

Process and device for producing an analytical tape for liquid samples

Description

The invention concerns a process and a device for producing an analytical tape as well as the corresponding product of the process according to the pre-characterizing portion of the independent patent claims.

Such analytical tapes can be used especially for determining blood sugar in portable test instruments which can also be simply and rapidly used by laymen to carry out the required analytical steps. Instead of conventional individual test strips, a plurality of test fields provided with a suitable test chemistry are successively arranged on the analytical tape that is wound up in a spool-like manner. In this process the body fluid is applied to a test field that is brought into an active position by advancing the tape in order to then enable a detection inside the instrument for example by an optical measuring unit. This enables a large number of tests to be carried out without requiring a separate handling and disposal of disposable test strips.

An analytical tape in the form of a tape cassette is described in US-5,077,010. The test fields that are spaced apart consist of a reagent layer and a spreading layer for the liquid to be examined. Nothing is stated in this document about how the test fields are connected with the support tape or the formation of interspaces.

On this basis the object of the invention is to specify a process and device as well as a suitable analytical tape which enables an automated tape manufacture without complicated handling steps.

The combination of features stated in the characterizing portion of each of the independent claims is proposed to achieve this object. Advantageous embodiments and further developments of the invention are derived from the dependent claims.

The idea behind the invention is to simplify the layered tape construction by a two-step process. Accordingly with regard to the process it is proposed that a test label tape is premanufactured comprising at least a detection film and an adhesive tape and that the test fields are transferred from the test label tape onto the transport tape as self-adhesive test labels. The labelling process allows a simple positioning and attachment of the test fields as the transport tape passes through. This allows a continuous processing in a production line without requiring a kinematically complex handling by pick-and-place devices.

The test fields are advantageously adhesively attached by bonding one adhesive side of a double-sided adhesive tape to the detection film and the other adhesive side (in the form of self-adhesive labels) to the transport tape.

In order to increase the reliability of the process it is advantageous to stabilize the adhesive tape by an intermediate foil that is coated on both sides with adhesive.

Another improvement provides that the detection film is applied to the adhesive tape while keeping lateral strips of tape free. In order to achieve a uniform sample distribution the detection film can be covered by a cover layer which is preferably in the form of a fabric or fleece where the cover layer is advantageously wider than the detection film and is held by the adhesive tape in the area of its overhanging edges.

In order to further reduce the required amount of sample it is advantageous when the absorbent cover layer is provided with a water-repellent impregnation outside a detection zone.

The process may be simplified by printing on the impregnation as a strip at the side of the detection film by a printing process. It is also conceivable that the fibres of a filament structure forming the cover layer are already coated with an impregnation agent.

With regard to the production process it is particularly advantageous when the adhesive tape is processed by means of a carrier sheet from roll-to-roll. In this case the test labels can be produced as detachable flat structures on a carrier sheet of the adhesive tape by cutting or punching.

The feed during passage can be achieved by detaching the test labels from the carrier sheet of the adhesive tape preferably by deflection over a dispensing edge and labelling them onto the transport tape as it is transported from roll-to-roll.

For an economical concurrent processing it is advantageous when a multitrack test label tape is formed by several detection films next to one another on an adhesive tape. This allows the multitrack test label tape to be divided in sections into multiple test labels by cutting or punching. Alternatively it is also possible that sections of the multitrack test label tape are divided by cutting or punching into label blocks comprising several individual test labels next to one another. The multiple test labels or the label blocks can then be labelled onto the transport tape spaced apart from one another and subsequently the transport tape is divided longitudinally into individual tracks.

With regard to the device the aforementioned object is achieved by a conveying device operating from roll-to-roll for a rollable transport tape and by a labelling device for labelling a test label comprising at least a detection film and an adhesive tape onto a labelling position on the transport tape as it passes.

The labelling device advantageously comprises a punching or cutting device located before the labelling site and in particular a laser cutter for dividing the adhesive tape furnished with the detection film into self-adhesive test labels.

The invention also encompasses an analytical tape for liquid samples and in particular body fluids comprising a rollable transport tape and a plurality of test fields mounted thereon for analysing liquid samples wherein the test fields are prefabricated as self-adhesive test labels consisting of at least a detection film and an adhesive tape and are labelled onto the transport tape.

The invention is elucidated in more detail in the following on the basis of the examples shown schematically in the drawing.

- Fig. 1 shows an analytical tape with a multilayered test field in a sectional perspective view;
- Fig. 2 shows a test instrument with the analytical tape used therein in cross-section;
- Fig. 3 to 6 show various constructional stages of a test label tape forming the test fields in each case in a top-view and in cross-section;
- Fig. 7 shows the test label tape cut into individual test labels in a sectional top-view;
- Fig. 8 shows a punched test label tape in a view corresponding to fig. 7;
- Fig. 9 shows a top-view of the analytical tape of fig. 1;

Fig. 10 to 13 show various steps of a multitrack manufacture of analytical tapes in a sectional top-view; and

Fig. 14 to 17 show another example of a multitrack manufacture in a view corresponding to fig. 10 to 13.

The analytical tapes 10 shown in the drawing consist of a rollable transport tape 12 with a plurality of test fields 14 that are applied thereto and spaced apart in the direction of the tape for analysing body fluids and in particular blood.

As shown in fig. 1 the test fields 14 are multilayered and in the form of self-adhesive test labels. They each comprise a section of an adhesive tape 16, a detection film 18 and an absorbent cover layer 20 some areas of which are furnished with an impregnation 22.

According to fig. 2 the reel of analytical tape 10 is used in the form of a cassette 24 in a portable blood sugar test instrument 26. Winding the tape forwards exposes the individual test fields or test labels 14 in the area of a measuring head 28 in order to apply a drop of blood for the glucose determination. The liquid is taken up in the central detection zone 30 of the cover layer 20 where the impregnated edge strips 22 limit the spread of liquid. Due to their multilayered structure, the test fields 14 have a certain height while the thin flexible transport tape 12 in the intermediate areas allows a reliable sealing against sealing elements thus enabling a reliable storage which is protected against the effects of the environment.

The analytical tape 10 is produced by a roll-to-roll processing in two process steps. In the first step according to figs. 3 to 8, a test label tape 32 is firstly prefabricated whereupon the self-adhesive test labels 14 are transferred from the test label tape 32 onto the transport tape 12 in the second step according to fig. 9.

As illustrated in the top-view of fig. 3a and in the cross-section of fig. 3b – which are not shown to scale – the double-sided adhesive tape 16 forms the base of the test label tape 32. This has a carrier sheet 34 or a release liner for tape transport from a feed spool to a take-up spool through various processing stations. On the carrier sheet 34 there are two adhesive layers 38, 40 which are separated by an intermediate layer 36. According to fig. 4 a detection film 18 of narrow width is glued centrally onto the upper free adhesive layer 40 of the adhesive tape 16 as it passes through such that lateral strips of adhesive 42 of the adhesive layer 40 are kept free.

Afterwards the cover layer 20 in the form of a fabric is applied as a tape according to fig. 5. The cover layer 20 is wider than the detection film 18 and is therefore attached by the free adhesive strips 42 in the area of its laterally protruding edges. The protruding edge strips of the cover layer 20 outside the detection film 18 are subsequently printed with a water-repellent impregnation 22 such that only the central detection zone 30 can absorb the body fluid that is applied whose spread is then limited (fig. 6).

Individual test labels 14 can be cut out of a test label tape 32 manufactured in this manner as detachable flat structures according to fig. 7. For this purpose cuts 44 that run perpendicular to the direction of the tape are introduced for example by laser cutting from the cover layer 20 down to the depth of the carrier sheet 34 such that the test labels 14 with the adhesive layer 38 can be detached. Instead of the cutting process they can also be separated by punching according to fig. 8 in which case the punching grid 46 is removed from the label tape 32 to expose the labels 14.

In the second step of the process the transport tape 12 is guided from a feed roll to a take-up roll during which the individual labels 14 are applied spaced apart at a labelling station according fig. 9. For this purpose the test labels 14 are detached from the carrier sheet 34 of the adhesive tape 16 by deflection over a dispensing edge and pressed onto the transport tape 12 in a self-adhesive manner by means of the exposed adhesive layer 38.

The process principle described above can also be used for an economic production in a multitrack process. For this purpose a multitrack test label tape 32' is formed according to fig. 10 in the arrangement described above with several parallel detection tracks 18 on a wide adhesive tape 16. According to fig. 11 this multitrack label tape 32' is divided in sections into multiple test labels 14' by punching and removing the punching grid. They can be labelled onto a wide transport tape 12 spaced apart from one another according to fig. 12 whereupon the transport tape according to fig. 13 is divided into individual tracks or individual analytical tapes 10 by longitudinal cuts 48.

The example illustrated in figs. 14 to 17 differs essentially only in that instead of the multiple test labels 14', label blocks 50 consisting of several (in the present case five) individual test labels 14' are formed in sections on the carrier tape 32' by punching (fig. 15). These can then be labelled in blocks onto the transport tape 12 according to fig. 16 in order to in turn obtain the individual analytical tapes 10 by longitudinal cuts 48.

Claims

1. Process for producing an analytical tape (10) for liquid samples and in particular body fluids in which a rollable transport tape (12) is provided with a plurality of test fields (14) that are spaced apart in the direction of the tape for analysing the liquid samples, **characterized in that** a test label tape (32) is prefabricated from at least a detection film (18) and an adhesive tape (16) and that the test fields are transferred as self-adhesive test labels (14) from the test label tape (32) onto the transport tape (12).
2. Process as claimed in claim 1, **characterized in that** one adhesive side (40) of a double-sided adhesive tape (16) is bonded to the detection film (18) and the other adhesive side (38) is bonded to the transport tape (12).
3. Process as claimed in claim 1 or 2, **characterized in that** the adhesive tape (16) is stabilized by an intermediate foil (36) which is coated on both sides with adhesive.
4. Process as claimed in one of the claims 1 to 3, **characterized in that** the detection film (18) is applied to the adhesive tape (16) while keeping lateral adhesive strips (42) free.
5. Process as claimed in one of the claims 1 to 4, **characterized in that** the detection film (18) is covered by a cover layer (20) that is preferably in the form of a fabric or fleece for a planar sample uptake.
6. Process as claimed in claim 5, **characterized in that** the cover layer (20) is wider than the detection film (18) and is held by the adhesive tape (16) in the area of its protruding edges.

7. Process as claimed in claim 5 or 6, **characterized in that** the absorbent cover layer (20) is provided with a water-repellent impregnation (22) outside a detection zone (30).
8. Process as claimed in one of the claims 5 to 7, **characterized in that** an impregnation agent is printed on in a strip shape at the sides of the detection film (18) by a printing process.
9. Process as claimed in one of the claims 5 to 7, **characterized in that** a filament structure forming the cover layer (20) is coated with an impregnation agent.
10. Process as claimed in one of the claims 1 to 9, **characterized in that** the adhesive tape (16) is processed from roll-to-roll by means of a carrier sheet (34).
11. Process as claimed in one of the claims 1 to 10, **characterized in that** the test labels (14) are produced as detachable flat structures on a carrier sheet (34) of the adhesive tape (16) by cutting or punching.
12. Process as claimed in one of the claims 1 to 11, **characterized in that** the test labels (14) are detached from the carrier sheet (34) of the adhesive tape (16) preferably by deflection over a dispensing edge and labelled onto the transport tape (12) as it is transported from roll-to-roll.
13. Process as claimed in one of the claims 1 to 12, **characterized in that** a multitrack test label tape (32') is formed by several detection films (18) next to one another on an adhesive tape (16).

14. Process as claimed in claim 13, **characterized in that** the multitrack test label tape (32') is divided in sections into multiple test labels (14') by cutting or punching.
15. Process as claimed in claim 13, **characterized in that** the multitrack test label tape (32') is divided in sections into label blocks (50) comprising several individual test labels (14) lying next to one another by cutting or punching.
16. Process as claimed in claim 14 or 15, **characterized in that** the multiple test labels (14') or the label blocks (50) are labelled spaced apart onto the transport tape (12) and subsequently the transport tape (12) is divided longitudinally into individual tracks.
17. Device for producing an analytical tape (10) for liquid samples, in particular body fluids comprising a conveying device operating from roll-to-roll for a rollable transport tape (12) and a labelling device for labelling test labels (14) consisting of at least a detection film (18) and an adhesive tape (16) onto the passing transport tape (12) at a labelling site.
18. Device as claimed in claim 17, **characterized in that** the labelling device has a punching or cutting device located in front of the labelling site and in particular a laser cutter to divide the adhesive tape (16) furnished with the detection film (18) into self-adhesive test labels (14).

19. Analytical tape for liquid samples in particular body fluids comprising a rollable transport tape (12) and a plurality of test fields (14) applied thereto for analysing liquid samples, **characterized in that** the test fields are prefabricated as self-adhesive test labels (14; 14') consisting of at least a detection film (18) and an adhesive tape (16) and are labelled onto the transport tape (12).