

BEADS FUSED TO A TEST DEVICE SUPPORT**RELATED APPLICATIONS**

This is a continuation-in-part application of U.S. Ser. No. 583,106 filed on Sep. 17, 1990, now abandoned.

FIELD OF THE INVENTION

This invention concerns the attachment of test beads bearing a reagent, so that they are not washed away by the test sample liquid.

BACKGROUND OF THE INVENTION

Detection devices can use a bead layer mounted on a support, wherein reagents are bonded to the beads to react with a sample. In many such devices, liquid flows perpendicularly into the layer so that flow occurring ACROSS the layer, such as could wash off beads inadequately adhered, is minimized.

However, in some environments, particularly qualitative detection of DNA, it is preferred that the sample liquid being analyzed flow-by, rather than through, the bead layer, for the desired reaction with the beads used for detection. In such a case, the flow-by of the liquid will wash off any beads that are not securely attached. If enough of the beads wash off, there will be insufficient numbers remaining to produce a visible signal that indicates the target DNA is present. For example, no color will generate even though the targeted DNA had been replicated or was present. It is possible to anchor beads against washoff, by using as their support, a latex-coated paper. However, the use of a paper support creates manufacturing disadvantages. The paper with the beads pre-attached must be carefully transported to the device's detection chamber, where it must be fixed in place. A more preferred method would be to somehow place the beads directly onto the material comprising the detection chamber, which can be polyethylene. This, however, has not been readily possible, since simply drying the beads in place on such a material, from an aqueous solution, provides insufficient anchoring of the beads when the sample to be detected flows by.

Accordingly, prior to this invention there has been a need to anchor detection beads to a support in a manner that is more convenient, that is, does not require an interim support other than the wall of the detection chamber.

SUMMARY OF THE INVENTION

We have constructed a test device that anchors the beads sufficiently to meet the above-noted need.

More specifically, there is provided a test device comprising inert beads to which reagents are attached, and an inert support on which the beads are disposed to react with a test sample liquid, the support and beads comprising different materials. The device is improved in that support is physically fused to at least some of the beads, and the material of the support is selected to have a significantly lower melting point than the material of the beads, so that the fused beads cannot be washed off the support by the test sample liquid.

Accordingly, it is an advantageous feature of the invention that a flow-by test device is provided with beads that are anchored directly to the wall of the detection chamber.

It is a related advantageous feature of the invention that a flow-by test device is provided using simplified manufacturing procedures.

Other advantageous features will become apparent upon reference to the following detailed Description of the Preferred Embodiments, when read in light of the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary plan view of a cuvette pouch constructed in accordance with the invention;

FIG. 2 is a section view taken generally along the line II—II of FIG. 1; and

FIG. 3 is an enlarged partially schematic section view taken generally along the line III—III of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention is hereinafter described in connection with a pouch test device for qualitatively detecting the presence of replicated DNA by the use of certain beads having thereon certain immobilizing groups that anneal to DNA as it flows by the beads. In addition, the invention is useful even if the test device is not a pouch, regardless whether DNA or some other target is being detected, and even regardless whether or not the immobilizing of the target occurs for detection purposes or some other purpose. Also, it is useful regardless of the chemical nature of the beads and/or the immobilizing groups, provided the beads have an appropriate melting point as in hereinafter explained.

As shown in FIG. 1, the preferred device is a pouch 10, which cooperates with an external source of pressure 60 to transfer liquid within the pouch. As described in commonly owned EPA publication 381,501, by Schnipelsky et al, entitled "Containment Cuvette for PCR and Method of Use", such a device is intended primarily for use with PCR amplification to generate enough replicates of a particular DNA as to render detectable that such DNA is present. More particularly, the device is a containment cuvette constructed to be completely closed after sample introduction occurs, so that no leak of target DNA can occur during or after amplification such as would contaminate nearby pouches yet to be supplied with sample.

Thus, cuvette 10 comprises two relatively thin sheets 12, 14, FIG. 2, formed such as by molding to mate together with pockets or compartments and connecting passageways protruding from the plane of the contacting sheets, FIG. 2. The sheets are secured together at least along their outer periphery 16, FIG. 1, and preferably at all points surrounding compartments or passageways, such as by heat- and/or ultrasonic pressure-sealing. A heat-activatable adhesive such as polyethylene-co-vinyl acetate is useful for such joining operation.

The compartments are as follows: compartment 26 is the reaction compartment, and optionally has amplifying reagents pre-incorporated therein, in liquid or dried form. DNA sample is injected via passageway 21 which is then sealed. Compartment 30 is a storage compartment containing wash water as a pre-incorporated reagent. Other compartments, not shown, provide a) a storage compartment containing at least one of the detection materials pre-incorporated therein, namely a biotinylated probe having at one end a complementary nucleotide for attachment to the amplified DNA, and preferably also a signal generating moiety, for example, avidin bound to the horseradish peroxidase; b) a second