

# Automated Biochemistry analyzer – Issues & Trouble shoot

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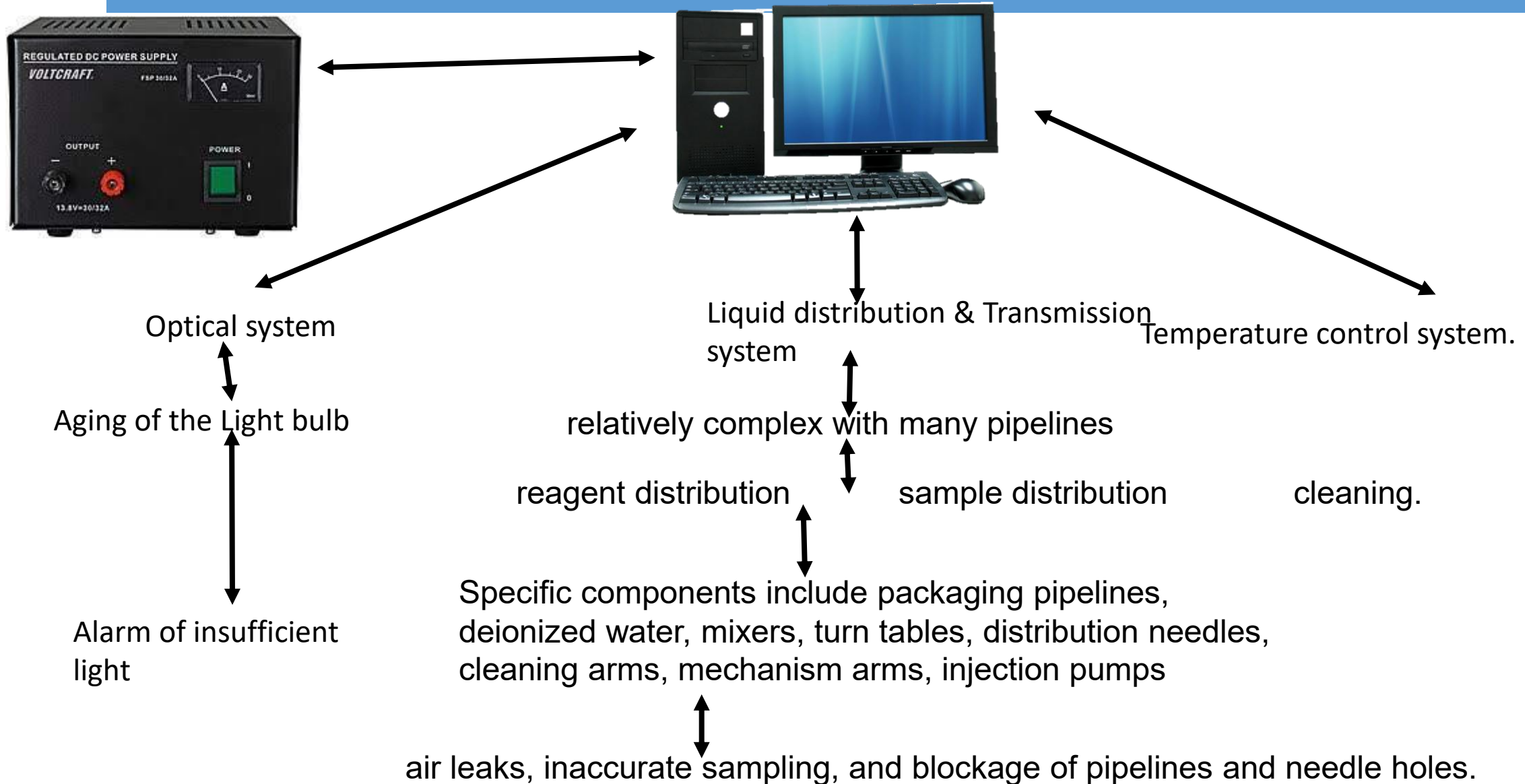
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1. Clinical chemistry analyzers are vital tools used in laboratories to perform **a wide variety of tests**.
2. These tests are essential in the **diagnosis, treatment, and monitoring** of diseases.  
Lets explore common errors and pitfalls in clinical chemistry analyzer testing and Trouble shoots
3. **Accurate** testing results are necessary to ensure that patients receive proper treatment.
4. However, **errors and pitfalls** can occur during testing that can lead to inaccurate results

# various hardware components of biochemical analyzers can be divided into three major blocks

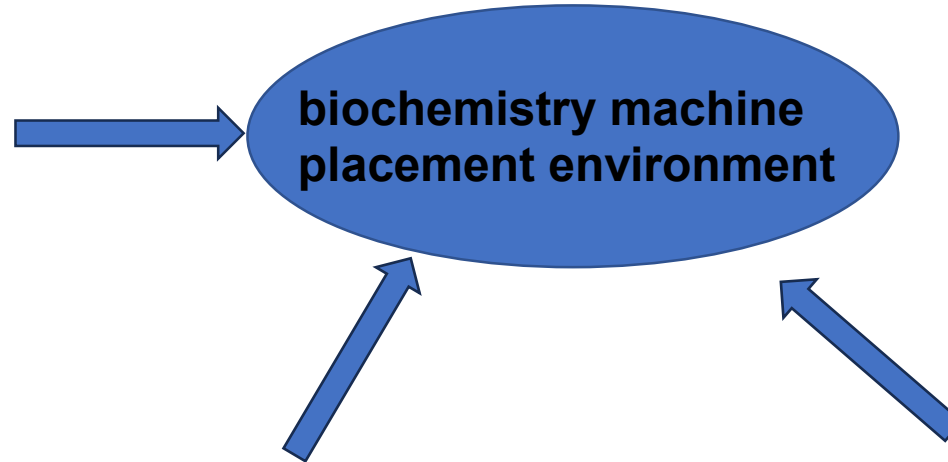


good ventilation and less dust, no direct sunlight

Placed in a special instrument room. The temperature - 15°C - 32°C. Humidity - 45% - 85% RH

place away from the air conditioning

**Avoid blowing directly** on the biochemistry machine table



Avoid dust and temperature on the biochemistry machine's **electrical, optical and mechanical system**

Can reduce failure rate of the instrument

dust and dirt removal should be done properly. Cinders and dust should not affect the **colorimetric system and transmission motor of the biochemistry machine.**

## **Electricity requirements of biochemistry machine**

1. Properly connected to the **ground wire**.
2. Check the ground wire in the **plug** and the biochemical laboratory.
3. Ensure that the connection is good, and the **grounding resistance needs to be set to 100 or less**.
4. In addition, it should be equipped with a **more stable voltage power supply**.
5. To ensure that there is no **abnormal electromagnetic interference** in the vicinity.

### **3. Water quality requirements of biochemistry machine**

- I. to be set to the conductivity of 1us/cm or less.
- II. The use of biochemical analyzers have high requirements for water quality.
- III. Unqualified water quality will not only affect the test results, but also damage to the automatic biochemical analyzer.
- IV. The conductivity of the biochemistry analyzer is usually set at 0.5us/cm.
- V. If the conductivity is higher than 0.8us/cm, the biochemistry machine needs to be maintained and serviced by a professional engineer.

# Fully automatic biochemistry analyzer is contaminated



## Fully automatic biochemistry analyzer reagent needle contamination

Most fully automatic biochemical analyzers currently use dual reagents to detect samples

Reagents R1, R2 aspirate and spit out

equipped with only one set of reagent needles

the reagent needle is incompletely cleaned, or when adhesion increases,

Residual reagents may have an impact on the next pro-test results.



# Fully automatic biochemistry analyzer is contaminated



## Contamination of the stir bar of the Fully automatic biochemistry analyzer

After the reagents are mixed with the sample, the stirring bar is needed to mix them.

If the stirring bar is not completely cleaned after mixing, or if the adhesion increases,

the residual reagents may affect the results of the next clinical test.

# Fully automatic biochemistry analyzer is contaminated

## Contamination of the colorimetric cup of biochemical analyzer



The colorimetric cups of biochemistry machines are generally recycled

After each colorimetric cup is tested, it is cleaned and then continued to the next test item.

When a colorimetric cup is not completely cleaned, the residual reagents adsorbed on the cup may affect the results of the next test performed in this cup.

1. colorimetric cup is the **most difficult to clean** clean.
2. in the actual test is **difficult to determine** what the colorimetric **cup last tested items**.

## Chemical contamination between reagents

### Reagent components involved in the reaction

Reagent component A + Substrate to be measured B

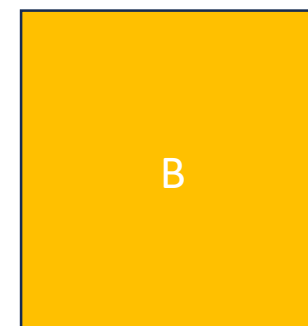
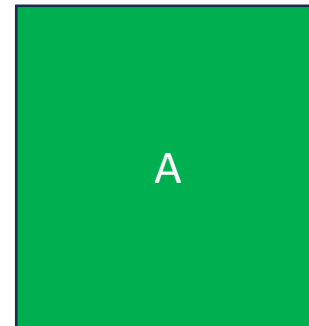
### The reaction process is the same

Reaction A → product → Reaction process B

The next item measured is the result of the combined effect of the reactions of the two items before and after .

### Direct contamination of reagent components

Substance to be measured (In Reagent A) + reagent B  
This directly interferes with the measurement results of the next test.



# 5 ways to eliminate interference between biochemistry reagents

1. To reduce the mutual interference between reagents.

Biochemical machines should be **properly maintained on a regular basis**.

- Wiping the reagent needle with decontaminant
- Replacing the pipeline whenever necessary
- Cleaning colorimetric cup with decontaminant or acidic washing solution
- Scrubbing the stirring bar with benzyl alcohol

2. Reasonable arrangement of the order of testing items

- at least one non-interference project between the two projects.
- interfered with project before the interference project.

3. The inspector must be very familiar with the working state of the instrument

P, Alb, DBIL, TBIL, K, Ca, CK, TBA, TG, AFU, ALT, CK-MB, APOA1, T-CH, APOB, Cl, HDL-C, LP(a), AST, GPDA, AMY, LDL-C, BUN, UA, CHE, ADA, r-GT, Mg, Na, ALP, LDH, GPDA, TP, Cr.

4. some biochemical analyzers have additional flushing functions.

5. the use of **reagents with anti-cross-contamination kit.**

1. The cleaning time of the needle hole can be programmed
2. when doing strong acid and strong alkali projects, it is best to edit them separately, and there should be other weak acid and alkali projects in the middle to form a buffer.
3. the quality of **pure water** during cleaning also very important

Among the assay measurements for biochemical analysis, **enzyme determination is more complex**. It requires **higher conditions** and is more difficult to test.

Generally, as long as the determination of enzymes is **accurate and reproducible**, the determination of other items in fully automatic biochemical analyzers is generally not a problem.

generally tested by kinetic method

Principle to use any method of analysis under optimum condition of enzyme reaction

The results of the enzyme test are related to the following points.

(1) 340nm is **the low end of wavelength** and has **lower energy**.

At the same time, 340nm filter **is more used and easy to be aged**. Therefore, the wavelength drift is not allowed, and the **half-width change will affect the accuracy and repeatability** of the measurement.

(2) dynamic method of testing has (a)delay time (b) test time requirements

- a. Delay time – Pre response time
- b. Test time - Total time of the test.



Heterogenous

Stable

The reagent vendors have strict rules for these two time periods.

So the dynamic method test generally temperature at 37 °C, the delay time is not less than 15s is good.

(3) For **the input of parameters**, the given values should be entered according to the **requirements of reagents**. Generally reagent vendors give instructions in the kit manual.



(4) **The reaction temperature.**

(5) The **test blank** should be accurate

(6) **inaccuracy and poor reproducibility** from the operation of the main

- a. automatic biochemical analyzer itself causes such as bubbles in the colorimetric cup.
- b. Aging of the light source lamp.
- c. Unstable voltage of the light source.
- d. poor performance of the 340nm filter, transmittance becomes smaller.
- e. inaccurate wavelength and other related.

In the automatic biochemical analyzer testing process, deionized water as a biochemical reaction carrier and medium, the sample or reagent dilution and solvent, the instrument cleaning solution and even the reaction of participants throughout the entire process of testing. Its purity level is directly related to the credibility of the test results.

Deionized water quality on the biochemical analyzer and the impact of test result

- **The main components of unqualified deionized water**

- (1) electrolytes, common H, Na, K, NH<sup>+</sup>, Mg, Ca ... Fe, Cu, Mn, Zn, Al and other cations and F, Cl, NO ... SO<sub>4</sub>, PO, HPO, HSiO and other anions.
- (2) Organic substances, such as organic acids, pesticides, hydrocarbons, alcohols and esters, etc.
- (3) Particulate matter.
- (4) Microorganisms.
- (5) dissolved gases (N<sub>2</sub>, O, Cl<sub>2</sub>, H<sub>2</sub>S, CO, CO<sub>2</sub>CH, etc.)
- (6) Others



# Effect of different impurity components on biochemical analyzer and test results

## • The effect of high electrolyte content

1. The most direct effect is the increase of different kinds of ions in the serum (plasma) measurement results. For example, the determination of **Mg, Ca, Fe, Cu, Mn, Zn**, etc.. It also has an impact on the **calibrations** of these items.
2. Since many metal ions are **cofactors of enzymes**, it often affects the **assay of enzyme activity** when the metal ion content is high.
3. For example,

Mg is the activator of many phosphorylated kinases → excessive Mg → Increased Enzyme value of the enzyme activities

Many heavy metal ions → inhibitory effect on enzymes → Decrease in enzyme activity.

# Effect of different impurity components on biochemical analyzer and test results

## Effect of different impurity components on biochemical analyzer and test results

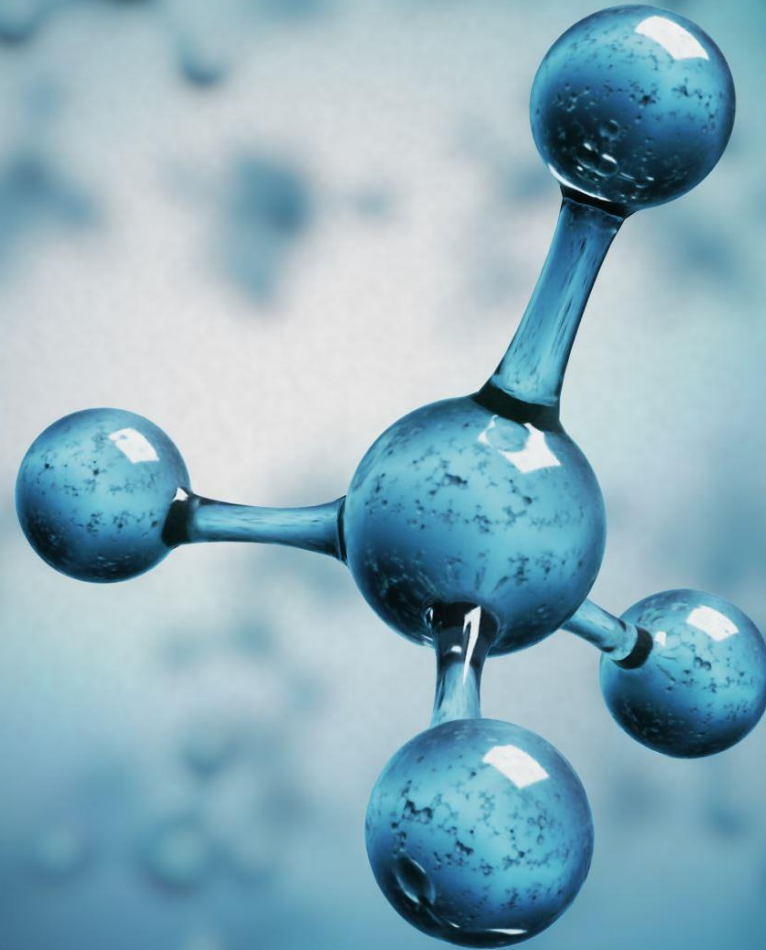
(3) Many anions are also present as cofactors of enzymes, which have an impact on the determination of enzyme activity.

(4) Water with **high electrolyte** content is more likely to form crystals and cause organic matter such as **proteins to denature and adhere to the piping system**, thus making the biochemical analyzer piping system more **prone to clogging**. Eventually, it **causes distortion or failure** of the assay. It is also difficult to clean the reaction cup when it is used for cleaning. It will accelerate the **aging and damage** of the reaction cup and make the **cup blank rise**.

# Effect of different impurity components on biochemical analyzer and test results

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- Influence of particulate matter
  - Generally difficult to enter the biochemical analyzer pipeline and reaction system through the deionized water system.
  - Its source is generally the **purification process or storage tank** occurred in the secondary pollution. However, once it enters, in addition to causing an **increase in absorbance**, it is also easy to **block the pipeline and damage the reaction cup**.





# Effect of different impurity components on biochemical analyzer and test results

## Effect of microorganisms

- Microorganisms breed in the **piping and reaction** system, leading to **clogging** of the piping, as well as an increase in **absorbance and cup blank**.
- Microorganisms produce **specific enzymes** that have an **impact on the enzyme assay** of the biochemical analyzer. The specific effects depend on the type of contaminating bacteria.

# Effect of different impurity components on biochemical analyzer and test results

## Effects of increased dissolved gases

- The effect on the determination of the **same gas** (e.g. CO<sub>2</sub>).
- The effect on the **pH value of water**. Such as the dissolution of CO<sub>2</sub>, Cl<sup>-</sup>, H<sub>2</sub>S, etc. leads to a **decrease in PH** value. This also has an effect on the determination of biochemical items that depend **strongly on the PH value**
- The increase of certain gases, such as **Cl<sub>2</sub>**, will have an impact on the biochemical measurement items related to **redox reactions** because of its own strong oxidizing properties.
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# Tips for biochemistry analyzer use

- 1.The biochemistry analyzer should be equipped with a (500 to 1000) W **electronic AC voltage regulator**. This is to **prevent power fluctuations** from affecting the measurement results or damaging the instrument. In addition, biochemical instruments must have **good grounding**.
- 2.The room where the biochemical analyzer is placed should be **away from electromagnetic fields and X-ray sources**. It should be **dust-free and dry**. Keep the ambient temperature in the range of (15-30)°C.
- 3.Do not switch **on and off** the biochemistry analyzer **frequently** in a short period of time. Instrument continuous work generally does not exceed 4h.
- 4.If the biochemical analyzer is **not used for a long time**, ensure that the power is **turned on once every half month** or so, **4h** each time, so that the battery in the biochemical instrument can be charged. At the same time can also drive away the moisture in the circuit.

5. The printer should be replaced **with new printing paper** before the paper roll is almost used up. Avoid emptying the printer without paper. Prevent the rubber wheel from wearing the print sheet. Or print paper with empty can not feed the paper and damage the printer gear. Flush the printer with distilled water after turning it on every day. This is conducive to pipe cleaning and sample zeroing.

6. When it comes to items with standard measurement, take the **standard as a sample and measure again**. This can be based on the standard value to **determine the accuracy** of the results.

7. The most common failure of biochemistry analyzer is the **blockage of piping or colorimetric cell**. As long as the daily maintenance work, you can prevent the colorimetric pool and pipeline blockage, greatly reducing the failure rate of biochemical analyzer.

8. The **biochemistry analyzer should be maintained** daily. After doing the sample twice a day, rinse it with distilled water first. Then let the biochemistry machine clean itself. After the instrument is cleaned return to the main screen and turn off the power. Finally, wipe the instrument housing with a slightly damp cloth. Be careful not to let water enter the instrument.

thank you