing the complete removal and washing of its component parts.

Another object of the present invention is detecting and visualizing the amount of glucose, vitamins, gluten, proteins, in order to obtain data improving the nutritional phase of infants, with the purpose of early identifying possible issues.

Finally, another object of the present invention is to provide a system for preparing beverages based on substitutes of breast milk and/or powdered products or the like, that is able to detect possible contaminants before consumption of the products.

Said objects are achieved by a system for preparing beverages based on substitutes of breast milk and/or powdered products or the like, where the system comprises:

- at least one refillable container of beverage preparation; and
- a machine provided with a water line starting from a tank and ending with an outlet, where the machine further comprises a support adapted to house said at least one container and a dosing unit adapted to receive at least one beverage preparation, characterized in that:
- said at least one container of beverage preparation is introducible in said machine for preparing a beverage;
- the machine comprises one sensor provided with a receiver having a surface for detecting substances in the beverage and a transducer for converting the signal obtained from the receiver to an electric signal.

Preferably, the tank, the support and the container are removable from

the machine and washable and the container contains at least two doses of beverage preparation.

Amongst the advantages of the invention it can be included that it allows to easily remove the main components of the machine with the purpose of washing them, thus resulting in the asepsis for the various components, in particular by removing possible residues from the components of the machine, as well as by disassembling and washing the water tank, the latter of which allows avoiding issues due to stagnant water.

According to another embodiment of the invention, a conical element is provided to channel the beverage coming from the outlet of the water line towards a bottle, where the conical element is not constrained to the machine.

An advantage of such embodiment is that it allows easily washing the conical element.

Preferably, said at least one sensor is a biosensor.

Conveniently, said at least one biosensor comprises an enzyme named glucose oxidase (GOD) that, when contacting the glucose, triggers an enzymatic reaction adapted to produce hydrogen peroxide (H2O2) causing current fluctuations in a circuit of constant current. A biosensor is defined as a compact analysis device incorporating a biological (nucleic acid, enzymes, antibodies, receptors, tissues, cells) or biometrical (PIM, aptamers, PNA) recognition element, associated with a system allowing the transduction process of the signal produced by the interaction between the recognition element and the analyte.

Advantageously, said at least one biosensor is an amperometric biosensor.

Preferably, said biosensor is designed to detect at least one from

fructose, fats, gluten, proteins and vitamins.

Preferably, the detecting surface of the receiver comprises graphene, graphene oxide or reduced graphene oxide.

Conveniently, the measures the transducer detects are obtained by electrochemical impedance.

Advantageously, the biosensor comprises nanoparticles of magnetite coated with carbon.

Alternatively, the sensor is an optical sensor provided with a detecting surface comprising graphene oxide and a plurality of quantum dots interacting with the graphene oxide in order to detect microorganisms or microbial toxins by fluorescence.

Advantageously, the detecting surface of the receiver comprises graphene, graphene oxide or reduced graphene oxide.

Conveniently, the measures the transducer detects are obtained by electrochemical impedance.

Preferably, the sensor is an aptasensor.

Preferably, the sensor is an optical sensor provided with a detecting surface comprising graphene oxide and a plurality of quantum dots interacting with the graphene oxide in order to detect microorganisms or microbial toxins by fluorescence.

According to another embodiment of the invention, the machine comprises a removable and washable funnel-shaped element comprising at least one circumferential inlet for the water coming from the tank, where the funnel-shaped element is adapted to channel the water to the outlet of the water line.

According to another embodiment, the system comprises a sterile box for

carrying containers of beverage preparation and a device for making vacuum in the sterile box.

According to another embodiment of the invention, the device for making vacuum in the sterile box is included in the machine.

According to still another embodiment of the invention, the device for making vacuum is external to the machine.

According to another embodiment of the invention, the machine provides for a cylindrical support to house containers of beverage preparations, where the containers have such a crescent shape that, when coupled one to another, a hole is left open to house part of the water tank between them. An advantage of such an embodiment is that it allows a greater compactness of the machine, in other words a smaller bulk.

According to another embodiment of the invention, the dosing unit is designed to switch from a position in which it is adapted to receive the beverage preparation, to a position in which it is adapted to transfer the beverage preparation to the conical element.

Amongst the advantages of the invention it can be included the fact that it allows obtaining the direct passage to the bottle of the elements of the beverage, without contaminations with the outside, by maintaining asepsis and without mixers as stated by the health care organizations.

According to another embodiment of the invention, the dosing unit provides for a modular arrangement comprising a body movable between the first and the second position, where the body is contained between an upper plate and a lower plate.

An advantage of this embodiment is that it allows easing the transfer of the beverage preparation to the dosing unit.

According to another embodiment of the invention, the water line provides for a peristaltic pump.

An advantage of this embodiment is that the contact of water with elements of the pump is avoided. According to another embodiment of the invention, the water line provides for an electric coil for heating water up to a temperature comprised between 70°C and 75°C.

According to another embodiment of the invention, the container can contain at least two doses of beverage preparation, where a dose comprises at least 70 grams of products.

According to another embodiment of the invention, the container has a capacity selected from 500 to 1500 grams of products.

According to a further embodiment of the invention, the capacity of the tank can be selected in the range from 500 to 750 ml.

According to a further embodiment of the invention, the capacity of the container of beverage preparation is equal to 9 grams per each 30 ml water of the tank.

Further characteristics and advantages of the invention can be deduced from the dependent claims.

Further characteristics and advantages of the invention will become apparent from the following description given by way of non-limiting example, with the aid of the figures illustrated in the attached drawings, in which:

- Figure 1 depicts an axonometric view of a machine for preparing beverages, according to an embodiment of the present invention;
- Figure 2 depicts a group of containers for use in the machine of the invention, which are grouped in a sterile box for carrying thereof;

- Figure 3 depicts an exploded view of a dosing unit belonging to the machine of Figure 1; and

- Figure 4 depicts a top view of the dosing unit of Figure 3;

- Figure 5 depicts a diagram showing the reaction kinetics of a biosensor used in the machine according to the present invention; and

- Figure 6 depicts a diagram showing the oxidation on the working electrode by applying potentials higher than 0.6 V of the Py monomer.

Object of the present disclosure is a system for preparing beverages, comprising a machine wherein a first embodiment thereof is globally denoted with the numeral reference 100 in Figure 1.

The machine 100 has a support 115 able to house a bottle 20 to be filled with the prepared beverage, as well as a tank 150 of water (or other liquid adapted for preparing a beverage). The tank 150 also provides for a filter, for example a microbial filter or the like.

Around the upper portion of the tank 150, two refillable containers 130, 140 of powdered preparations, or in other form, and adapted to supply the ingredients for preparing the beverage, have been placed.

The containers 130, 140 are in turn housed within a cylindrical vessel 160 and have a substantially crescent shape so that, when coupled one to another, a hole 190 is left open to house part of the water tank 150 between them.

In particular, each container 130, 140 has a respective surface 132, 142, where the surfaces 132, 142 are specular to one another.

Below the containers 130, 140, a support 60 and a dosing unit 70 are provided. Furthermore, below the dosing unit 70, a conical element 80 channeling the beverage towards the bottle 20 by its own outlet 89, is

provided. The conical element 80 also has a mouth for the inflow of water coming from the tank 150 and the input of the beverage preparations.

The dosing unit 70 will be better described with reference to Figures 3 and 4.

In the machine 100, a water line starting from the tank 150 and reaching upstream the conical element 80, which in turn is ending with its own outlet 89 towards the bottle 20, is provided. The conical element 80 thus has at least one mouth for the inflow of water coming from the water line.

In general, and as better described below, the tank 50, the containers 130, 140, the support 60 and the vessel 160 are removable from the machine 10 and washable.

In a first embodiment of the invention, the conical element 80 is not constrained to the machine 100.

In an embodiment of the invention, the machine 100 comprises a removable and washable funnel-shaped element comprising at least one circumferential inlet for the water coming from the tank 150, where the funnel-shaped element is adapted to channel the water to an outlet 89 of the water line.

Thus, the machine 100 is provided with a water line starting from the tank 150 and ending with the outlet 89.

From the outlet 89 of the water line, the water enters the conical element 80.

According to a further embodiment of the invention, the capacity of the tank 150 can be selected in the range from 500 to 750 ml.

According to a further embodiment of the invention, the capacity of the container of beverage preparation is equal to 9 grams per each 30 ml

water of the tank.

Thus, in general, the containers 130, 140 contain more than one dose of beverage preparation.

In particular, one dose comprises at least 70 grams of products.

According to another embodiment of the invention, the containers 130, 140 can have a capacity selected from 500 to 1500 grams of products.

In Figure 2 a group of containers 130, 140 is also shown for use in the machine of the invention, which can be arranged, due to their standardized shape, in a sterile box 195 of containment 90 for carrying them.

In general, the system of the invention can comprise the sterile box 195 for carrying the containers 130, 140 of beverage preparation and a device for making vacuum in the sterile box 195.

According to an embodiment of the invention, the device for making vacuum in the sterile box 195 is included in the machine 100.

Still according to another embodiment of the invention, the device for making vacuum is external to the machine 100.

Figure 3 depicts an exploded view of the dosing unit 70 belonging to the machine 100 of Figure 1.

The dosing unit 70 is structured so that it can be disassembled and washed and firstly it comprises, for this purpose, an upper plate 71 and a lower plate 72 where, between the upper plate 71 and the lower plate 72, a body 75 substantially shaped as a triangle with rounded corners and adapted to accomplish rotation movements around its pin 79, is provided.

The upper plate 71 has mouths 73 and 74 adapted to respectively receive the containers 30, 40, as well as a hole 81 engaging the pin 79 present on the body 75 of the dosing unit 70.

The body 75 of the dosing unit 70 has a through hole 77, as well as a hole 83 adapted to engage an eccentric upper peg 86 placed on a rotating element 76.

The rotating element 76 has, on one side facing the body 75 of the dosing unit 70, the eccentric upper peg 86 and, on one side facing the lower plate 72, one non-eccentric lower peg 87.

The lower peg 87 of the rotating element 76 is, in turn, adapted to engage a hole 85 of the lower plate 72.

The lower plate 72 further has a through hole 78 for the outflow of the product and a hole 84 for the engagement with a pin (not depicted for simplicity) of the body 75 of the dosing unit 70.

With reference to Figure 4 depicting a top view of the dosing unit of Figure 3, it will be now illustrated the operation thereof.

When the machine 100 is activated, the beverage preparation contained in the first container 130 can be brought down, for example by gravity, in the through hole 77 of the body 75 of the dosing unit 70.

This phenomenon can take place by rotating the body 75 of the dosing unit 70 in the direction of arrow F1 of Figure 4 by the use of a motor (not shown) which drives the rotating element 76 so that the lower peg 87 of the rotating element 76 rotates in the hole 85 of the lower plate 72, while the eccentric upper peg 86 of the rotating element 76, engaging the hole 83 of the body 75, makes it rotate by a certain angle, by taking advantage of the pin 79 introduced in hole 81 of the upper plate 71, so that the through hole 77 of the dosing unit 70 is on the vertical line of the mouth 73.

In such a way, the preparation contained in the first container 130 falls

from it, through the mouth 73, into the hole 77 of the body 75 of the dosing unit 70.

The preparation now present in the hole 77 of the dosing unit can then be led, still by rotating the body 75 of the dosing unit 70 in an opposite direction, towards the hole 78 present on the lower plate 72, so that it falls in the underlying conical element 80.

In the same way, by rotating the body 75 of the dosing unit 70, it can be led to a position in which the mouth 74 is on the vertical line of the hole 77, so that the preparation contained in the second container 140 falls through the mouth 74 in the hole 77.

In such a case, the motor drives the rotating element 76 in the opposite rotation direction, in such a way that the body 75 of the dosing unit 70 rotates in the direction of arrow F2 of Figure 4.

Also in this case, the preparation present in the hole 77 of the dosing unit 70 can be led towards the hole 78 present on the lower plate 72, so that it falls in the underlying conical element 80.

The steps described for emptying the containers 130, 140 can also be assisted be means that vibrate the machine 10, or the dosing unit 70 only, when the dosing unit 70 is in one of the two loading positions.

The withdrawal of powders from the containers 130, 140 can be eased by the use of a cannula (not shown).

At the same time of the fall of the preparation in the conical element 80, the water contained in the tank 50 can be brought by a pump (not depicted for simplicity), making it flow through a side opening in the conical element 80.

The water can be heated, for example by an electric coil, so that it

reaches 70-75°C.

It is recommended to sterilize the water by boiling the use thereof. In particular, for sterilization the whole quantity of water to be used is boiled.

The use of mineral water suitable for ingestion at 30-40°C is also possible.

According to a preferred embodiment, for a better sterilization, the water line can comprise a peristaltic pump so that the water does not contact any element of the pump.

In such a way, both the preparations of the containers 130, 140 are added together with water for making the beverage falling into the bottle 20.

According a further embodiment of the invention, within the machine 100 at least one sensor provided with a receiver having detecting surface and a transducer for converting the signal obtained from the receiver to an electric signal, is provided.

In detail, the sensors can be biosensors.

A biosensor is defined as a compact analysis device incorporating a biological (nucleic acid, enzymes, antibodies, receptors, tissues, cells) or biometrical (PIM, aptamers, PNA) recognition element, associated with a system allowing the transduction process of the signal produced by the interaction between the recognition element and the analyte.

In a first case, the biosensor comprises amongst its components an enzyme named glucose oxidase (GOD) that, when contacting the glucose, triggers enzymatic reaction producing hydrogen peroxide (H_2O_2). The presence of this substance causes current fluctuations in a circuit of constant current and these fluctuations are those that allow quantifying the

amount of glucose present in the sample. This is a type of indirect measure because what is recorded is the current fluctuation generated by hydrogen peroxide. Thus the biosensor has a double function: on one side it causes a chemical reaction through its components; and on the other side, it behaves as an electrode assisting in recording fluctuations of the current flow caused by such a reaction.

In the system according to the present invention amperometric biosensors, which are developed in order to detect at least one from fructose, fats, gluten, proteins and vitamins, are also present.

Preferably, the biosensor can be a miniaturized amperometric biosensor. Based on the same technology developed for the biosensor of the glucose, the Applicant developed devices for determining other analytes such as the fructose, fats, gluten, proteins and vitamins. A key to this type of biosensor is the use of nanoparticles coated with carbon. Synthesizing a magnetite nanoparticle, an iron oxide, that in addition to its magnetic properties is able to accelerate some chemical reactions.

For manufacturing this nanoparticle a simple and low cost method has been invented. It is a high energy "grinding" consisting of introducing hematite (the most common iron oxide) together with powdered carbon and steel beans in a mill rotating at appropriate speeds.

The proportion of precursor materials is such that nanoparticles of magnetite coated with carbon are obtained after a few hours.

Furthermore, incorporating the conductive material such as carbon allows recording a better response in terms of speed and reaction, which is in the range of 10 to 12 seconds, the same time the routine measuring apparatuses on the market have. In figure 5 for purposes of illustration

the reaction kinetics of the biosensor is shown.

For what concerns the biosensors with enzyme it has to be noticed that, in order to keep the enzyme active, the enzyme is necessarily immobilized by:

a) absorbing, by contacting the biomolecules (b) with an absorbent material for a certain period

b) entrapping the biomolecule (b) in the biological material, only permeable to the analyte, and in the products of the recognition reaction.

c) forming covalent links between the biological material and the sensor surface.

The biological material has been immobilized over amperometric chips manufactured by silicon microelectronics technology; this type of transducers allows using minimal amounts of reagents, especially enzymes, and this is lowering the cost of analyses.

There are different parameters for determining the quality, of what should be highlighted, such as sugars, ethanol, polyphenols, gluconic acid, malic acid, etc., are routinely determined by refractometry or by their reduction employing an alkaline solution of copper salts.

Basically, this step consists in making cyclic voltamperograms, in a KCl solution 0.1 mol/dm3 between - 1.2 V and -2.2 V, at 100 mV/S, generating gaseous hydrogen on the electrode surface, eliminating the adhering particles, thus obtaining its activation.

Electropolymerization of a pyrrole and mediator pre-layer.

Best results are obtained upon deposit of a PPy pre-layer.

With this purpose, the amperometric microsensor has been introduced in a LiCIO4y 0.1 mol/dm3 and Py 0.05 mol/dm3 aqueous solution, and a cyclic dragging of potential between 0 V and 0.8 V at a speed of 10 mV/s has

been made.

The use of conductive polymers is very useful for the enzymatic immobilization on the microtransducer, allowing to direct the formation of polymeric layers over surfaces of little sizes in a very simple way.

The Py monomer is able to oxidize on the working electrode by applying potentials higher than 0.6 V, as shown in figure 6.

The employed mediators, FeCN and MB, have been immobilized on the electrode in the formation process of this pre-layer. In both cases, the suitable amount of each mediator has been added to the employed pyrrole solution.

It has to be noted that in case of use of MB as mediator, it is necessary to implement the dissolution of PPy, LiClO4 and MB in an aqueous solution with 16% methanol, with the purpose of facilitating the dissolution.

The nanoparticles can generally be incorporated in the analytical process in the following forms:

1. As such, by maintaining an individual identity or forming heaps.

2. Chemically bonded on a surface.

3. Incorporated in an inert solid, which bonded together, are used in manufacturing electrodes.

4. Functionalized with inorganic, organic and biochemical compounds for increasing their solubility or making it biocompatible.

The role of the nanoparticles in the analytical process is very various and depends on its natural origin and state. They are basically used for the treatment of samples and in the electrophoretic and chromatographic separations. To continue with, the role the nanoparticles can play in different steps of the analytical process is set forth.

Below the analytes used for detecting information in the biosensors

according to the present invention are reported.

The analytes can be selected between organic compounds, inorganic compounds, toxins in food.

Organic compounds include: amino acids, cholesterol, carbohydrates, vitamins, lipids, lecithin, lysine, citrate, acetaldehyde, polyphenols, histamine, salicylate, hypoxanthine, benzoate, sorbic acid, amygdalin, saccharin, aspartame, cyclamate.

Inorganic compounds include: Sulfites, sulphur dioxide, potassium, sodium, calcium, magnesium, nitrates, nitrites, chlorides, sulfates, fluorides, carbonates, zinc, mercury.

Toxins in food include: saxitoxin, gonyautoxins, hepatitis A virus, aflatoxin, salmonella, Escherichia coli, listeria, campulobacter, tetrodotoxin.

According to another alternative embodiment, the detecting surface of the sensor receiver comprises graphene, graphene oxide or reduced graphene oxide.

As it is known, graphene is a type of carbon, such as graphite or diamond, whose structure is constituted by a foil of carbon atoms forming a crystalline network with a reticular honeycomb shape. This structure has a thickness of one carbon atom.

Since its discovery, this material has received a particular interest for its exceptional properties, as great conductor of electricity, high thermal conductivity, excellent mechanical properties, i.e. lighter, stronger, more resistant and flexible than the steel and having high biocompatibility.

For these and other properties, applications of graphene can be very varying, for example as material in integrated electronic circuits, solar

cells and also in chemical sensors.

Different species of graphene, such as pure graphene, graphene oxide or reduced graphene oxide, are known; the last two have some functional groups having oxygen in the structure. These functional groups have higher reactivity but their properties are very similar to pure graphene.

As it is known, a chemical sensor can be defined as a device transforming chemical information in a useful analytic signal.

Essentially it consists of two parts: a receiver, proportioning the recognition of the substance to be analyzed, and a transducer converting the signal obtained from the chemical substance in a signal measurable with an instrument, for example a spectrometer able to perform chemical analyses for detecting bacteria.

If the detection element is a biological reagent, it is a biosensor.

In the scope of the present invention, chemical sensors and biosensors in which graphene is used, can be used in conjunction or in alternative, in some of the graphene forms allowing analyzing various chemical substances of interest.

For example, you can detect unwanted substances by an aptasensor, i.e. a sensor using DNA strands as recognition element. These DNA strands are used to capture the unwanted substances on the sensor surface, and by this way this type of substances only is detected.

The sensor surface is preferably made in reduced graphene oxide, and the measures are made by electrochemical impedance.

For detecting bacteria or viruses, you can proceed by an optical sensor equipped with a surface comprising graphene oxide and a plurality of quantum dots interacting with the graphene oxide.

The quantum dots have fluorescent properties, but interacting with the graphene oxide, their fluorescence decreases.

Therefore, if the test is giving a positive result and there is a reaction with the substance to be detected, the quantum dots do not adhere to the graphene oxide and high fluorescence is measured.

Conversely if the test is negative, the quantum dots adhere to the graphene oxide and a low fluorescence is measured.

In such a way, bacteria or viruses in a sample can be quantified starting from detecting their DNA with this sensor.

In particular, optical sensors provided with surfaces comprising graphene oxide can be employed in order to detect microorganisms or microbial toxins that could be present in the powder for infants, such as Enterobacter sakazakii and enteric Salmonella.

Thanks to the use of this material, the chemical sensors developed with graphene have some advantages, such as:

- high absorption of substances in order to produce concentration and improve the sensitivity;
- low electrical noise in electrochemical sensors, improving the signal/noise ratio;
- high response of the sensor;
- high catalytic power, improving the selectivity in electrochemical sensors.

From the above, how the invention solves the technical issues to which is intended, stands out.

Obviously, modifications or improvements suggested by incidental or particular reasons can be made to the previously described invention without thereby departing from the scope of the invention as claimed below.

CLAIMS

1. System for preparing beverages based on substitutes of breast milk and/or powdered products or the like, where the system comprises:

- at least one refillable container (130, 140) of beverage preparation; and

- a machine (100) provided with a water line starting from a tank (150) and ending with an outlet (89), where the machine (100) further comprises a support (160) adapted to house said at least one container (130, 140) and a dosing unit (70) adapted to receive at least one beverage preparation, characterized in that:

- said at least one container (130, 140) of beverage preparation is introducible in said machine (100) for preparing a beverage;

- the machine (100) comprises at least one sensor provided with a receiver having a surface for detecting substances in the beverage and a transducer for converting the signal obtained from the receiver to an electric signal.

2. System according to claim 1, wherein the tank (150), the support (160) and the container (130, 140) are removable from the machine (100) and washable, and wherein the container (130, 140) contains at least two doses of beverage preparation.

3. System according to claim 2, wherein said at least one sensor is a biosensor.

4. System according to claim 2, wherein said at least one sensor is an amperometric biosensor.

5. System according to claim 3, wherein said at least one biosensor

comprises an enzyme named glucose oxidase (GOD) that, when contacting the glucose, triggers an enzymatic reaction adapted to produce hydrogen peroxide (H2O2) causing current fluctuations in a circuit of constant current.

6. System according to claim 4, wherein said at least one amperometric biosensor is designed to detect at least one from fructose, fats, gluten, proteins and vitamins.

7. System according to claim 2, wherein the detecting surface of the receiver comprises graphene, graphene oxide or reduced graphene oxide.

8. System according to claim 2, wherein the measures the transducer detects are obtained by electrochemical impedance.

9. System according to claim 2, wherein the sensor is an optical sensor provided with a detecting surface comprising graphene oxide and a plurality of quantum dots interacting with the graphene oxide in order to detect microorganisms or microbial toxins by fluorescence.

10. System according to claim 1, wherein a conical element (80) is provided to channel the beverage coming from the outlet (89) of the water line towards a bottle (20), where the conical element (80) is not constrained to the machine (100).

11. System according to claim 1, wherein the machine (100) comprises a removable and washable funnel-shaped element comprising at least one circumferential inlet for the water coming from the tank (150), where the funnel-shaped element is adapted to channel the water to the outlet (89) of the water line.

12. System according to the preceding claims, comprising a sterile box (195) for carrying containers (130, 140) of beverage preparation and a

device for making vacuum in the sterile box (195).

13. System according to claim 1, wherein the container (130, 140) contains at least two doses of beverage preparation, where a dose comprises at least 70 grams of products.

14. System according to claim 13, wherein the container (130, 140) has a capacity selected from 500 to 1000 grams of products.

15. System according to claim 1, wherein the machine (100) provides for a removable and washable cylindrical vessel (160) and adapted to house containers (130, 140) of beverage preparations, where the containers (130, 140) has such a shape that, when coupled one to another, a hole (190) is left open to house part of the water tank (150) between them.

16. System according to claim 1, wherein the dosing unit (70) is designed to switch from a first position, in which it is adapted to receive the beverage preparation, to a second position, in which it is adapted to transfer the beverage preparation to the conical element (80).

17. System according to claim 16, wherein the dosing unit (70) provides for a modular arrangement comprising a body (75) movable between the first and the second position, where the body (75) is contained between an upper plate (71) and a lower plate (72).

18. System according to claim 1, wherein the water line provides for an electric coil for heating water up to a temperature comprised between 70°C and 75°C.

19. System according to claim 1, wherein the water line provides for a peristaltic pump.

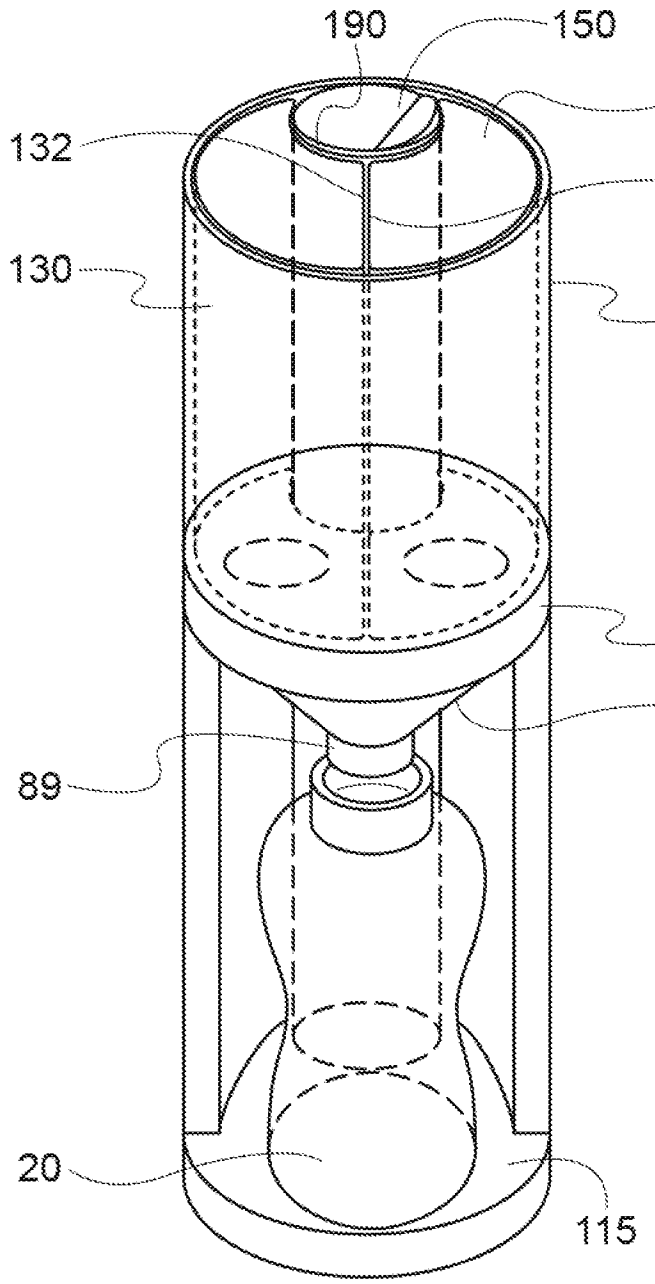


Fig. 1

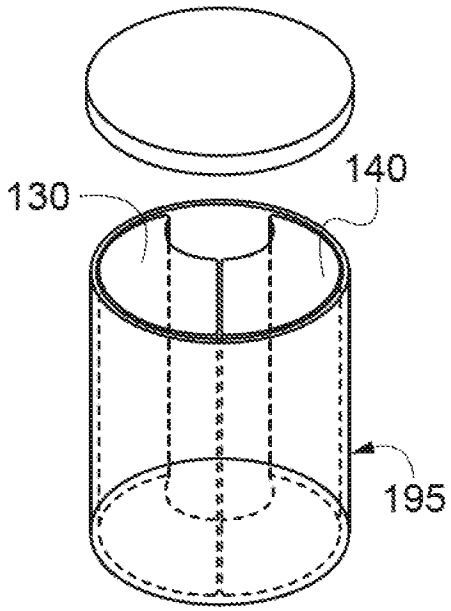


Fig. 2

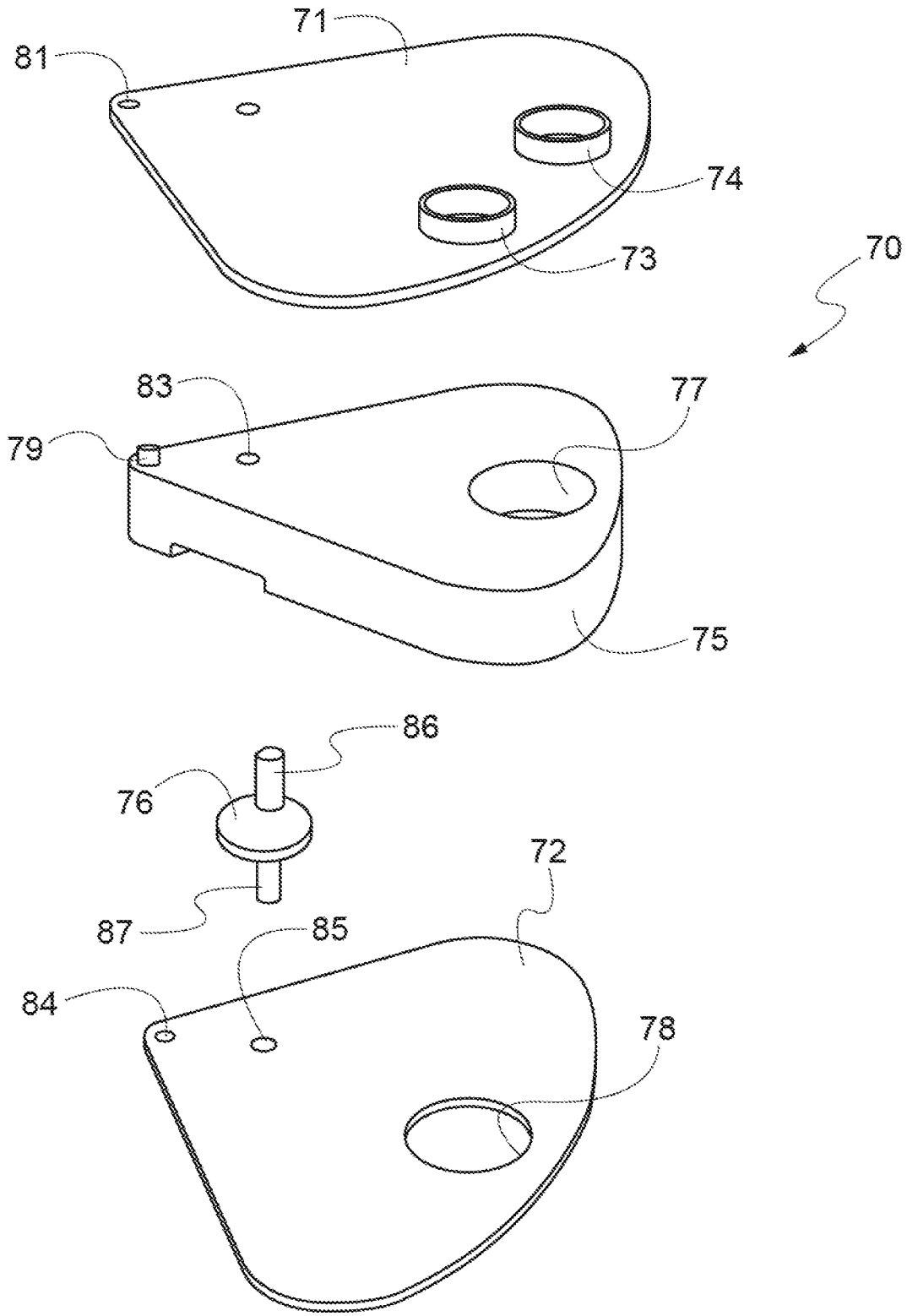


Fig. 3

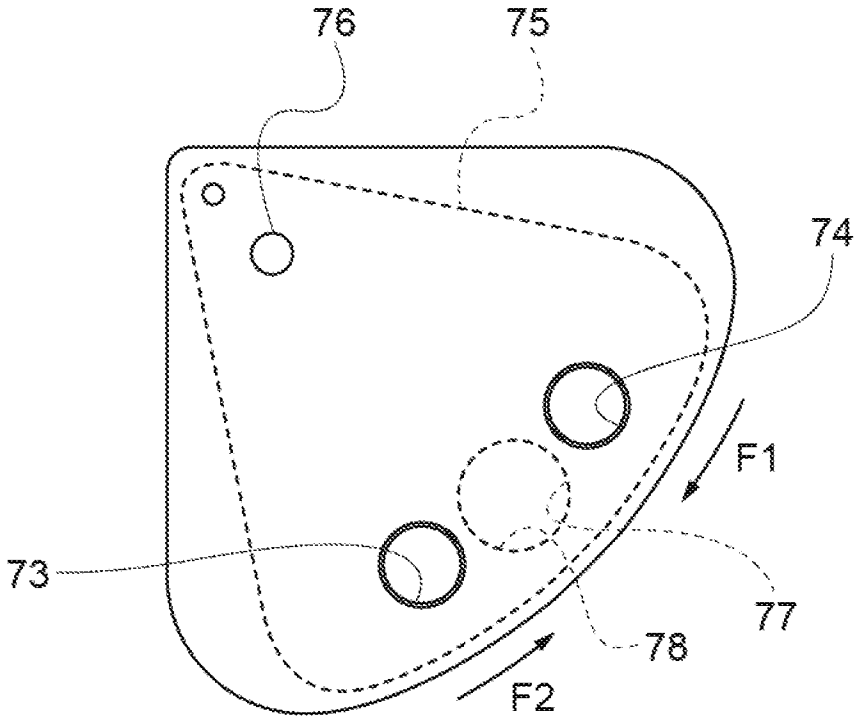
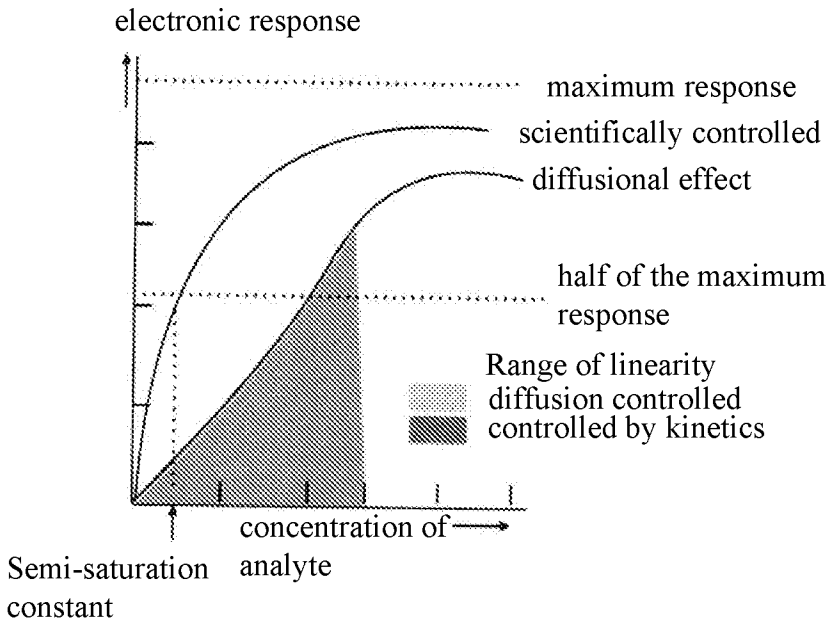


Fig. 4

Reaction Kinetics of the Biosensor



Range of response under diffusional and kinetics control conditions with biocatalytic biosensor

FIG 5

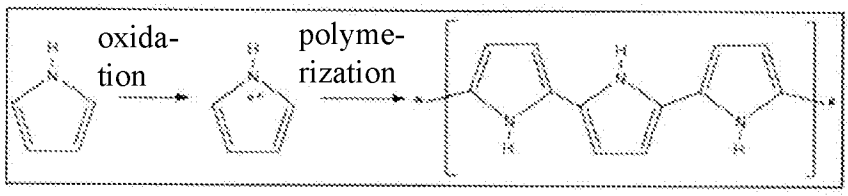


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/056499

A. CLASSIFICATION OF SUBJECT MATTER
INV. A47J31/40
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47J G06Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2008/059432 A1 (KONINKL PHILIPS ELECTRONICS NV [NL]; SINNEMA ANKE [NL]; VIET PETER S [) 22 May 2008 (2008-05-22)	1
Y	figure 1	2-9,13, 14,16-19
A		10-12,15

Y	WO 2014/075833 A2 (COSTA LTD [GB]) 22 May 2014 (2014-05-22)	2-9,13, 14,16-19
A	the whole document	10-12,15

Y	EP 2 835 771 A1 (NESTEC SA [CH]) 11 February 2015 (2015-02-11)	2-9,13, 14,16-19
A	the whole document	10-12,15

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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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 when the document is taken alone

"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

Date of the actual completion of the international search	Date of mailing of the international search report
28 April 2016	06/05/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Behammer, Frank

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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