ZytoFast PLUS
CISH Implementation Kit
HRP-HRP-Green

REF T-1073-40  40
REF T-1073-10  10

For chromogenic in situ hybridization (CISH) using any digoxigenin-labeled ZytoFast CISH Probe

In vitro diagnostic medical device
according to EU directive 98/79/EC
As of: March 7, 2012 (5.1)

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1. **Scope of Application**

The *ZytoFast PLUS CISH Implementation Kit HRP-HRP-Green* is designed to be used for the detection of digoxigenin (DIG)-labeled *ZytoFast CISH* probes in either formalin-fixed, paraffin-embedded tissue or cell samples by chromogenic *in situ* hybridization (CISH).

Interpretation of results must be made within the context of the patient’s clinical history with respect to further clinical and pathologic data of patient by a qualified pathologist.

2. **Basic Principles**

The presence of certain nucleic acid sequences in cells or tissue can be detected with *in situ* hybridization using labeled DNA probes. The hybridization results in duplex formation of sequences present in the test object and the specific probe.

The *ZytoFast PLUS CISH Implementation Kit HRP-HRP-Green* is to be used with any separately available digoxigenin-labeled *ZytoFast CISH* probe.

Duplex formation of the digoxigenin-labeled probe can be visualized using a primary (unmarked) anti-digoxigenin antibody, which is detected by a secondary polymerized enzyme-conjugated antibody. The enzymatic reaction of HRP-Green leads to the formation of strong green signals that can be visualized by light microscopy at a 10-20x dry lens.
3. Safety Precautions and Disposal

✓ Read the operating instructions prior to use!
✓ Do not use the reagents after the expiry date has been reached!
✓ Avoid any cross-contamination and micro-bacterial contamination of the reagents!
✓ Some of the system components contain substances (in low concentrations and volumes) that are harmful to health. Avoid any direct contact with the reagents. Take appropriate protective measures (use disposable gloves, protective glasses, and lab garments)!
✓ If reagents come into contact with skin, rinse skin immediately with copious quantities of water!
✓ Never pipet solutions with your mouth!
✓ The disposal of reagents must be carried out in accordance with local regulations!
✓ A material safety data sheet is available on request for the professional user!
4. The ZytoFast PLUS CISH Implementation Kit

**HRP-HRP-Green**

### 4.1 Components

The kit is made up of the following components:

<table>
<thead>
<tr>
<th>Code</th>
<th>Component</th>
<th>Quantity</th>
<th>Container</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF23</td>
<td>ZytoFast DNA (+) Control Probe</td>
<td>0.1 ml</td>
<td>Reaction vessel, blue lid</td>
</tr>
<tr>
<td>PF24</td>
<td>ZytoFast DNA (-) Control Probe</td>
<td>0.1 ml</td>
<td>Reaction vessel, white lid</td>
</tr>
<tr>
<td>PF32</td>
<td>ZytoFast RNA (+) Control Probe</td>
<td>0.1 ml</td>
<td>Reaction vessel, blue lid</td>
</tr>
<tr>
<td>PF33</td>
<td>ZytoFast RNA (-) Control Probe</td>
<td>0.1 ml</td>
<td>Reaction vessel, white lid</td>
</tr>
<tr>
<td>PT2</td>
<td>Heat Pretreatment Solution EDTA</td>
<td>500 ml</td>
<td>Screw-cap bottle (large)</td>
</tr>
<tr>
<td>ES1</td>
<td>Pepsin Solution</td>
<td>4 ml</td>
<td>Dropper bottle, white cap</td>
</tr>
<tr>
<td>WB5</td>
<td>20x Wash Buffer TBS</td>
<td>4x 50 ml</td>
<td>Screw-cap bottle</td>
</tr>
<tr>
<td>AB1</td>
<td>Mouse-Anti-DIG</td>
<td>4 ml</td>
<td>Dropper bottle, pink cap</td>
</tr>
<tr>
<td>AB2</td>
<td>Anti-Mouse-HRP-Polymer</td>
<td>4 ml</td>
<td>Dropper bottle, violet cap</td>
</tr>
<tr>
<td>SB7a</td>
<td>HRP-Green-Solution A</td>
<td>0.8 ml</td>
<td>Dropper bottle, green cap</td>
</tr>
<tr>
<td>SB7b</td>
<td>HRP-Green-Solution B</td>
<td>15 ml</td>
<td>Dropper bottle, grey cap</td>
</tr>
<tr>
<td>CS3</td>
<td>Nuclear Red Solution</td>
<td>20 ml</td>
<td>Screw-cap bottle, black</td>
</tr>
<tr>
<td>MT4</td>
<td>Mounting Solution (alcoholic)</td>
<td>4 ml</td>
<td>Glass bottle, brown</td>
</tr>
</tbody>
</table>

**T-1073-40 (40 tests):** Components (ES1), (AB1), (AB2), (SB7a-b), (CS3), and (MT4) are sufficient for 40 reactions. Components (PF23), (PF24), (PF32), and (PF33) are sufficient for 10 reactions. Component (PT2) is sufficient for 7 staining jars of 70 ml each. Component (WB5) is sufficient for 57 staining jars of 70 ml each.

**T-1073-10 (10 tests):** Components (ES1), (AB1), (AB2), (SB7a-b), (CS3), and (MT4) are sufficient for 10 reactions. Components (PF23), (PF24), (PF32), and (PF33) are sufficient for 10 reactions. Component (PT2) is sufficient for 2 staining jars of 70 ml each. Component (WB5) is sufficient for 28 staining jars of 70 ml each.

### 4.2 Storage and Shelf Life

The components of the kit must be stored at 2...8°C. If these storage conditions are followed, the kit will function, without loss of performance, at least until the expiry date printed on the label.
4.3 Test Material

The *ZytoFast* PLUS CISH Implementation Kit HRP-HRP-Green has been optimized for the use with formalin-fixed, paraffin-embedded tissue and cell samples. When test material is used that has been fixed or embedded in a different manner (e.g. methanol/glacial-acetic-acid-fixed cells or blood smears) the test protocol may need to be adapted by the user. Our specialists are available to support you whenever adjustments are necessary.

We recommend the following tissue preparation:

- Fixation in 10% neutrally buffered formalin for 24 h at RT
  
  *In order to achieve optimum and uniform fixation and paraffin embedding, the sample size should not exceed 0.5 cm³.*

- Standard processing and paraffin embedding

  *Use premium quality paraffin. Infiltration and embedding should be carried out at temperatures lower than 65°C.*

- Prepare 3-5 µm microtome sections

  *Draw up the sections onto silane-coated or adhesion slides (e.g. HistoBond®) and fix for 2-16 h at 50-60°C.*

4.4 Additional Materials

The following reagents, materials, and equipment are not included in the kit:

**Reagents and materials**

- *Digoxigenin-labeled ZytoFast CISH probe*
- *Adhesive pistol, including hot adhesive, or rubber cement (Fixogum)*
- *Ethanol 100%, denatured*
- *Deionized or distilled water*
- *Xylene*
- *Hydrogen peroxide (H₂O₂) 30%*
- *Methanol 100%*

**Equipment**

- *Water bath (boiling, 55°C)*
- *Hot plate*
- *Hybridization oven (heating oven)*
- *Staining jars, 50-80 ml*
- *Humidity chamber*
- *Pipet (10 µl, 1000 µl)*
- *Coverslips (22 mm x 22 mm, 24 mm x 32 mm)*
- *Light microscope*
4.5 Important Information

The following should be kept in mind:

☑ The tissue and cell sections must not be allowed to dry during the hybridization and washing steps!

☑ The temperature for denaturating and washing, described in the protocol, should be used as a guide. Dependent upon the age and the fixation step of the sample material, an increase or decrease in temperature of the denaturating or wash steps can lead to better hybridization results!

☑ Do not wash slides hybridized with ZytoFast RNA (+) Control Probe (PF32) at 55°C as this will reduce signal intensity!

5. The ZytoFast PLUS CISH Implementation Kit

5.1 Preparatory Steps

Preparation of 3% H₂O₂: Dilute 1 part of 30% H₂O₂ with 9 parts of 100% methanol.

Heat Pretreatment Solution EDTA (PT2): Heat in a covered staining jar standing in a boiling water bath to at least 95°C.

Preparation of 1x Wash Buffer TBS: Dilute 1 part of 20x Wash Buffer TBS (WB5) in 19 parts deionized or distilled water. Diluted 1x Wash Buffer TBS lasts for one week when stored at 2-8°C.

1x Wash Buffer TBS: Prepare one staining jar with 1x Wash Buffer TBS (prepared using WB5) and heat in a water bath to 55°C.

ZytoFast DNA (+) Control Probe (PF23), ZytoFast DNA (-) Control Probe (PF24), ZytoFast RNA (+) Control Probe (PF32), ZytoFast RNA (-) Control Probe (PF33): Bring to hybridization temperature before use.

Pepsin Solution (ES1), Mouse-Anti-DIG (AB1), Anti-Mouse-HRP-Polymer (AB2), Nuclear Red Solution (CS3), Mounting Solution (alcoholic) (MT4): Bring to room temperature before use.

Preparation of HRP-Green Solution: Prior to immediate use, add two drops (2x 20 µl) HRP-Green-Solution A (SB7a) in a graduated cup (e.g. HRP-Green reaction vessel), fill up to 1 ml with HRP-Green-Solution B (SB7b) and mix well.
5.2 Pretreatment (Dewax/Proteolysis)

1. Incubate slides for 10 min at 70°C (e.g. on a hot plate)
2. Incubate slides for 2x 5 min in xylene
3. Incubate 3x 3 min in 100% ethanol

Alternatively, dewaxing protocols routinely used in immunohistochemistry procedures, e.g. 2x 15 min xylene, 2x 5 min 100% ethanol, 2x 5 min 96% ethanol, 1x 5 min 70% ethanol, can be used.

4. Incubate slides for 10 min in 3% H$_2$O$_2$
5. Wash 3x 1 min in deionized or distilled water and drain off or blot off the water
6. Apply (dropwise) Pepsin Solution (ES1) to the tissue/cell section and incubate for 10-20 min at 37°C in a humidity chamber

Depending on multiple factors, e.g. nature and duration of fixing, thickness of sections, and nature of tissue/cells, different incubation times may be required. As a general rule, we recommend to ascertain the optimum time for proteolysis in pre-tests.

7. Immerse slides in deionized or distilled water
8. Heat Heat Pretreatment Solution EDTA (PT2) in a covered staining jar standing in a boiling water bath to at least 95°C
9. Place slides in the Heat Pretreatment Solution EDTA (PT2) and incubate for 15 min
10. Immerse slides in deionized or distilled water and drain off or blot off the water
5.3 Denaturation and Hybridization

1. Vortex the *ZytoFast* CISH probe and pipette 10 µl each onto individual samples.
   
   *Distribute dropwise on the whole target area to avoid local concentration of probe. Alternatively, add probe to the center of a coverslip and place coverslip upside down on target area.*

2. Avoiding trapped bubbles, cover the samples with a coverslip (22 mm x 22 mm). Seal the coverslip, e.g. with a layer of hot glue from an adhesive pistol or with rubber cement.

3. Denature the slides at 75°C for 5 min, e.g. on a hot plate.

4. Transfer the slides to a humidity chamber and hybridize (e.g. in a hybridization oven) for 60 min at:
   
   - 37°C for DNA-targeting probes or at
   - 55°C for RNA-targeting probes
   
   *It is essential that the tissue/cell samples do not dry out during the hybridization step.*

5.4 Post-Hybridization and Detection

1. Carefully remove the rubber cement or glue.

2. Remove the coverslip by submerging in 1x Wash Buffer TBS (prepared using [WB5](#)).

3. Wash 5 min in 1x Wash Buffer TBS (prepared using [WB5](#)) at 55°C.
   
   *Do NOT perform this step on slides hybridized with *ZytoFast RNA (+) Control Probe* (PF32) as this will reduce signal intensity!*
   
   *1x Wash Buffer TBS must be sufficiently prewarmed. Check with a thermometer if necessary.*

4. Wash 5 min in 1x Wash Buffer TBS (prepared using [WB5](#)) at RT.

5. Apply *Mouse-Anti-DIG (AB1)* dropwise (3-4 drops per slide) to the slides and incubate for 30 min at 37°C in a humidity chamber.

6. Wash 3x 1 min in 1x Wash Buffer TBS (prepared using [WB5](#)).

7. Apply *Anti-Mouse-HRP-Polymer (AB2)* dropwise (3-4 drops per slide) to the slides and incubate for 30 min at 37°C in a humidity chamber.

8. Wash 3x 1 min in 1x Wash Buffer TBS (prepared using [WB5](#)).
9. During the wash steps, prepare HRP-Green Solution by adding two drops (2x 20 µl) of HRP-Green Solution A \((\text{SB7a})\) in a graduated cup (e.g. HRP-Green reaction vessel), fill up to 1 ml with HRP-Green-Solution B \((\text{SB7b})\) and mix well

10. Apply HRP-Green Solution dropwise (3-4 drops per slide) to the slides and incubate for 15-30 min at 37°C in the dark

11. Transfer slides into a staining jar and wash 1 min in running tap water

12. Counterstain the tissue or cell samples for 2-5 min with Nuclear Red Solution \((\text{CS3})\)

    The counterstaining time depends on the nature of tissue/cell used and should therefore be optimized. Avoid dark counterstaining, because it may obscure positive staining signals.

13. Transfer slides into a staining jar and wash 1 min in running tap water

14. Dehydration: 3x 30 s in 100% ethanol (use very pure ethanol)

15. Incubate 2x 30 s in xylene (use very pure xylene)

    Do not prolong the incubation time as this might result in loss of signals!

16. Avoiding trapped bubbles, cover the samples with a coverslip (22 mm x 22 mm; 24 mm x 32 mm) by using Mounting Solution (alcoholic) \((\text{MT4})\) and air dry the slides for approx. 30 min

17. Evaluation of the sample material is carried out by light microscopy
6. Interpretation of Results

The ZytoFast PLUS CISH Implementation Kit HRP-HRP-Green procedure causes green colored precipitates within the cells targeted by the ZytoFast CISH probe, which can be clearly distinguished from the background. Counterstaining the samples using Nuclear Red Solution (CS3) will result in nuclei stained light red.

Depending on the target being RNA or DNA, a positive reactivity in the target cells is indicated by a green colored reaction product either within the cytoplasm or the nucleus, respectively. For a more detailed description of the expected signal pattern, please refer to the package insert accompanying the probe.

Visualization of signals should be performed by light microscopy using a 10x or 20x objective. For signal evaluation, necrotic, degenerated or over-digested cells should be avoided as these cells often stain nonspecifically.

In order to judge the specificity of the hybridization signals and to confirm the correct performance of the method, any hybridization should be accompanied by controls. We recommend using at least one control sample containing both true positive and negative staining cells.

A negative or unspecific result can be caused by multiple factors. For troubleshooting, please refer to chapter 8.

The ZytoFast RNA (+) Control Probe (PF32) consists of poly-dT oligonucleotides targeting the poly(A) tails of mRNAs. Strong hybridization signals within the cytoplasm of cells verify the integrity of cellular mRNA in specimens.

The ZytoFast DNA (+) Control Probe (PF23) consists of oligonucleotides targeting human Alu repetitive sequences. Strong hybridization signals within the nuclei of cells verify the integrity of cellular DNA in specimens.

The ZytoFast RNA (-) Control Probe (PF33) and ZytoFast DNA (-) Control Probe (PF24) consist of a set of random sequence oligonucleotides with GC contents of 40-70% without known consensus to any naturally occurring sequences. These probes should not result in positive staining signals and are to be used to assess the unspecific background staining within specimens.
7. Literature

ISBN 0 19 963327 4
8. Problems and Possible Causes

Any deviation from the operating instructions can lead to inferior staining results or to no staining at all.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor tissue morphology</td>
<td>Overdigested tissue</td>
<td>Shorten the pepsin incubation time</td>
</tr>
<tr>
<td>Weak signals or no signals</td>
<td>No target sequence in test material</td>
<td>Use control slides</td>
</tr>
<tr>
<td></td>
<td>Cell or tissue sample has not been fixed properly</td>
<td>Optimization of fixation time; check quality of fixative and its compatibility with <em>in situ</em>-hybridization systems</td>
</tr>
<tr>
<td></td>
<td>Over- or underdigested tissue</td>
<td>Optimization of proteolytic pretreatment time</td>
</tr>
<tr>
<td></td>
<td>Denaturation temperature not correct</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hybridization temperature not correct</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stringency wash temperature not correct</td>
<td>Check temperature; adjust temperature if necessary</td>
</tr>
<tr>
<td></td>
<td>Antibody incubation temperature not correct</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hybridization time too short</td>
<td>Hybridize for at least 60 min; extend hybridization time if necessary</td>
</tr>
<tr>
<td></td>
<td>Incubation with chromogenic substrate too short</td>
<td>Extend incubation time</td>
</tr>
<tr>
<td></td>
<td>Chromogenic substrates were prepared too early</td>
<td>Prepare chromogenic substrates prior to immediate use</td>
</tr>
<tr>
<td></td>
<td>Counterstaining too dark</td>
<td>Reduce counterstaining time</td>
</tr>
<tr>
<td></td>
<td>Insufficient preparation of chromogenic substrates</td>
<td>Instead of using two drops of HRP-Green Solution A use 40 µl, and fill up to 1 ml with HRP-Green Solution B</td>
</tr>
<tr>
<td></td>
<td>Incubation times of any washing steps after staining with HRP-Green too long</td>
<td>Do not exceed given incubation times</td>
</tr>
<tr>
<td></td>
<td>Counterstaining time too long</td>
<td>Reduce counterstaining time</td>
</tr>
<tr>
<td></td>
<td>Green signals fades or merges</td>
<td></td>
</tr>
<tr>
<td></td>
<td>An unsuitable mounting solution has been used</td>
<td>Use only the mounting solution provided with the kit or xylene-based mounting solutions free of any impurities; do not use coverslip tape</td>
</tr>
<tr>
<td></td>
<td>Sections were not dehydrated properly</td>
<td>Use fresh ethanol and xylene solutions; use only xylene of “pure” quality</td>
</tr>
<tr>
<td></td>
<td>Substrate reaction is too intensive</td>
<td>Shorten substrate incubation time; do not heat substrate solution over 25°C; incubate at room temperature only</td>
</tr>
<tr>
<td>Uneven / in some parts only very light staining</td>
<td>Incomplete dewaxing</td>
<td>Use fresh solutions; check length of dewaxing times</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>Reagent volume too small</td>
<td>Ensure that the reagent volume is large enough to cover the tissue area</td>
</tr>
<tr>
<td></td>
<td>Air bubbles caught before hybridization or during mounting</td>
<td>Avoid air bubbles</td>
</tr>
<tr>
<td>Strong background staining</td>
<td>Slides not thoroughly rinsed</td>
<td>Use fresh wash buffers and deionized or distilled water where indicated</td>
</tr>
<tr>
<td></td>
<td>Sections dried out any time during or after hybridization</td>
<td>Avoid sections being dried out; use humidity chamber; seal coverslip properly</td>
</tr>
<tr>
<td></td>
<td>Washing temperature following hybridization too low</td>
<td>Check temperature; adjust temperature if necessary</td>
</tr>
<tr>
<td></td>
<td>Prolonged substrate incubation time</td>
<td>Shorten substrate incubation time</td>
</tr>
<tr>
<td>Section floats off the slide</td>
<td>Unsuitable slide coating</td>
<td>Use silane-coated or adhesion slides</td>
</tr>
</tbody>
</table>