ichroma™ COVID-19 Ag

INTENDED USE

ichroma™ COVID-19 Ag is a fluorescence Immunoassay (FIA) for the qualitative detection of novel corona virus (SARS-CoV-2, 2019-nCoV) in human nasopharyngeal swab. It is helpful as an aid in the screening of early mild, asymptomatic, or acute patients for identification of 'Novel Coronavirus' infection.

For *in vitro* diagnostic use only.

INTRODUCTION

The third zoonotic human coronavirus (CoV) of the century emerged in December 2019, with a cluster of patients connected to Wuhan, Hubei Province, China. This virus, the newly identified coronavirus 2019 nCOV, could cause risky pneumonia so that prevention and control of the infection has become highly required. The 2019-nCoV is a member of the Betacoronavirus Genus, that also includes Severe Acute Respiratory Syndrome coronavirus (SARS-CoV) and Middle East Respiratory Syndrome coronavirus (MERS-CoV). Since it is identified that symptoms become rapidly severe without a proper treatment after onset of illness, early diagnosis of the virus infection is quite crucial. Currently, the spread of the viral transmission become fast so that the prevention of local transmission requires a point-of care test (POCT), which shows quick outcome within 20 minutes.

ichroma™ COVID-19 Ag is an *in vitro* diagnostic medical device that helps you to diagnose novel coronavirus infections by detecting the specific antigen of SARS-CoV-2.

PRINCIPLE

This test uses a sandwich immunodetection method; the detector antibodies in buffer bind to antigens in the sample, forming antigen-antibody complexes, and migrates onto nitrocellulose matrix to be captured by the other immobilized antibodies on test strip.

More antigens in the sample will form the more antigen-antibody complexes which lead to stronger fluorescence signal by detector antibodies, which is processed by instrument for ichroma tests to show concentration of SARS-CoV-2 antigens in sample respectively. This signal then is interpreted by the reader to display the 'Positive'/ 'Negative' in the sample.

COMPONENTS

ichroma™ COVID-19 Ag consists of 'cartridges', 'detector tubes', 'extraction sets', 'ID chip' and 'instruction for use'.

- The cartridge contains the membrane called a test strip which has anti-nCoV antibody at the test line, and chicken IgY at the control line. All cartridges are individually sealed in an aluminum foil pouch containing a desiccant in a box.
- The detector tube has a granule containing anti-nCoV fluorescence conjugate, anti-chicken IgY-fluorescence conjugate, BSA and sucrose as a stabilizer and sodium azide as a preservative in Tris-HCL buffer.
- The extraction buffer tube contains sodium chloride, sodium azide as a preservative in Tris-HCL buffer.

WARNINGS AND PRECAUTIONS

- For *in vitro* diagnostic use only.
- Follow instructions and procedures described in this 'Instruction for use'.
- Do not reuse cartridge, detector and extraction set.
- After mixing samples with extracts, use it immediately.
- Do not use the extraction buffer of other products.
- Avoid the mixed use of other products.
- Lot numbers of all the test components (cartridge, detector and ID chip) must match each other.
- Do not interchange the test components between different lots or use the test components after the expiration date, either of which might yield incorrect test result(s).
- The cartridge should remain sealed in its original pouch until just before use. Do not use cartridge, if pouch is damaged or has already been opened.
- Do not eat the desiccant which is kept in a pouch.
- Do not use the test components after the expiration date. The use after expiration date may yield misleading test result.
- Do not use the contaminated extraction buffer, otherwise it might yield misleading result.
- Do not eat the extraction buffer. Any extraction buffer intake could cause diarrhea or vomiting.
- The extraction buffer contains sodium azide as preservatives, of which the contact to eyes, skin or clothing should be avoided. If it happens, please wash with running water immediately.
- An exposure to larger quantities of sodium azide may cause specific health issues like convulsions, low blood pressure and heart rate, loss of consciousness, lung injury and respiratory failure.
- Please apply the exact drops for accurate test result. Or it may cause erroneous results.
- The instrument for ichroma™ tests may generate slight vibration during use.
- Used cartridges, detectors, extraction tubes, nozzles and swabs should be handled carefully and discarded by an appropriate measure in accordance with the relevant local regulations.
- **ichroma™ COVID-19 Ag** will provide accurate and reliable results when it is used only in conjunction with the instrument for ichroma™ tests.

WARNINGS AND PRECAUTIONS FOR SAMPLE

- It is recommended to test the sample immediately after sample collection.
- Use the fresh samples.
- Refrain from smoking or eating, while sample is collected.
- Do not collect samples outside of the nasopharynx. In any cases, pre-education for user is required for the proper sample collection.

- Please use fresh swab to avoid the cross-reactivity between samples. Never reuse the sterile swab.
- The improper samples such as those from an individual who has recently taken any interfering medicine or samples mistakenly mixed up with different patients shall cause inaccurate test results.

STORAGE AND STABILITY

Storage condition			
Component	Storage Temperature	Shelf life	Note
Cartridge	2 - 30 °C	20 months	Disposable
Detector tube	2 - 30 °C	20 months	Disposable
Extraction buffer tube	2 - 30 °C	20 months	Disposable

- After the cartridge pouch is opened, the test should be performed immediately.

LIMITATION OF THE TEST SYSTEM

- The test may yield false positive result(s) due to the cross-reactions and/or non-specific adhesion of certain sample components to the capture/detector antibodies.
- The test may yield false negative result(s) due to the non-responsiveness of the antigen to the antibodies which is most common if the epitope is masked by some unknown components, so therefore not being able to be detected or captured by the antibodies. The instability or degradation of the antigen with time and/or temperature may also cause false negative as it makes antigen unrecognizable by the antibodies.
- Other factors may interfere with the test and cause erroneous results, such as technical/procedural errors, degradation of the test components/reagents or presence of interfering substances in the test samples.
- If the test result is “Negative” even though the patient has significant infectious symptoms, it should be recommended to conduct additional test including PCR or culture test.
- The accurate determination of test result as “Positive” should be confirmed by additional clinical evaluation.
- “Negative” result should be considered with possibilities of other infections. Positive result should be considered with additional infections by another pathogenic bacterium.
- If the product has positive results, any clinical diagnosis based on the test result must be supported by a comprehensive judgment of the concerned physician including clinical symptoms and other relevant test results.
- In case of antigen concentration is low, the test may yield false negative results. Therefore, the negative results cannot exclude the possibility of infection completely.
- This product is only to detect the presence of a SARS-CoV-2 antigen.

MATERIALS SUPPLIED

REF CFPC-115

Components of **ichroma™ COVID-19 Ag**

- Cartridge Box:
  - Cartridge 25
  - Detector tube 25
  - Extraction set
    - Extraction buffer tube 25
    - Nozzle 25
  - ID chip 1
  - Instruction for use 1

MATERIALS REQUIRED BUT SUPPLIED ON DEMAND

Following items can be purchased separately from **ichroma™ COVID-19 Ag.**

Please contact our sales division for more information.

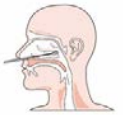
- **ichroma™ II** REF FPRR021
- **Boditech COVID-19 Ag control** REF CFPO-293

SAMPLE COLLECTION AND PROCESSING

The sample type for **ichroma™ COVID-19 Ag** is human nasopharyngeal swab

- **Collection method for sample**

To collect samples, insert a sterile swab in the nasal cavity and spin it smoothly in the nasopharynx.



< Nasopharyngeal swab>

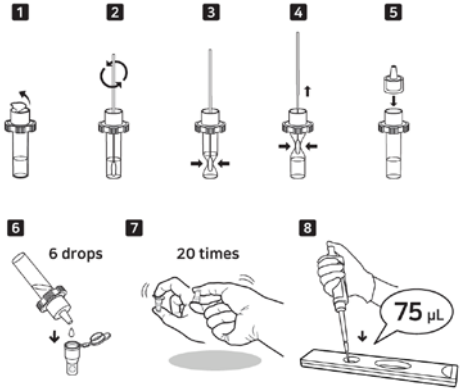
- It is recommended to test the sample immediately after collection. If do not use sample immediately, should store at 2-8 °C.
- Samples stored at 2-8 °C for 3 days showed no performance difference.
- It is highly recommended that **ichroma™ COVID-19 Ag** test would be performed on the nasopharyngeal swab specimens directly collected from patients with provided extraction buffer.

TEST SETUP

- Check the contents of **ichroma™ COVID-19 Ag**: Sealed Cartridges, Detector tubes, Extraction sets, ID chip and Instruction for use.
- Ensure that the lot number of the cartridge matches that of the detector tube as well as an ID Chip.
- If the sealed cartridge, the detector tube and the extraction buffer have been stored in a refrigerator, place them on a clean and flat surface at room temperature for at least 30 minutes before testing
- Avoid directly windy place. The air flow can affect the flow of samples.
- Turn on the instrument for ichroma™ tests.
  (Please refer to the instrument for ichroma™ tests operation manual for the complete information and operating instructions).

TEST PROCEDURE

▪ **ichroma™ II**



<Single mode>

① Open the lid of the aluminum foil of the extraction buffer tube.
② Collect samples with a sterile swab and then put it into the extraction buffer tube. Spin the sterile swab 5 times and squeeze the sterile swab to extract the sample into the buffer.
③ Squeeze the bottom to extract the sample into the buffer and start pushing the swab to the top.
④ Continue squeezing and pushing the swab to the top of extraction buffer tube to pull it out of tube.
⑤ Assemble a nozzle to the top of extraction buffer tube.
⑥ Load six drops of sample mixture onto the detector tube.
⑦ Close the lid of the detector tube and mix the sample thoroughly by shaking it about 20 times. The sample mixture must be used immediately within 30 seconds.
⑧ Pipette out 75 µL of a sample mixture and load it into the sample well on the cartridge.
⑨ Insert the sample-loaded cartridge into the instrument for ichroma™ test
⑩ Tap the "Start" button on the instrument for ichroma™ tests.
⑪ Cartridge goes inside the Instrument for ichroma™ tests and will automatically start scanning the sample-loaded cartridge after 12 minutes.
⑫ Read the test result on the display screen of the instrument for ichroma™ tests.

<Multi mode>

① Open the lid of the aluminum foil of the extraction buffer tube.
② Collect samples with a sterile swab and then put it into the extraction buffer tube. Spin the sterile swab 5 times and squeeze the sterile swab to extract the sample into the buffer.
③ Squeeze the bottom to extract the sample into the buffer and start pushing the swab to the top.
④ Continue squeezing and pushing the swab to the top of extraction buffer tube to pull it out of tube.
⑤ Assemble a nozzle to the top of extraction buffer tube.
⑥ Load six drops of sample mixture onto the detector tube.
⑦ Close the lid of the detector tube and mix the sample thoroughly by shaking it about 20 times. The sample mixture must be used immediately within 30 seconds.
⑧ Pipette out 75 µL of a sample mixture and load it into the sample well on the cartridge.
⑨ Leave the Cartridge at room temperature for 12 minutes before inserting the cartridge into the holder.
⚠ *Scan the sample-loaded cartridge immediately when the incubation time is over. If not, it will cause inaccurate test result.*
⑩ To scan the sample-loaded cartridge, insert it into the cartridge holder of the instrument for ichroma™ tests. Ensure proper orientation of the cartridge before pushing it all the way inside the cartridge holder. An arrow is marked on the cartridge especially for this purpose
⑪ The Instrument for ichroma™ tests will start scanning the sample-loaded cartridge immediately.
⑫ Read the test result on the display screen of the instrument for ichroma™ tests.

※ It is highly recommended that **ichroma™ COVID-19 Ag** test would be performed on the nasopharyngeal swab specimens directly collected from patients with provided extraction buffer.

▪ **ichroma™ M2**

< Read Now mode >

① Check the display "Read Now" on the ichroma™ M2 screen and set the sample type.
② The test procedure is same with "ichroma™ II Multi test mode ①–⑧".
③ Leave the cartridge at room temperature for 12 minutes before inserting the cartridge into the cartridge holder of ichroma™ M2.
⚠ *Scan the sample loaded cartridge immediately when the incubation time is over. If not, it will cause inexact test result.*
④ To scan the sample-loaded cartridge, insert it into the cartridge holder of the instrument for ichroma™ tests. Ensure proper orientation of the cartridge before pushing it all the way inside the cartridge holder. An arrow is marked on the cartridge especially for this purpose.
⑤ The instrument will automatically start scanning the cartridge. Do not remove the cartridge or touch the reader during scanning.
⑥ Read the test result on the display screen of the instrument.
⑦ When the cartridge is removed from cartridge holder, the display will show "Read Now" as a standby state.

< Walk Away mode >

① Check the display "Walk Away" on the ichroma™ M2 screen and set the sample type.
② The test procedure is same with "ichroma™ II Multi test mode ①–⑧".
③ After loading the sample mixture, insert the mixture loaded cartridge into the holder. Ensure proper

orientation of the cartridge before pushing it all the way inside the cartridge holder. An arrow is marked on the cartridge especially for this purpose.

④ The instrument will automatically start scanning the cartridge after reaction time. When the cartridge is inserted, reaction time is displayed.

⑤ Read the test result on the display screen of the instrument.

⑥ When the cartridge is removed from cartridge holder, the display will show "Walk Away" as a standby state.

INTERPRETATION OF TEST RESULT

- The instrument for ichroma™ tests calculates the test result automatically and displays 'Positive' or 'Negative'.
- If test result is Invalid, you need to perform a new test on a new test cartridge with a new test sample.

QUALITY CONTROL

- The Quality control tests should be used to confirm the reliability and the validity of **ichroma™ COVID-19 Ag**.
- The positive/negative controls are provided with the product for quality control.
- Quality control tests should be performed both to verify proper operation of instrument and to exclude any possible performance change in storage.
- For more information regarding obtaining the control materials, contact Boditech Med Inc.'s Sales Division for assistance.

PERFORMANCE CHARACTERISTICS

- **Analytical sensitivity**

- **Cut-off**

The cut-off value is 1 as COI (Cut off index) that is obtained from algorithm of the instrument.

<COVID-19 Ag judgment standard (positive/negative)>

COI (Cut-off index)	Judgment
< 1	Negative (-)
≥ 1	Positive (+)

- **Analytical specificity**

- **Cross-reactivity**

There was no significant cross-reactivity on 30 various other viruses and 36 various bacteria with the **ichroma™ COVID-19 Ag** test.

	Virus		
1	Corona virus - FCV(3A2)	16	Echovirus 25
2	Corona virus - FIP(2A4)	17	Echovirus 3
3	Influenza A virus H3N2 Hongkong	18	Echovirus 6
4	Influenza B virus B/Lee/40	19	Echovirus 9
5	Respiratory Syncytial virus A	20	Enterovirus 71
6	Adenovirus type1	21	HCMV-AD-169
7	Adenovirus type2	22	HSV-1 - F(3A20)
8	Adenovirus type3	23	HSV-2 - MS(4A6)
9	Adenovirus type4	24	Meales virus
10	Adenovirus type6	25	Mumps virus
11	Adenovirus type7	26	Polio virus - sabin(3A4)
12	Coxaievirus A2	27	Rhinovirus - RV21
13	Coxaievirus A4	28	Rhinovirus - RV14
14	Coxakie virus B1 - conn5	29	Rhinovirus - RV71
15	Coxakie virus B3 - nancy (5A1)	30	Rubella virus

	Bacteria		
1	*Candida albicans*	19	*Neisseria gonorrhoeae*
2	*Candida glabrata*	20	*Neisseria meningitidis*
3	*Candida tropicalis*	21	*Neisseiria sicca*
4	*Citrobacter freundii*	22	*Proteus mirabilis*
5	*Corynebacterium sp.*	23	*Proteus vulgaris*
6	*Corynebacterium diphtheriae*	24	*Pseudomonas aeruginosa*
7	*Enterococcus faecalis*	25	*Serratia marcescens*
8	*Enterococcus gallinarum*	26	*Staphylococcus aureus*
9	*Escherichia coli*	27	*Staphylococcus epidermidis*
10	*Hemophilus influenzae*	28	*Stenotrophomonas maltophilia*
11	*Hemophilus parainfluenzae*	29	*Streptococcus sp. (Grourp D)*
12	*Klebsiella oxytoca*	30	*Streptococcus agalactiae (Group B)*
13	*Klebsiella pneumoniae*	31	*Streptococcus anginosus (Group F)*
14	*Lactobacillus sp.*	32	*Streptococcus dysgalactiae (Group C)*
15	*Legionella spp.*	33	*Streptococcus dysgalactiae (Group G)*
16	*Listeria monocytogenes*	34	*Streptococcus mutans*
17	*Moraxella catarrhalis*	35	*Streptococcus pneumoniae*
18	*Mycobacterium tuberculosis*	36	*Streptococcus pyogenes*

- **Interference**

There was no significant interference effect on from these substances.

	Interference materials	Conc.
1	Nasal sprays drop	20%
2	Nasal corticosteroids	20%
3	Homeopathic allergy relief medicine	20%
4	Mouth wash (Listerin)	5 mg/mL
5	Throat lozenges, oral anesthetic & analgesic	5 mg/mL
6	Antiviral drugs (Tamiflu; Oseltamivir)	5 mg/mL
7	Antibiotic nasal ointment (Bactroban; mupirocin)	5 mg/mL
8	Whole blood	1%
9	Analgesic (Acetaminophen)	10 mg/mL
10	Analgesic (Ibuprofen)	10 mg/mL
11	Povidone-iodine	1%
12	Acetylsalicylic acid (Aspirin)	20 mg/mL
13	Antibacterial (cefadroxil)	5 mg/mL
14	Mucin (Porcine stomach)	0.50%
15	Throat lozenge (VICKS; cetylpyridinium chloride)	20 mg/mL
16	Throat lozenge (dipotassium glycyrrhizinate)	20 mg/mL
17	Throat lozenge (Nandina extraction)	20 mg/mL

- **Precision**

- Between lots

One person tested three different lots of **ichroma™ COVID-19 Ag**, ten times at each concentration of the control standard.

- Between persons

Three different persons tested one lot of **ichroma™ COVID-19 Ag**, ten times at each concentration of the control standard.

- Between days

One person tested one lot of **ichroma™ COVID-19 Ag** during three days, ten times at each concentration of the control standard.

- Between sites
  One person tested **ichroma™ COVID-19 Ag** at three different site, ten times at each concentration of the control standard.

Cal No.	Between lot		Between person	
	Positive / No.	Positive rate	Positive / No.	Positive rate
1	0/30	0%	0/30	0%
2	30/30	100%	30/30	100%
3	30/30	100%	30/30	100%
Cal No.	Between day		Between site	
	Positive / No.	Positive rate	Positive / No.	Positive rate
1	0/30	0%	0/30	0%
2	30/30	100%	30/30	100%
3	30/30	100%	30/30	100%

- **Clinical performance evaluation**
  ichroma™ COVID-19 Ag has demonstrated the following clinical performance results.

		RT-PCR		
		Positive	Negative	Total
ichroma™ COVID-19 Ag	Positive	21	2	23
	Negative	3	55	58
	Total	24	57	81

- Clinical sensitivity: 87.5 %
- Clinical specificity: 96.5 %

REFERENCES

1. Laboratory testing for 2019 novel coronavirus (2019-nCoV) in suspected human cases Interim guidance (2020) 17 Jan, WHO.
2. Wölfel et al. Virological assessment of hospitalized cases of coronavirus disease 2019 (2020) Nature. [Epub ahead of print]
3. Trivedi SU et al. Development and Evaluation of a Multiplexed Immunoassay for Simultaneous Detection of Serum IgG Antibodies to Six Human Coronaviruses (2019) Sci Rep. 9: 1390
4. Yongchen et al. Different longitudinal patterns of nucleic acid and serology testing results based on disease severity of COVID-19 patients (2020) Emerg Microbes Infect 20: 1

Note: Please refer to the table below to identify various symbols.

	Sufficient for <n> tests
	Read instruction for use
	Use by Date
LOT	Batch code
REF	Catalog number
	Caution
	Manufacturer
EC REP	Authorized representative of the European Community
IVD	In vitro diagnostic medical device
	Temperature limit
	Do not reuse
CE	This product fulfills the requirements of the Directive 98/79/EC on in vitro diagnostic medical devices

For technical assistance; please contact:
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